With the warm regards of
Charles W. Dabney

SCIENCE AND CIVILIZATION [1]

SCIENCE is the patrimony of humanity, the torch which gives light to the world.—*Pasteur.*

It is a great pleasure, Mr. President, to meet your academic family and their friends under any circumstances; to meet them in this beautiful court and on this festal occasion is delightful. I thank you for the privilege, and congratulate you on the success of the session concluded this day. We are happy to know that it has been a year of progress in academic development, as well as in physical upbuilding. As citizens of Houston, we are witnesses that it has been a year of noble service to this community and to the cause of learning and science to which its far-seeing founder dedicated it. We are proud of the leadership that Rice has taken in education and science, and of the distinction it has brought to Houston. I am sure, therefore, that I express the sentiment in the hearts of this company when I tender to the President, Trustees and Faculty the grateful acknowledgment of the people of Houston and their wishes for your continuous success.

Promoting lives of luxury and pleasure, the industrial and commercial development, which has made Houston such a prosperous and wealthy city, makes such an institution devoted to the higher aims of life, all the more necessary. Older cities have their histories, traditions and customs to help maintain the cultural life, but new cities like this must develop their ideals of culture through their own institu-

[1] Address delivered by Charles William Dabney, formerly President of the University of Cincinnati, at the ninth commencement convocation of the Rice Institute, held Monday morning, June 9, 1924, at nine o'clock.

tions. Such institutions as Rice are vitally necessary, therefore, not only for the training of youth and the advancement of science and learning, but for the esthetic, moral and spiritual development of the community.

Two great currents of civilization have flowed down the ages. One current has borne on its tide the people of the West, who have devoted their energies chiefly to the development of the material world and the production of wealth and power. This they did by the use of science and invention through the agencies of industry and commerce.

The other great current of civilization, originating in the East, has borne the men who since the most ancient days have looked into their own minds and hearts rather than at the material world, seeking through meditation to develop the soul of man. This civilization professed, at least, to think more of man's principles than of his possessions. It has, therefore, produced less science and fewer inventions, but more philosophies and religions. Its industries have been domestic and simple and its commerce limited.

In a way each of these civilizations complements the other. Each was incomplete and unequal to the all-round development of man. The two currents were never entirely distinct, though the main drift of Western civilization has always been towards materialism as that of the Eastern has been towards humanism. Small streams from each have mingled with the other all down the ages, and where they have joined we have had the most complete civilization. Though the distinction is not strictly accurate, it is customary to describe modern Western civilization as political and the old Eastern civilization as cultural.

The chief characteristic of the Western, or political civilization, is the struggle for power;—first, between class and class, and later between nation and nation. The struggle within the nation goes on until one class secures control and proceeds to arouse the national spirit among its people and to make wars on other nations. These wars, made first for territory, are continued from time to time to keep what has been already conquered and to extend the influence of the nation. A balance of power may be established for a time, but it is always liable to break down, causing more wars.

This Western civilization has been greatly aided, especially in modern times, by physical science and invention, to which, therefore, it has given large support. By discovering raw materials and how to use them and by teaching men to employ natural forces, like water, steam and electricity, the scientist and engineer have greatly increased man's power. By forming great organizations for manufacturing and for trading, by pushing transportation and communication and sending armies of merchants and agents close behind its soldiers, Western civilization has now spread over nearly the whole world.

Because it has so nearly conquered the world, are we to conclude that the Western civilization is the better? We are so accustomed to the political type and so saturated with the habits of thinking which have grown out of it, that we cannot judge. Moreover, no pure examples of cultural civilization are left in the modern world.

By the aid of science and invention, industry and commerce, organized and supported by militant nationalism or imperialism, the Western nations have reduced nearly all the other lands to the position of provinces. In doing so they have conferred some great benefits upon them, especially by sanitation and modern medicines. These benefits are not questioned, neither do we question the benefits of education and religion given them by the churches. But we may seriously question the wisdom of forcing our science and mechanical practice and even our culture and philosophy upon so-called uncivilized peoples to the destruction of all their own knowledge and culture and of their arts and philosophy. Are we so sure that our boasted American civilization, for example, has always proved of benefit to the people to whom we have given it? It is said that when the authorities gathered all the Hopi Indian children for the first time into the boarding school provided for them by a benevolent government, their mothers made tragic protest by riding around the school building singing dirges as if their children were dead: "We do not wish our children to ride the whiteman's road," they cried. Just a natural feeling for primitive mothers, you say. But does it not express both a natural right and a fundamental truth? May we not seriously question the right and the wisdom of teaching all primitive peoples our inventions and practices, our industries and arts, even if we do not question the benefits of our education and religion? If we take the American Indian as an illustration, we have undoubtedly made a great mistake somewhere. Was it not in trying to give him our civilization completely? Their love of nature and artistic sense, their conception of virtue as a trust from one's ancestors, their sense of social obligation, their love of ordered liberty, their natural dignity of manner, their reverence for the unseen are precious things not to be lightly thrown away. The same applies to many people of the East. Why teach them our science and our mechanic arts and so destroy their poetic philosophy of nature and their beautiful domestic arts?

Is it not time that we stopped to ask whether science and invention in and by themselves are always beneficial? There are, it appears to me, serious reasons why we should do so.

Many thinkers are, in fact, doing so, and it is to a few of their strictures that I invite your attention.

The aid science has rendered to civilization has been enormous and grows greater with every year. But many thinkers believe that there is another side to the question. Does science always promote morals and culture, as well as industry? Some people even doubt the benefit of many scientific inventions. The moving picture, for example, is denounced by some good people as causing more evil than good. An admirable thing in itself, the picture machine has been put to bad uses by being commercialized. I predict that it will have a noble rôle in the future. It will make amends for the harm done by its absurd and immoral stories. In teaching the sciences it will show the plant growing, the flower blooming, the animal's heart beating, the insect and the bird flying. All the technical industries will be passed before the eyes of pupils. The great men and women of history will live before us again, and teaching will be improved by putting the object behind the word.

The phonograph and the radio are being abused in a similar manner. Never so much debased as the moving picture, the phonograph with its voices out of the past and the radio broadcasting those of the present will be made more and more the instruments of education and religion. Why may they not become like tongues of fire and voices of angels proclaiming the Gospel to the world?

What shall we say of science and industry? In economic production as developed in modern times there are three steps. First, there is the discovery of some new force, of some new material, or of some new law of nature. The scientist is not primarily interested in the application of his discovery. He seeks to learn the truth of nature, regardless of its use. So the technician, always on the lookout for a way better to perform some task, takes the second step and studies the bearings of the discovery upon his problem. The average business man or manufacturer does not see and cares little at first for these first two steps. What interests him is the third step, namely, the product, the process or the machine, which makes money for him. In the scientist and his discovery he has at most only a distant and romantic interest. But the fact remains that industry is created and made successful, not by the raw material, not by the products, but by the scientists and the engineers in its service. It is the mind that makes the values, not the materials or the machine. A mind found the right material, a mind devised the right machine and a mind discovered the right force to operate it.

Intelligent business men recognize now that industry cannot advance without science, and they are therefore devoting a large portion of their earnings to maintaining laboratories. The production of aluminum is an illustration. This desirable metal has been known for some time, but was not produced economically until Charles M. Hall, after long study and experiment, made its manufacture an established industry and its use universal.

Most industrialists, as well as many states and cities, now recognize their duty to support the pure and technical sciences by providing them facilities and endowments. For this reason, therefore, as well as for the sake of the education it provides for their youth, it is the duty of the people of Houston and of Texas to see that this Institute is fully equipped and manned. Wealth derived from scientific investigation should be regarded as held in trust for the advancement of science and the welfare of mankind. Its possession is a stewardship for the benefit of institutions of learning—the advancement of civilization and improvement of life. It is most encouraging that individuals are learning this and great gifts for universities are becoming more numerous every year. Hall, for example, gave his entire fortune to Oberlin College, his Alma Mater. But the nations must learn that they also are stewards for all the world. In this service of the world the Carnegie and Rockefeller Boards are noble pioneers. Their missions to many countries are splendid illustrations of what the beneficiaries of science and invention can do for mankind. By such methods and not by war, western civilization may win the world.

But what shall we say of these vast industrial and commercial companies reaching out into all lands? By many, like Bertrand Russell, they are considered the greatest menace of the age. Science and invention, he says, have made it possible to build these organizations on an ever larger scale.

"Wherever expensive fixed capital is required, organization on a large scale is, of course, necessary. In view of the economies of large production, organization in marketing also becomes of great importance. For some purposes, if not for all, many industries come to be organized nationally, so as to be in effect one business in each nation." [1]

"Science has not only brought about the need of large organizations, but also the technical possibility of their existence. Without railways, telegraphs and telephones, control from a centre is difficult." In this way, Russell explains, science has promoted a selfish grasping nationalism and imperialism. Such vast national organizations of business become oligarchical. "In consequence of scientific inventions which facilitate centralization, groups become more organized, more disciplined, more conscious and more

[1] "Icarus, or the Future of Science," Bertrand Russell.

docile to leaders." The control by leaders becomes more marked.

"In all this," Russell continues, "there would be nothing very tragic but for the fact with which science has nothing to do, that organization is almost wholly national."

"The harm that is being done by science and industrialism is almost wholly due to the fact that while they have proved strong enough to produce a national organization of economic forces, they have not proven strong enough to produce an international organization." Here I think Russell is wrong; national organizations of industry and finance made possible by science are only the first phase. As a matter of fact, international organizations of industry and commerce exist already on a large scale and are growing and multiplying rapidly. Like the international postal system of the governments, international systems of telegraph and wireless communication, of trade and exchange, of shipping, etc., are growing up to counteract these nationalistic organizations and take their places.

No, it is not true that science itself promotes trusts and selfish national organizations and so retards a proper internationalism. As Pasteur has said, "Science has no nationality because knowledge is the patrimony of humanity, the torch which gives light to the world."

It is a much more serious thing, it seems to me, that associations of men are by such grouping given more power to indulge their purposes and passions. Having eliminated the individual conscience and responsibility, the purposes of these great companies are most profitable to their members while often injurious to mankind in general. The alcohol industry is an illustration. Science and invention made it possible on a greatly increased scale and its vast commercialization made it a fearful menace to man. This industry became so strong in our country both politically and financially that it took forty years to overthrow it. The opium trade and cocaine production are still growing with the aid of science. At least one foreign country is said to be making a business of the manufacture of these poisons for illicit export.

The world still stands aghast at the horrors wrought by science in the war. So Galsworthy appeals to scientific men to refrain from releasing any further discoveries until they are certain they will be used for helpful and not for hurtful purposes. The discovery of poison gas should never have been revealed. The aeroplane, the greatest achievement of our age, ought never to have been used in war. The suggestion that the possible release of atomic energy or the liberation of the forces in the ether may even destroy the whole world, alarms him. "Destructive Science" should, he says, be stopped by the concurrent action of civilized nations.

This solution appears to be impracticable. We can never put a stop to the instinctive urge in men towards discoveries and inventions. In all these things, in great organizations of industry and in nations, the fault is not with the scientist or the inventor. The fault is with the human will which utilizes these and many other discoveries to hurt or destroy men. Pasteur's discovery of the germs of disease was one of the most beneficial ever made, and yet some devils in human form have proposed the wholesale use of disease germs in war to destroy the enemy population.

No, science is not by nature destructive or even injurious. Science is neutral. It provides forces, which, like everything else, can be used or can be abused. We must advance ethical ideas to a higher plane so that scientific discoveries will be used only to benefit the race and not to destroy it.

Every other use of science is futile. Scientific warfare with big guns, electricity, poison gas, bombs dropped from aeroplanes, and all its other hellish instruments, does not conquer men. It destroys them. Science did not win the war. The honor of the Belgians who would rather die than break a treaty, the courage of the British "Contemptibles" who held at Mons till they were all killed, the heroism of the young American marines who drove the enemy back at Chateau Thierry, the spirit of the French poilu who declared at Verdun, "They shall not pass!"—these won the war and not science. These are not physical forces, they are spiritual.

More significant than these attacks is the idealistic reaction against a rationalistic interpretation of science, which we are glad has come at last. The grossly exaggerated rationalism which threatened to establish materialism as the only conceivable view of the universe and to regard man merely as the most wonderful of nature's machines, has aroused philosophers as well as theologians. Disagreements in the ranks of science have added to the revolt. Psychology arose to claim independence of physics and physiology. Biology declared that mechanical laws were utterly inadequate to explain the phenomena of life. Radio activity came to upset the theories of the physicist, chemist, geologist, and astronomer, and the theory of relativity makes it necessary to build our scientific philosophy all over again. So long as the science-philosophers are at sea, the rest of us had best stay near land. At any rate the mechanistic materialism is dead.

What then has science to do for religion? Naturalism claims to hold the future of mankind in its own hands. It also claims that man needs no other religion. Are these things true? Science may provide for all our physical needs and command all the physical forces to work for us. But science will never give us a religion or a philosophy that will satisfy our hearts. For science knows nothing of the æsthetic and religious demands of our nature. There are three eternal values—Truth, Beauty and Goodness—each independent of the others and all necessary for our spiritual satisfaction. Science supplies a vast body of Truth, but it cannot supply us with either Beauty or Goodwill. Even if we never solve the difficulties caused by the revelation of the Eternal, as Truth, Beauty and Goodwill, we must have a philosophy that will provide us with art and religion, as well as with science. The world known to science is not really put together of electrons revolving around each other in the ether. The world was put together and is kept together by Infinite Mind.

What about science and government? It is in politics and in the legislative departments of our government that the methods and teachings of science are least used. The man of science has less use for what is called practical politics than any other thing in the world and the practical politician returns the compliment. And yet the scientist and the politician must get together some day if government is ever to be perfected. Mr. Lloyd George, in his address as Rector of Glasgow University, said that "Government nowadays is a government by talking." As the greatest talker of his age and the Premier of Great Britain during the most critical period in its history, he ought to know. From what we have seen and heard in Washington, we fear that this is true of our Government also. "Government by talk!"—yes, that is too frequently the way in which our democracies decide things.

The evils that afflict the world, for which we have made ourselves largely responsible, are numerous and great. The cries of men for the more abundant life are loud. The call is for action, not talk. If we can do nothing until we have talked ourselves and our colleagues out, we will never catch up with the suffering and the misery of the world. It is tragic to talk and keep on talking while millions are perishing as they have been in Europe these last five years. As a recent writer has said, "What the world wants to-day is not a League of Nations, but a league of people who know each other, and can work together for the peace and happiness of all."

Plato said that the world would never be well governed until philosophers became kings. This is too much to expect in Texas or these United States, but it is true that the weakest thing about our democracy is its failure to employ its best men for its important work. The end for which we endure governments is the highest development of every citizen. The democracy should be a school for citizens. If it fails to make good citizens, it fails entirely. It is a serious matter that our most intelligent and best men and women take no part in government. What else can we expect when the schools and colleges set pecuniary success before their pupils as the goal of their efforts? The end of education is not the power to make money, but character and fitness to serve. We start the youth on the vocational or professional course before he is really educated. Science studies alone do not supply the material for the complete education. From the study of humanities come, as from no other studies, concentration, discrimination, strengthened memory, exact expression, a feeling for making things right, the power to conquer difficulty and a knowledge of the sources of civilization and of those primal men whose spirit has permeated the ages. On the one side comes power to think, on the other knowledge of the basic material with which our thinking is concerned. To that is added the purification and elevation of spirit that follows the contemplation of beauty, the ideal of how to live, that is beyond the knowledge of how to make a living.

Incompleteness of culture and character is the trouble. Incomplete faith that has no great end in view, and, therefore, has no courage; the refusal to see more than one side of a question and the habit of visualizing everything we do see in raw primary colors, without shading or discrimination; the inability to concentrate or to think correctly, and consequent acceptance of the crass and superficial; a sensationalism in speech and writing, that is only a more or less camouflaged appeal to low passion and a soul debasing cynicism, ever the companion of sensuality, that casts a deadly blight over beauty and virtue—these are some of the results of a one-sided, materialistic education.

At the present time, this unmoral trend of our education gives rise to a dangerous contempt for law that threatens the very foundation of government. The law that crosses the personal pleasure or habit of some people is a law not to be regarded. The pursuit of selfish ends, even to the hurt of others, is maintained under the guise of the right of property and of personal liberty. To such men, having no thought for the welfare of the young or weak, liberty means license. Those, who legislate for the protection of their property from taxation, they declare statesmen; those, who endeavor by law to protect the bodies and souls of the people from corruption, they deride as "uplifters". They forget that the only true liberty is liberty regulated by law.

This state of the public mind and conscience is directly attributable to the incomplete development of the minds and hearts of the people. There must be a renaissance of cultural education. This does not imply a reactionary movement against science and invention. It will not be a movement against scientific investigation. Science will pursue its shining path. It will be used more and more for the good of men, and not their hurt. Our efforts should be directed, not to the curbing of science but to its furthest advancement, and to its fullest utilization for good.

Now finally, what is the solution? What is the disease? What is the remedy? The trouble is that we have more knowledge than we can use. We have had a boom in knowledge and a slump in wisdom. Man has now sharper tools than he is prepared to handle. His scientific knowledge has too far surpassed his cultural and moral training. He has not sufficient self-control and good will to use these gigantic forces for the well-being of mankind. Our knowledge has outstripped our morals. As a result the foundations of faith are shaken, the minds of the youth confused, moral restraints and codes of conduct are being discarded.

Civic virtue to endure must be based on spiritual enlightenment. Only religion can provide this. In natural evolution many believe; in spiritual evolution we must all believe. To doubt this is to make life a race after a mere shadow. There must be a spiritual evolution of man corresponding to this evolution of science and industry. This vast accretion of scientific knowledge and this tremendous power in invention create a great new responsibility, which calls for a greater service to men than we have the strength to render, which demands a higher character and stronger will than we possess.

This marvellous development of science and industry constitutes a challenge to the school, and a challenge to the church. It constitutes a challenge to the school, the college and the university to give men cultural as well as scientific education, moral as well as physical training, a love of the beautiful as well as of the merely big things in nature and art, and above all the strength of character to use and not abuse the tremendous new power and vast new wealth bestowed upon man by science and invention. It is a challenge to the church so to enlighten the consciences, and develop the hearts and wills of men that they shall have the power to see the right, the will to do it and the love to serve their fellowmen even at the sacrifice of their own pleasure, comfort, and life if need be.

Aristotle said, "The State should be the means to the good life." Such was the avowed aim of the civilization of Greece and of India and China for thousands of years. Such, far more richly, was the civilization of the ancient Hebrews, as taught by their prophets and priests, and this was definitely the teaching of Jesus who came "to give men life and life more abundantly." With the coming of Christ the world took on a new life. He was the Star in the East that brought hope to man wandering for ages in the wilderness of despair, seeking a way into the light of truth and righteousness. Jesus first taught man that it was not by physical science and industry, not by meditation and the cultivation of his own mind and soul, but by love and service to his fellowman that he would complete his life and attain the Kingdom of God, the perfect civilization. Science, industry and commerce have given western civilization the power to conquer the material world. Christianity alone will enable it to conquer the souls of men. The only hope of humanity is that Christianized western civilization, overflowing the world, may carry to all nations this religion of love and peace.

I believe that we are at the dawn of this renaissance of culture. The process of a moral reform is beginning. It is similar to the old Reformation and it will be more fundamental. The raw materials for such a renewal lie all about us. Much of this material is the result of modern scientific investigation, and science will provide more as it goes forward. This new renaissance will bring together in a new synthesis the products of these investigations and of the thinking of truth-seeking scientists. The result will be a new and better formulation of the old faith in one God, the Father of all.

Who shall be the leader, the prophet of this new renaissance? He need not be a theologian necessarily, a Luther or a Calvin. The man who shall lead the way to the new world, may be a statesman or he may be a teacher. When the miserable partisanship of our age has died away, some man may arise to lead us past the idols of narrow nationalism and the "bogies" of entangling alliances into a new association of nations that will be the clearing-house, not only for the political, but for the social activities of men. Or the new leader may be a teacher, the head of a great society of scholars like this University, who will study what the human mind has done and should do, as it works its way out of darkness and error towards the understanding of itself and its destiny. Such universities as this, constituted of such scholars as these around us to-day shall train a new race of thinkers, men with hopes as well as with habits; men with standards of eternal values as well as of human science; men with ideals of service as well as of professional success. This will be the new birth of civilization.

Facing to-day a new world of opportunities, as you do, young women, we feel a special interest in you. You are fascinated by the glamour of new experiences in freedom. These offer themselves to you in business, in science, in social effort, in the professions. All is not gold that shines in this bright array of these new careers. That, too, you are beginning to sense. You see the temptations which are hidden in the "New Freedom," but I believe you also see new uses to which to put it.

Whatever our views, we all admit a definite progress in woman's use of her talents. Her accomplishments in the professions are fully recognized. Some are surprised by her grasp of the sciences. In the arts she has long played the double rôle of patron and creator. Her rise in business in the last two decades has been rapid. She merits a higher position in finance and administration than has so far been accorded her. These careers rightly set the college woman to dreaming of new fields to conquer. Looking to the future she will feel a keen appreciation of the aid science and learning have brought her. More inspiring still is her share in the partnership which will be formed by the best of young college people. Surely the world holds nothing finer than the happiness to be found in such marriages, if based on a single and high standard of responsibility. And let her not forget that as wife and mother she must always carry the torch!

The two great currents in the history of the world express the issue this day presented to you, young men and women. What shall be your chief purpose in life? The acquisition of wealth and power, or the development of your own character and that of your fellow man? What will you do with the knowledge and training you have acquired? How will you use your life? The race is about to start—which goal will you run for?

It is said that when the Olympic games were re-established in the great Stadium in Athens in 1896, the native Greek youths looked on with utter indifference while the modern athletic events were all won by the American and foreign athletes. To the Greek, the British and American games seemed trivial and purposeless, conveying no sentiment and no ideal. But when the Marathon race was called, every Greek eye shone with light and every Greek pulse throbbed with heat as the minutes went painfully by. At last, when the Greek champion was described in the distance racing far in advance of all competitors, the hundred thousand Greeks gave vent to their feelings in silent floods of tears. And when the King handed their victorious runner the olive wreath from the mountains of Marathon, all felt that historic Greek honor had been vindicated and ancient Greek glory restored.

Young men and women, which race will you run? Shall it be the modern race for selfish power, or shall it be the world-old race for humanity? I beg you to enter the Marathon for the "abundant life" for all men. It is the only life worthy of the scholar, for it is the race of Knowledge with Ignorance, of Wisdom with Error, of Love with Selfishness, of Life with Death! Run it like men! And God speed you!

CHARLES WILLIAM DABNEY.

HARVARD ALUMNI BULLETIN

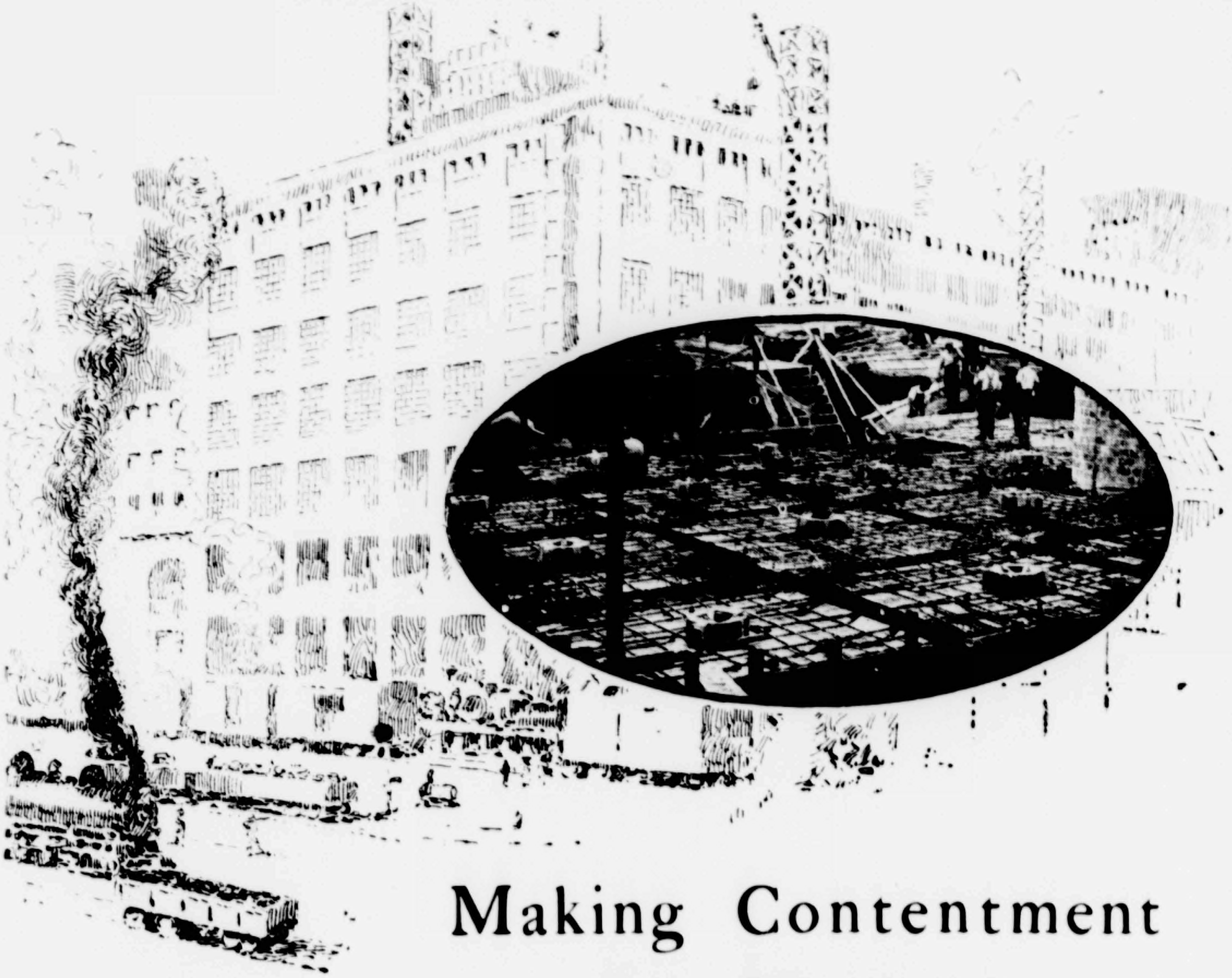
Vol. XXIII June 23, 1921 No. 37

Increasing the Effectiveness of the X-Ray
by Professor Duane

The Harvard Engineering Camp

PUBLISHED FOR THE HARVARD ALUMNI ASSOCIATION BY THE HARVARD BULLETIN, INCORPORATED, BOSTON, MASS.

HARVARD ALUMNI BULLETIN. Published weekly during the College year at 50 State St., Boston, Mass. Subscription, $4 a year. Entered as second class matter, Oct. 7, 1910, at the Post Office at Boston, Mass., under the act of March 3, 1879.



HARVARD ALUMNI BULLETIN

OFFICIAL PUBLICATION OF THE HARVARD ALUMNI ASSOCIATION, AND OF THE ASSOCIATED HARVARD CLUBS

VOLUME XXIII. THURSDAY, JUNE 23, 1921 NUMBER 37.

News and Views

The Undergraduate Mind.

A moderate man determines his position by centering himself between the revolutionary and the reactionary. His method is not unlike those auditory range-finding devices which gauge the distance by the echo. The moderate addresses himself to the revolutionary and to the reactionary in turn, and then shifts his position until the revolutionary calls him a reactionary, and the reactionary calls him a revolutionary. Then he knows where he is. The point at which these retorts are equal and opposite marks the precise centre of moderation.

The undergraduate mind has recently been so oriented and tested by the unintentional coöperation of the National Security League and *The Freeman*. The National Security League announces an organized effort to "counteract" the "poison" of socialistic propaganda which is "striking at the foundation of Americanism" by attempting to implant "Utopian theories in the immature minds of the young men and young women in the colleges and universities of America". *The Freeman*, on the other hand, says that "if there is one single phase of the active and thoughtless life of the American collegian that tends naturally to the production of spiritual unrest, it has thus far escaped our notice". The average college man, the writer argues, is neither detached and disillusioned enough to be a parlor radical, nor unfortunate enough to be an "unruly proletarian". He has no intention but to expand and perfect "the existing system of exploitation".

If either of these comments had been made in the absence of the other there might have been occasion for slight flutterings of apprehension. But the nearly simultaneous appearance of the two is equivalent to an "all's well" from the watch.

It might be added that neither of these observers shows much understanding of human nature in general or the college species in particular. In the first place, college men are mostly like other people, and astonishingly like their parents and neighbors. But, in the second place, college and university men range in age from about seventeen to about twenty-seven. This is a period of life that has frequently been written about in prose and in poetry. It is a time of comparative immaturity in point of experience; but it is not to be inferred that it is a time of gullibility. Quite the contrary. It is a time when curiosity and criticism are strangely blended with ardor and enthusiasm. Young men and young women either do not think at all, in which case they follow the opinions and habits of the community at large; or they think rather more searchingly and vigorously about fundamental questions than their more mature elders. The average American college or university man is not likely to be a revolutionary because he comes from somewhere and belongs somewhere; because he is on the whole fortunate and hopeful; and because his information and discipline are comparatively well-balanced. On the other hand he cannot be wholly complacent for the decisive reason that he hasn't been cooking long enough to be hard-boiled.

* * *

Limiting the Size of the Business School. Some months ago when the Governing Boards of the University decided on the recommendation of the Faculty that the tuition fee in the Graduate School of Business Administration should be increased to $400 per annum, it was taken for granted that this action might, and probably would, lead to a reduction in the number of students next year. The present indications are, however, that the prophets were wrong on this point and that this year's entering class of 285 students will be somewhat exceeded next September. Already the School has received a larger number of applications than at the corresponding date a year ago, and they are still coming in. It is significant, morever, that the majority of these applications are from graduates of colleges other than Harvard.

The Faculty of the Business School, for reasons which are set forth elsewhere in this issue, has decided that not more than 300 new students will be enrolled next autumn. When the applications have reached that figure, as they are expected to do by Commencement or shortly thereafter, the lists will be closed. It is a case of first come, first served. This does not mean, however, that the entering class in the School is to be permanently fixed at 300; on the contrary, it is the intention of the authorities to alter the quota from time to time as the facilities of the School permit. Indeed, it is hoped and expected that a year or two later the present figure can be lifted to 450, but this action will not be taken until there has been a sufficient expansion in staff and equipment to make certain that the increased enrollment can be adequately handled.

During the nine years of its existence the Graduate School of Business Administration has acquired a reputation for high standards and efficient personal instruction. The members of its teaching staff are naturally anxious that this reputation shall not be impaired by reason of placing an undue load upon existing facilities. It has been the policy of the School to lay emphasis upon the small-group system of instruction, with discussions rather than formal lectures, and free use of the problem method. The work of the students has been done under close and constant supervision on the part of the instructors. It is easy to see that under such a plan of instruction the size of the teaching staff must be increased with every new increment of students, a situation somewhat different from that in the undergraduate departments where there is no fixed limit upon the number of students who can be handled by any one instructor. And when new instructors are added to the staff of the Business School there must be full-time work for them to do; hence the desirability of keeping the limit at a designated figure until it can be raised substantially.

Moreover, there is the question of physical facilities. At present the Business School has no building of its own; its work is being carried on in scattered quarters all over the University, in basements and in attics. Its library space is already inadequate. The authorities of the School would like a building adequate for handling a thousand students. They believe that they could fill such a structure by the time it is completed, and judging from the present popularity of the School they are right.

The Harvard Union. The officers of the Harvard Union are to be congratulated on the success of their efforts to make the Union a more central and vital feature of University life. The considerable increase of membership means improvement in both the financial situation and the interest and support of members of the University.

The most notable feature of the Union's policy during the last two or three years has been the securing of outside speakers to address its members on topics of the day. During the past year the management was unusually successful in securing speakers of distinction. The issues of the presidential campaign were presented on the one side by Hon. Frederick H. Gillett, LL.B. '77, Speaker of the National House, and on the other side by the Democratic candidate himself. Among the well-known foreigners who visited the Union, were General Marie Fayolle, General Georges Nivelle, Baron Eugene Stein, and Hon. Mark Sheldon. In addition to these the list included Mark Sullivan, '00, Vilhjalmur Stefansson, Dv. '03-04; Gr. '04-06, Thomas W. Lamont, '92, William Allen White, Lt. Col. Theodore Roosevelt, '09, Henry W. Morgenthau, Henry Clay, and others of equal renown. Plans for an equally attractive list for next year are already well-advanced.

There can be no doubt of the importance of the service which the Union renders to the University in providing this opportunity of hearing directly from men of action in the diverse fields of contemporary life. It forms an important part of that unorganized and atmospheric educational activity that distinguishes a great university. It helps to overcome the proverbial academic aloofness. It sharpens the intellectual appetite, and so assists in the assimilation of the ample and hearty intellectual nourishment provided in the regular courses. In rendering such a service the Union is more than a convenience or a luxury; it is rapidly growing to be a necessity.

* * *

The New England Federation at St. George's. Several years ago the New England Federation of Harvard Clubs held its annual meeting at Phillips Exeter Academy. This, like the recent meeting in Cambridge, was a gathering primarily for the transaction of business. On July 16-17 the Federation is to hold a meeting—it is called a "midsummer outing"—primarily for the transaction of pleasure. Again a boys' school is to provide the background—this time, St. George's School at Newport, R. I. The program of "plaisuring", in the good old Yankee term, includes possibilities of sight-seeing ashore and afloat, of a Rhode Island clambake, of Rhode Island johnny-cake for breakfast, of a dinner at which eminent speakers will provide the first aids to digestion, and of all the attainable delights associated with Newport in midsummer.

The Harvard Club of Rhode Island summons the Harvard men of New England to this symposium, and it is a summons well worth heeding. The headmaster of St. George's School is a Harvard man, Stephen P. Cabot, '92. The captain of next year's Harvard football team is a St. George's boy, Keith Kane, '22. The School itself is a place of extraordinary beauty and charm. But the purpose of the meeting is simply to bring the Harvard men of New England together, for friendly intercourse, under the auspices of the Harvard men of Rhode Island. It is a satisfaction to call attention to something not because any duty is involved in it, but merely because it is a plan of pleasure; for this is really what may be expected by those who will notify Mr. Cabot, at St. George's, that they hope to attend the Newport meeting.

Increasing the Effectiveness of X-Rays

A Stenographic Report of an Illustrated Lecture Delivered in the Jefferson Physical Laboratory by William Duane, Ph.D., Professor of Bio-Physics at the Harvard Medical School

YEARS ago Mr. Thomas A. Edison made an exceedingly important observation. He observed that, if you seal into an ordinary electric light bulb an extra wire, and if the filament of the electric light bulb is heated to incandescence, you can pass a current of negative electricity from the filament to this extra wire, but not a current of positive electricity. Negative electricity will pass from a hot body—a hot wire—through a vacuum to another wire, but positive electricity will not so pass. More recent researches, especially at Cambridge in England under Sir J. J. Thompson's guidance, have shown that this phenomenon is due to the emission from the hot body of small charges of negative electricity. We call these small charges of negative electricity electrons. They are really atoms of electricity. That is, according to modern views, electricity, as well as ordinary matter, has an atomic structure, and the atoms of electricity, which are negative charges, are given off by hot bodies. Further, these negative charges, these negative atoms, can carry current through a vacuum.

This Edison effect, as it is called, has been used in the construction of modern X-ray tubes. The idea of using this phenomenon in an X-ray tube originated in Germany, but the best tubes have been constructed in this country by the General Electric Co. They have been designed by Mr. W. D. Coolidge, a member of the research staff of that company. I have here a Coolidge X-ray tube. It consists of a small coil of tungsten wire, perhaps ten or twelve turns of wire, joined to two wires which come out from the glass globe and through which we may pass a current of electricity in order to heat the tungsten wire. By passing a current of electricity in through one of these terminals and out through the other we can heat the tungsten wire to any desired temperature. We can cause the tungsten wire to give off atoms of electricity. If, in addition to heating the tungsten wire, I place the tube between the poles of a powerful source of current, a very large battery, for instance, or an induction coil, when this pole is charged with negative electricity and that one with positive, the negative electrons, the negative atoms of electricity, will be forced across and will hit the other electrode, which you see here opposite the tungsten wire. This second electrode we call the target.

Now, I propose to show you some experiments which illustrate the fact that when a stream of atoms of electricity hits the atoms of ordinary matter in the target, those atoms radiate something. They send off waves, which travel out in straight lines through space, and which are capable of doing certain things.

[May we have the lantern?] There are three effects which I wish to show you. The first effect is this: coming off from the atoms of ordinary matter which are hit by the atoms of electricity there are rays, travelling in straight lines, which are capable of producing an effect on a photographic plate. Here at the top of this slide is a diagram of the Coolidge tube. The little coil of wire is toward the right, the target toward the left. The dotted line represents the path along which a ray travels from the point in the target where the negative electricity hits it. Here at the bottom is supposed to be a photographic plate wrapped in black paper, which will not allow ordinary light to pass through. If we develop the plate we shall find an image imprinted upon it, which is a pinhole camera image of the target of the X-ray tube. This experiment will show us, firstly, that there are radiations which travel in straight lines; secondly, that these radiations affect a photographic plate. It will also show us from which points of the X-ray tube the radiation comes, for we shall have a picture on the photographic plate of the part of the X-ray tube from which the radiation comes.

Here is a reproduction from the photographic plate. Most of the atoms of electricity hit the target on the surface of the bright circle, but I think that you can see an outline of the target running around in this direction and back again. The whole target is outlined. In other words, some of the atoms of electricity curve around and hit the target on the side and become there the source of the rays.

I wish now to show you, as a second effect, the fact that these rays make a gas a conductor of electricity when they pass through the gas. I have here a small electroscope, an image of which I am throwing on the screen. If you charge the electroscope you can see the image of a gold leaf. *This* part is a metal rod, and *this*, a leaf of gold foil. This metal rod and the gold foil are now charged. The charge on the gold foil repels the charge on the metal, so that the gold leaf stands out from the metal.

I have in this lead box an X-ray tube similar to the one on the table. I will first turn the induction coil current into the X-ray tube without heating the tungsten spiral. There is a very small effect. The gold leaf is very gradually falling. If I stop the induction coil and make the circuit which causes the filament to heat up, there is no motion of the gold leaf. That is, neither the induction coil current applied to the X-ray tube, nor the heating current alone caused the gold leaf to become rapidly discharged. If, however, I turn both currents on together, the gold leaf is immediately discharged.

This side of the lead box contains a round hole covered with black paper. The rays pass out through the hole, and travel through the air in the neighborhood of the charged electroscope. They make the air a conductor of electricity, and the electroscope is discharged.

If we turn this sheet of lead up in front of the hole you will notice that the motion of the gold leaf is very, very much slower. Very little radiation passes through the lead. If I myself stand in front of the hole you see that the leaf moves a little faster, but not so fast as it does when I step aside; that is, my body is somewhat transparent to the rays.

If we put this board up in front of the hole through which the rays come, the board does not stop the radiation. The rays are capable of passing freely through the wood although it is nearly an inch thick.

That, then, is one of the effects produced by the rays. They are capable of making the air a conductor of electricity. They are capable of ionizing the air, as we call it.

The third effect which I wish to show you is that the rays make certain substances phosphorescent. You cannot see the rays themselves, but if I hold a screen containing one of these substances in front of the hole I think you can see that the screen becomes the source of visible rays. If I place my hand behind the screen those of you who are nearest to the front can see the shadow of my hand on the screen, and you can see the shadow of the bones, because the bones absorb more of the rays than the rest of the flesh does. Those of you who have not examined the bones in your own hands before may do so at the end of the lecture?

I have shown you the three chief physical effects produced by this form of radiation. The rays also produce marked physiological effects. If I were to hold my hand in front of the tube for ten or fifteen minutes I would feel nothing at the time, but a week or ten days hence my hand would become red, just as if it were sunburned. If I held my hand in front of the tube for half an hour, my hand at the end of a week or so would become blistered, the skin would peel off, and I would have a bad burn. If I exposed it still longer, a good deal of the flesh would fall off and I would have a severe burn. If one exposes one's hand or any part of one's body, not once but again and again, day after day for years, as some X-ray experts have done, there is a certain amount of injury produced in the tissues, and somehow or other, we do not know exactly how, but somehow, the tissues get the habit of repairing that injury. They get the habit of growing in an abnormal manner, and after a while tumors develop which become malignant tumors, and the malignant tumors are cancers. A single exposure to X-rays, or two or three exposures, do not produce cancers, but exposures day after day for months and years can produce, and have produced, cancers which do not differ materially from cancers that develop naturally.

The exact details of the effect produced on the tissues are not understood at all well. We know, however, that radiation of this kind will slow down the growth of tissues. We know that it is possible to destroy certain kinds of tumor tissues by means of these rays, and this destructive effect produced by the rays is utilized in the treatment of malignant diseases. The treatment of malignant diseases has not been very effective in those cases in which the malignant tumor lies some distance below the surface of the skin. Tumors that grow on the skin have been treated very often with considerable success by means of radiation such as the X-radiation.

There are certain types of internal malignant diseases which are, nevertheless, very susceptible to radiation; for example, a disease known as leukemia. The exact origin of leukemia we do not know; the cause of it we do not know. Some of the symptoms we know. One of the symptoms is an enlarged spleen. Another symptom is an abnormally large number of white cells in the blood. It is possible by radiation to reduce the number of white cells in the blood, and it is possible to reduce the size of the spleen in these cases. It is possible to give a great deal of relief to patients, even if we don't cure them. One can relieve their symptoms in a very marked way by these peculiar radiations.

Certain other malignant diseases, malignant lymphometa, as they are called, (tumors growing from the lymphatic glands), are peculiarly susceptible to X-radiation. We do not, however, permanently cure cases of this kind.

It was in the hope of increasing the effectiveness of X-rays in treating cases of malignant disease that I began several years ago to study the best methods to employ in producing X-rays of a very penetrating character. You noticed that the X-rays passed through my body, but not very well. A great deal of radiation was absorbed in passing through that thickness of tissue. What has limited us in the treatment of internal malignant diseases has been the amount of radiation that the skin itself will stand. You can radiate through the skin only a certain amount of energy. If you try to send more than that amount through the skin, the skin becomes burnt and you get more or less severe ulceration. The problem, therefore, is to produce, if possible, a form of X-radiation that will penetrate more easily to the deeper layers of tissue and leave less of itself in the skin.

One of the first discoveries that we made, a most important discovery, was the fact that a certain law in physics known as the quantum law applied to X-rays. The quantum theory is an exceedingly abstruse theory, very difficult to understand in some of its phases. No one would have believed ten years ago that the quantum theory would ever be used in the treatment of malignant disease, but, as a matter of fact, the quantum law applies to X-rays, and the fact that it applies to X-rays is really the basis of the recent development in X-ray therapy. The quantum law is the fundamental principle involved in the production of penetrating X-rays. At the time that we published our experiments it was believed in Europe that the quantum law did not apply to X-rays, that you could not produce X-rays more penetrating than a certain amount.

Although the general quantum theory is very abstruse, in the form in which it is applied to X-rays the law appears to be very simple. In the first place, X-rays consist of a series of waves sent out one after another. Suppose there are a series of waves travelling through space. We call the wave-length of those rays the distance from the centre of one wave to the centre of the next following or the next preceding wave. It has been known for a long time that X-rays having a very short wave-length are more penetrating than X-rays having a longer wave-length. The problem became, therefore, to find out what we must do in order to produce X-rays of very short wave-length.

The quantum law applied to X-radiation may be stated in this way: If you multiply the wave-length of the shortest X-rays that are given out by the tube into what we call the difference of potential applied to the tube the product is constant. The difference of potential applied to the tube may be regarded as the force driving the electrons through it. In interpreting the quantum law we see that in order to get very short wave-lengths we must apply a very great force.

I shall pass now to the discovery of radium. Roentgen discovered in 1895 the peculiar rays which we call X-rays. During the next few years in Paris a number of scientists discovered radio activity, radium, and the other thirty odd substances which are similar to radium. The discovery of radium and the other radioactive substances was not a matter of chance, but rather the result of a well-thought-out campaign of research. Shortly after Roentgen published the account of his researches Monsieur Becquerel, who at that time was the leading expert in the world on phosphorescence, conceived the idea that possibly certain salts that were capable of emitting ordinary light might emit rays similar to the X-rays, i.e. rays capable of passing through black paper, of effecting a photographic plate, and of ionizing a gas. He tried experiments with salts of uranium. Uranium is a chemical element, the chemical element of highest atomic weight. Monsieur Becquerel found that salts of uranium do emit a kind of radiation that is similar to the X-rays, in that it is capable of producing the same effects. At this point Madame Curie took up the research. She began an extensive examination of all known chemical compounds, and, as far as she was able, of all minerals. She examined an enormous number of substances, and she found that some of the minerals were very active. Later she and her husband discovered that the excessive activity of the minerals was due to the presence in them of new chemical elements, two of which they called polonium and radium.

On this slide we have pictures of a certain mineral called pitchblende. The lower photograph was taken in the ordinary manner, by means of ordinary light shining upon the pitchblende. The upper photograph represents a photograph of the same piece of ore taken by its own light. The ore was laid on top of a photographic plate, which was wrapped in a piece of black paper. The peculiar radiations passed through the paper and left their mark on the photographic plate. They show in the photograph the points in the ore from which they came.

The next slide shows a picture of a Welsbach mantle taken by its own light; that is, the Welsbach mantle was laid on a photographic plate, the rays coming from the different points in the mantle producing their effects upon it. A Welsbach mantle contains the chemical element thorium, which is the next heaviest chemical element to uranium; and thorium, or any salt or any chemical compound containing thorium, is a source of these peculiar rays.

Here is a photograph of some drawing pencils, shadow pictures produced by rays from radium. You cannot make very good shadow pictures by means of the rays from radium, because they are too penetrating, they are much more penetrating than the X-rays.

I have here a slide representing the

effects produced by these rays on bacteria. The X-rays or the rays from the radioactive substance kill bacteria of all kinds, provided they are sufficiently intense. In general, however, they cannot be used for treating cases of infection, because the intensity of the radiation required to kill the bacteria is so great that the rays would kill the tissues in which the bacteria are growing.

A plate containing radium was placed over the bacteria, and underneath the plate containing the radium was placed a strip of metal. This slide represents the development of the bacteria some time later. The portions of the original infection which did not lie underneath the radium, and the portions underneath the brass plate, where the rays were cut off from the bacteria by the plate, have grown; and those portions of the original infection which were directly subjected to the radiation show no growth at all; that is, the bacteria were killed. If you take a plate containing radium and put it down on top of a surface like that, you produce a tremendous radiation on that surface. Those bacteria were subjected to rays of tremendous energy.

The rays are also capable of producing certain very extraordinary abnormal growths, monstrosities. Here on this slide is a certain animal that belongs to the lower walks of life which normally would grow up as represented at B. After having received quite strong radiation it developed in a very abnormal manner, as represented at A.

The mechanism of the production of these rays is somewhat as follows: On this slide we have a list of almost all the radioactive substances known. I wish to call your attention to only five of them at this time. The sixth from the top is radium. The next below it is the emanation of radium, and then follow radium A, B, and C. The radium itself is a solid substance. It is a metal. The radium transforms itself into the emanation, which is a gas; and the emanation transforms itself into radium A, which is a solid. Further, radium A transforms itself into radium B, another solid, and radium B into radium C, another solid. During each of the transformations the substances emit the peculiar types of rays.

In treating cases of malignant disease at the Harvard Cancer Commission's hospital, we do not use radium itself. We use the other substances that come from the radium. We have a machine at the Medical School which extracts and purifies the gas that we call the emanation of radium. On this slide we have a diagram of it. The radium dissolved in water is in a globe at the top. Here is a mercury pump, which pumps the gas from the radium solution into these tubes, where it is purified. This represents another pump, which pumps the pure emanation off through a tube and into any vessel which we choose to fasten on at this point.

I have here a tube which was filled with emanation last Monday. The glass tube also contains a small amount of a phosphorescent salt, willemite. You can see how brightly the salt shines. Now I want to show you that in addition to making the willemite shine, this emanation produces rays that are capable of making the gas in the neighborhood of the electroscope a conductor of electricity. If I hold the tube near the electroscope the gold leaf falls rapidly. That is, the substances in this tube emit rays which are capable of making the gas in the neighborhood of the electroscope a conductor of electricity.

I have in this other tube some emanation and a thin sheet of metal wrapped around the inside surface of the glass. The emanation transforms itself into these other substances, radium A, B and C, and these other substances are deposited on the walls of the tube and also on the metal or anything that there is inside the tube.

I am going to ask Mr. Whitten if he will break this tube outside the laboratory and bring us back the sheet of metal,—break it outside the laboratory because, if we broke the tube inside, this room would become infected by the emanation, and we should not be able to perform certain experiments here. We will break it outside, and let the gas escape. We will then examine the sheet of metal, and we shall find that the contact of the sheet of metal with the gas has made the metal active. We shall be able to show that the metal emits rays capable of producing phosphorescence and capable of discharging the electroscope. It is necessary to bring the metal into contact with the emanation in order to produce this effect.

I have here a piece of willemite in my hand. If I hold the piece of willemite close to the metal I think you can see that it shines. If I bring the metal near the electroscope, you see the gold leaf falls back immediately. In this experiment we have radiation of tremendous activity, because we are using what are called the *alpha* rays, and the *alpha* rays carry 90 per cent of the energy. If you will pass this around, I think that you will see that when you hold the metal at a certain distance, about so far, from the willemite, and then move it a little closer, there is a marked increase in effect. That represents the distance to which these *alpha* rays, carrying 90 per cent of the energy, travel through air.

In making treatments of malignant disease we use small tubes containing radium emanation, and these small glass tubes, some of which are represented on this slide, are placed in steel tubes, or in applicators of various forms, and laid on the tumor or inserted in the tumor as the case may be. We have great variety of methods that may be employed in actually applying the radioactive substances to a tumor. The substances must be placed in or near the tumors in such a way that the rays pass through the tumor tissue and destroy it. That is the fundamental principle.

Here are other applicators. I shall not go into the details, except in the case of this one at the upper right hand corner. It is a lead box, in which these tubes containing the radium emanation are placed. The box wrapped in a thick layer of gauze, is place on the skin. In that way the source of the rays is lifted up at a distance of several inches from the skin. The purpose is to reduce the effect produced on the skin itself in comparison with the effect produced below. The lead is used to cut off those rays which would be easily absorbed in the skin, and allow those which are more penetrating to pass through. The most penetrating rays are called the *gamma* rays, and those are the ones which we use in deep therapeucy.

It has been the object of some of our researches to try to produce X-rays that would be as penetrating as these *gamma* rays from radium for the treatment of the internal malignant tumors.

THE "HARVARD FUND"

The account of the Milwaukee meeting of the Associated Harvard Clubs, published in the BULLETIN last week, made no mention of action taken in regard to the establishment of a permanent fund for the support of Harvard University. At the afternoon session on June 10 the meeting passed unanimously a resolution, presented as the unanimous recommendation of the Associated Harvard Clubs, which approved the report of the Committee on Service to the University for the establishment of a permanent alumni fund to which Harvard men should make small annual contributions. The resolution provided for the appointment of a committee to consult with representatives of the Alumni Association and with the Corporation with a view to making definite plans for the establishment of such a fund.

The sentiment of the meeting was in favor of calling it the "Harvard Fund", instead of the "Alumni Fund", on the ground that use of the word "alumni" might give rise to the impression that contributions were to be expected only from degree-holders. The Committee on Service to the University, which made the report on which the resolution was based, was composed of 60 Harvard graduates; the chairman was G. Cook Kimball, '00, of Pittsburgh.

STARTING FOR THE FIELD.

The Harvard Engineering Summer Camp

By H. J. Hughes, '94, Dean of the Harvard Engineering School.

THE Engineering Camp at Squam Lake, N. H., was in session during the summer of 1920. It had been closed for three years previous on account of the war. The camp is now reëstablished as one of the regular activities of the new Engineering School, and the current term opened last Saturday.

The first engineering camp was started nearly thirty years ago at Dean Shaler's farm on Martha's Vineyard to give summer instruction in plane, topographic, geodetic, and railroad surveying. Previous to that time it had been customary here, as elsewhere, to carry on both class-room instruction and field work in these subjects during the college year, using the afternoons for outside work. This practice was not satisfactory because it was difficult to find sufficient time for field work, and the conditions were unfavorable. At first the camp was organized chiefly for field work.

The success of the early camps led to the present, satisfactory arrangement of giving both class-room instruction and field work concurrently during the summer. The Harvard Camp was among the first to adopt such a plan, as well as one of the earliest summer engineering camps to be established. Nearly every large engineering school now has one; but many are still conducted only for field practice.

In 1901 the University purchased a small tract of land for the camp in Moultonboro, N. H., on the easterly shore of Squam Lake, five miles west of Lake Winnepesaukee, and twenty miles south of Mt. Chocorua. Additional land has been purchased from time to time by funds provided by generous alumni; and the property now comprises 700 acres of land with a mile and a half of shore line. It is located in an attractive spot in a picturesque region, has a delightful summer climate, and is admirably adapted by nature for surveying work and camping. There are on the place three large wooden buildings containing offices, class-rooms, drafting rooms, living rooms, servants' quarters, kitchen, and dining room; and also three cottages available for instructors and their families. The sleeping quarters are large tents set on elevated wooden platforms, each tent housing four men. The tents are arranged along the lake shore, and so near it that an early morning plunge is the easiest way to begin the day.

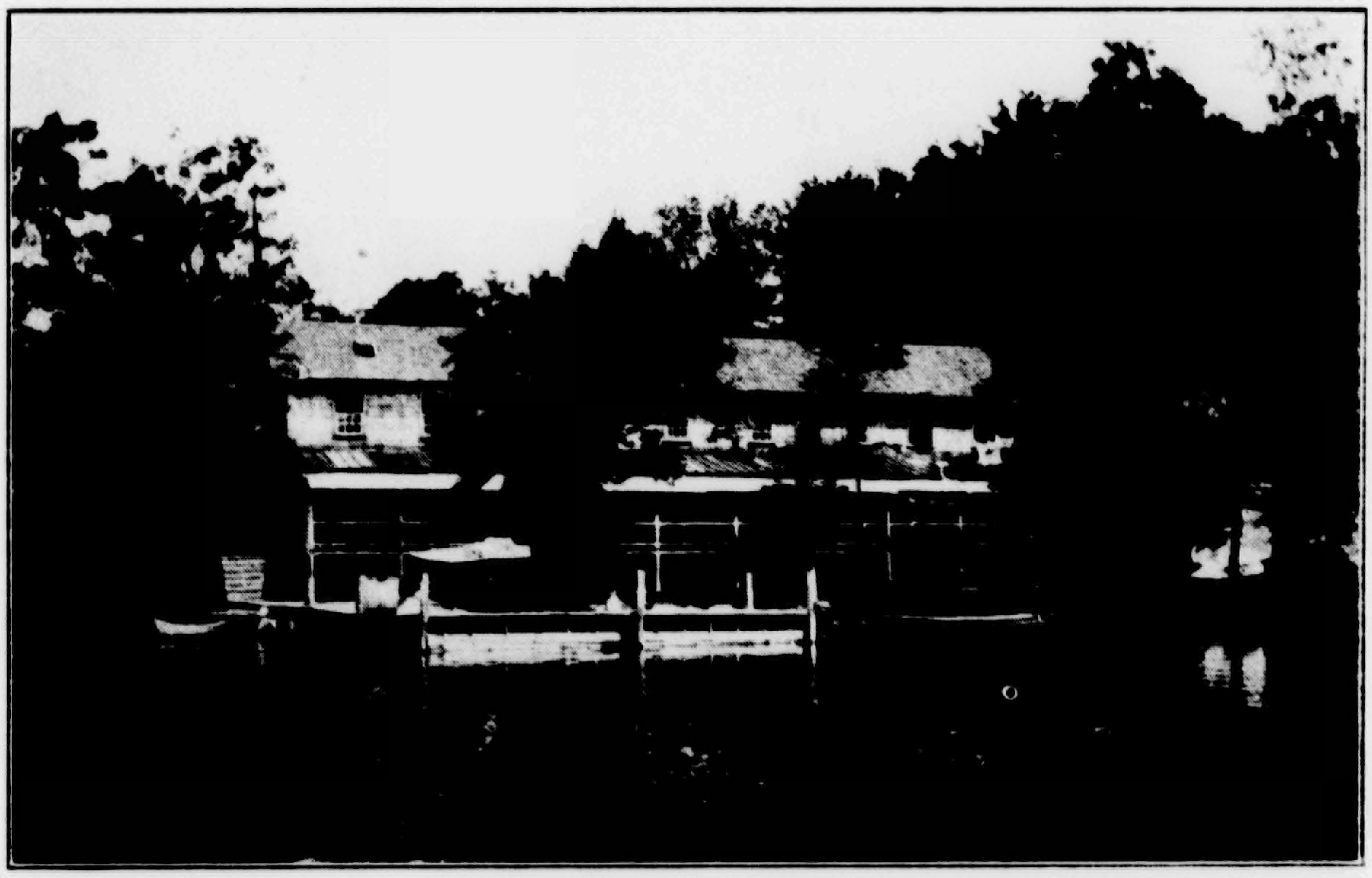
The health of the camp is carefully safeguarded; and though the methods for maintaining clean and wholesome conditions are necessarily primitive and simple, they are rigorously and effectively carried out; and in this every member of the camp is required to coöperate. The water for drinking and kitchen purposes cames from underground streams collected by a deep well on the hill above the camp, whence it is pumped into a compression tank under the main building, thus providing a safe and convenient supply as well as fair fire-protection. The conduct and character of the camp activities are in themselves conducive to good health. A large portion of the day's work is done in the fields and woods; everybody sleeps with his tent flaps open. And even the indoor work is carried on in buildings which, except in bad weather, are little more than roofs. The work is rigorous and long, but there is such variety and so much out-of-door exercise in the daily routine that other kinds of activity are not necessary to maintain health and vigor. Nevertheless, everybody finds time and energy to fish, paddle, swim, or take long tramps; and the camp always has a good baseball team. The camp life is vigorous, wholesome, and happy.

The instruction given at the camp has gone through many changes, both in

Main Street on the Edge of the Lake.

methods and in the courses offered. At first only surveying was taught, but, as the advantageous conditions for study at the camp became evident, other courses, such as mechanics and other engineering subjects, gradually became a regular part of the summer's offering. The work has always been conducted on the intensive plan; and students are allowed to take only one course at a time. Formerly the camp was in session for eleven weeks, but lately this has been reduced to eight weeks. And at present only plane, topographic, and railroad surveying are offered.

The camp courses are open to both engineering students and college students, and may count for either a college or an engineering degree. Although the instruction provides training which is required in some of the engineering programs the subject matter is treated from the standpoint of making the courses desirable electives



The Main Building.

for those who do not intend to become engineers. The broader aspects of engineering and related economic problems are brought out; and the aim, above all things, is to develop personal responsibility, efficiency, and accuracy.

The daily program begins with breakfast at 6.30; then a written test from 7 to 8, followed by short class-room discussion of the problems of the day. At 8.30 the field work begins; luncheon in the field from 12 to 12.45; and the field work ends promptly at 4. Then everybody has a swim, and at 5 o'clock an early dinner. On Saturdays the work stops at 12. Usually there is evening study; and the time required for this varies with the ability, the previous training, and the habits of work of the different students. Rainy days are spent in drawing maps and computing the results of field work; and occasional other office days are assigned. On the average about four days out of five are spent in the field. The summer's schedule is made up of a series of problems, each requiring from one to four days; each problem including field work, calculations, and a map or plan. Sufficient time is assigned to each unit of work to enable the average student to finish it on time. Systematic and regular habits of work are required. Results must be handed in when due; and procrastination is always costly and sometimes fatal.

All tests and examinations are graded strictly on the basis of right or wrong. This makes the first weeks at camp discouraging and difficult times for the easy-going, but the experience of many years has demonstrated the merits of this rule. If no credit is given for wrong answers, the students learn eventually to do their work accurately, with a resultant saving of time. Training in efficiency and accuracy is one of the most important features of the camp instruction. The camp is also a good school for training in democracy. The students dress simply and much alike; they all live in the same way; and every man stands on his own merits. Many lasting and valued friendships have been made at the camp among men who would otherwise never have known each other, because, in Cambridge, their paths so rarely come together.

In order to cover the necessary subject matter in a relatively short time, a summer at the camp is necessarily a busy one. Moreover it is common experience that the most effective way to keep boys happy and out of mischief is to have them thoroughly occupied with wholesome and interesting duties. A change from hard routine is obviously desirable; and the students may be out of camp from Saturday afternoon till

Waiting for the Postman.

Sunday evening. But long trips are thoroughly discouraged, because they are wearisome, and sometimes otherwise undesirable; for this reason motor boats and automobiles are not allowed in camp, but canoes are encouraged. There is always at the time some grumbling about hard work and the lack of opportunity for wandering afar; but for the most part the students are content to spend their days in or near the camp. And most of them find ultimate, if not immediate, satisfaction in hard work well done. The writer spent fourteen summers at the camp; and it is a constantly recurring pleasure to him as the years go by, to be told by former camp boys that the summers spent at Squam Lake were among the happiest and most satisfying of their college days.

WAR RECORDS—THEN AND NOW

There is no more striking indication of the growth of Harvard during the past 60 years than the contrast between the task of compiling the record of University men in the Civil War and that of assembling the material which will appear next autumn in the volume on "Harvard's Military Record" in the war against Germany.

The Civil War volume, collected by Dr. Francis H. Brown, '57, contained the names of 1,239 men. If we include also the hundred or more men whose records could not be secured until after the publication of the book, we have a total of something like 1,350 Harvard men in the Civil War. The present War Records office has already received 11,400 records of military service in the war against Germany; and although the date of going to press is imminent, more are coming in every day. It is safe to say that nearly nine times as many Harvard students and graduates served in the World War as in the Civil War.

In many respects, however, the task of the War Records office has been easier than Dr. Brown's. He had the disadvantage of a late start. Although a roll of honor of those who fell in the Civil War had been drawn up while the conflict was still going on, the work of collecting material concerning those whose lives were spared was not begun for several years. Again, Dr. Brown had to do the thing virtually single-handed. The result was that his book did not appear until 1886, more than 20 years after the close of the war.

In the case of the World War, the accumulation of records began in the summer of 1917. Since June, 1918, half a dozen clerks have been constantly occupied in assembling material sent in by thousands of graduates. A prompt start and an effective office force have sped the work, and "Harvard's Military Record", despite its immense bulk, is expected to appear within approximately three years of the date of the armistice.

RECENT PRIZE AWARDS

John F. Fulton, Jr., '22, of St. Paul, Minn., who won the first Bowdoin Prize "for dissertations in English" last year, has won first prize again this year. Last year Fulton entered two essays and won both first and second prizes. This year he entered an essay entitled "The Physiology of Novocaine", and won the first prize of $250 and a bronze medal. Robert A. Thorndike, '21, of Boston, won the second prize, and Franklin S. Pollak, '24, of New York City, won third.

George Van S. Smith, '22, of Richmond Hill, L. I., N. Y., won both Bowdoin prizes for dissertations in Greek and Latin; and S. B. Smith, Gr.3, of Schoolcraft, Minn., won the prize for Latin dissertations by graduate students.

The Bowdoin Prize Fund is the oldest of its kind at Harvard. The will of Governor James Bowdoin of Massachusetts, Harvard 1745, president of the convention which framed the Constitution of Massachusetts, provided that the interest on his gift of £400 be "annually applied in the way of premiums for the advancement of useful and polite literature among the residents" of Harvard University. The competition has been held annually ever since.

The Helen Choate Bell Prize of $275,

founded in 1920 in memory of Mrs. Bell of Boston for the best essay on a subject in American literature, has been awarded to John E. Bakeless, Gr. 2, of Bloomsburg, Pa. Mr. Bakeless graduated from Williams in 1918. He has recently joined the editorial staff of the *Living Age*.

William D. Murray, '21, of Yonkers, N. Y., has won the Philip Washburn Prize, for the best thesis on an historical subject presented by a successful candidate for a degree with distinction in history. Hector Lazo, '21, of Cambridge, has won the medal of the Comité France-Amerique for the best declamation in French. Irving L. Rapoport, '22, of New York City, has won the Susan Anthony Potter Prize for the best thesis on a subject in Comparative Literature.

The Jeremy Belknap Prize, for the best French composition by a first-year man in College, has been awarded to Louis Solano, '24, of Boston; the Sargent Prize for a lyrical translation of a lyric poem of Horace, to James W. Gould, '22, of Timewell, Ill.; and the Billings Prizes for improvement in pulpit delivery for theological students, to O. F. Green, of the Episcopal Theological School and C. D. Kepner, Jr., of Andover Theological Seminary.

GRADUATE FELLOWSHIP AWARDS

Richard Offner, '12, has been appointed to the Sachs Research Fellowship for the next academic year. He was a student at Harvard College from 1909 to 1912, and received the degree of Ph.D. at Vienna. He has recently been teaching fine arts at the University of Chicago. The Sachs Fellowship, with an income of $2,000, is awarded annually to a scholar of known ability for advanced work in fine arts in any part of the world.

The Bayard Cutting Fellowship has been awarded to William L. Langer, '15, assistant in History at Harvard. This fellowship, which bears a stipend of $1,250, is "reserved exclusively for men of the highest intellectual attainments and of the greatest promise as productive teachers". It was established in 1910 in memory of the late William Bayard Cutting, Jr., '10, of New York City.

The Rogers Travelling Fellowships have been awarded to Robert R. Cawley, '14, of Cambridge, now a graduate student in English, and Stanley B. Smith, '16, of Schoolcraft, Mich. They were established by a fund left to Harvard University by Henry Bromfield Rogers, of the class of 1822, "for the encouragement and attainment of a higher, broader, and more thorough scholarship than is required or expected of undergraduates, in all sound literature and learning, except science strictly so called". They bear stipends of $800 each.

HONORARY DEGREE FOR MISS CANNON

Miss Annie J. Cannon of the Harvard Astronomical Observatory has received from Groningen University in Holland an honorary doctor's degree in mathematics and astronomy, in acknowledgment of her work in the study of stellar spectra. She is one of the first American women to receive such a distinction from an European university for scientific work.

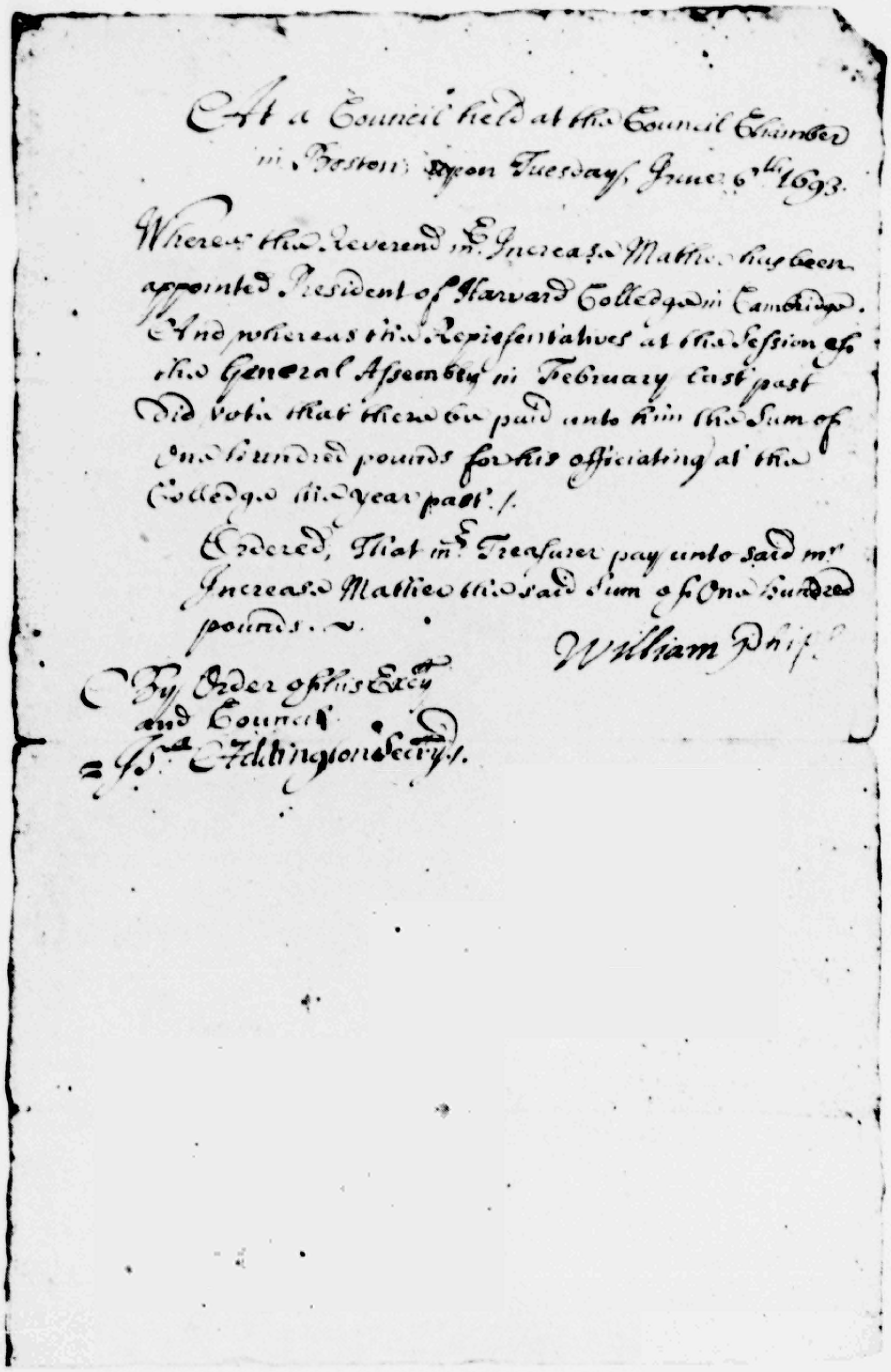
Miss Cannon graduated from Wellesley in 1884, and has been associated with the Harvard Observatory since 1897. During this time she has completed a catalogue of the spectra of some 220,000 stars all over the heavens, which when published will occupy nine quarto volumes. No such comprehensive study has ever been made before. She has also discovered three new stars, and 150 variable stars, and has completed a bibliography of variable stars containing about 45,000 references.

HONOR STUDENTS OF MEDICINE

Eleven students at the Harvard Medical School have been elected to Alpha Omega Alpha, the honor fraternity for medical schools. Those elected from the fourth-year class are: J. A. Crisler, Jr., University of Virginia '17, of Memphis, Tenn.; H. L. Blumgart, '17, of Allston; Augustus Thorndike, '15-17, of Boston; A. H. Washburn, Amherst '16, of Boston; S. R. Webber, '14-17, of Calais, Me.; and J. C. Whitehorn, Doane College '16, of Spencer, Neb. Those elected from the third-year class are: Hallowell Davis, '18, of Brookline; George Kahn, M. I. T. '19, of Dorchester; Howard B. Sprague, '18, of Swampscott; G. W. Taylor, '18, of Paterson, N. J.; and Louis Wolf, M. I. T. '18, of Revere.

An Increase Mather Document Given to Harvard

AN order, signed by Sir William Phips, Governor of the Province of the Massachusetts Bay, on June 6, 1693, authorizing the payment of 100 pounds to Increase Mather, then President of Harvard College, and bearing Mather's signature in acknowledgement, has been presented to the Widener Library by Henry R. Dalton, of Boston, and his brothers and sisters, in whose family the document had been for many years. The payment described in the order was in accordance



At a Council held at the Council Chamber in Boston: upon Tuesday, June 6th 1693.

Whereas the Reverend Mr. Increase Mather has been appointed President of Harvard Colledge in Cambridge. And whereas the Representatives at the Session of the General Assembly in February last past did vote that there be paid unto him the Sum of One hundred pounds for his officiating at the Colledge the year past./

Ordered, That Mr. Treasurer pay unto said Mr. Increase Mather the said Sum of One hundred pounds. ~

William Phips

By Order of his Excy and Council
Is.a Addington Secry./

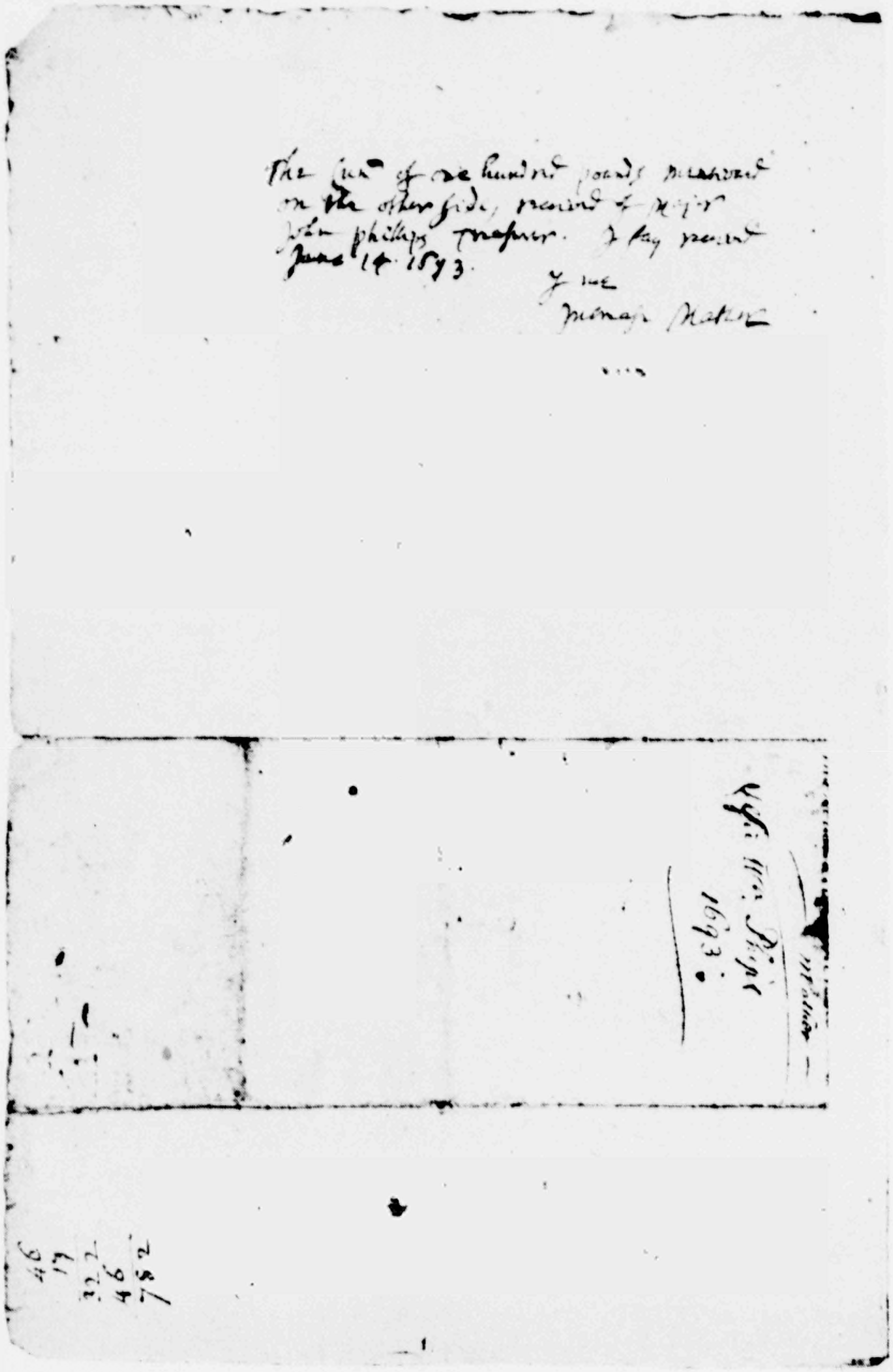
with a vote of the House of Representatives, passed during the preceding February.

On the back of the paper, both sides of which are reproduced herewith, is President Mather's receipt in the following form:

"The sum of one hundred pounds mentioned on the other side received of Major John Philips Treasurer. I say received June 14, 1693, by me Increase Mather."

Mr. Dalton's letter of presentation, dated Jan. 28, 1921, and inscribed to William C. Lane, Librarian of Harvard College, is as follows:

"I am sending through Mr. Wells a manuscript dated June 6, 1693, which, I believe, should be in the archives of Harvard University. I have talked the matter over with my sisters and brother, and we have come to the conclusion that we should like to present it to the College, and I trust that you will find it of sufficient value



and interest to accept. It is given in the names of

HENRY R. DALTON,
ELIZABETH L. DALTON,
PHILIP S. DALTON,
MRS. FREDERIC M. STONE,
(formerly Susan D. Dalton).
ELLEN B. DALTON.

"This manuscript was found among the effects of the late Charles H. Dalton, my uncle. How long it had been in the family, or the cause which led to its being in his possession, is unknown to me, and I have been unable in any way to trace its source.

"Very truly yours,
"H. R. DALTON."

UNIVERSITY UNION IN EUROPE

Professor Paul Van Dyke of Princeton University has been appointed director of the Continental Division of the American University Union in Europe in succession to Professor E. B. Babcock, who will return from Paris in the fall to resume his duties as head of the Department of Romance Languages at New York University. Professor Van Dyke, who was very active in the work of the Union in Paris during the war, will take charge of the Paris office at 1 rue de Fleurus on or about September 1. Dr. H. S. Krans, who has been in service at Paris, first as head of the Columbia University Bureau during the war and for the last two years as assistant director and secretary of the Continental Division of the Union, is on his way to this country on a short leave of absence, but will return to Paris to resume his duties at 1 rue de Fleurus before the departure of Professor Babcock. The trustees of the Union, at the same meeting at which they appointed Professor Van Dyke director of the Continental Division for 1921-22, reappointed Dr. Krans assistant director at Paris, and Dr. G. E. MacLean director of the British Division, which has its headquarters at 50 Russell Square, London.

Students who wish to enter British or French universities should write to one of the gentlemen named, or to the secretary of the trustees of the Union, Professor J. W. Cunliffe, Director, School of Journalism, Columbia University, New York City.

NEW PROFESSORSHIP AT HARVARD

By the will of the late Mrs. Emily R. M. Strauss, widow of Peter E. Strauss, a bequest of $10,000 was left to the President and Fellows of Harvard College for the establishment of a professorship in memory of her husband.

THE BIRTHPLACE OF ROOSEVELT

The work of restoring the birthplace of Theodore Roosevelt, '80, has been begun under the direction of the Woman's Roosevelt Memorial Association.

Mrs. John Henry Hammond, president of the Association, said in a recent statement:

"We are restoring not only the house in which Theodore Roosevelt was born but also the house of his uncle next door, which was a duplicate of it. The two will be called Roosevelt House. The birthplace itself, the Roosevelt Museum, will contain much of its original furnishings, including the bedstead in which Col. Roosevelt was born, and a mass of historic material connected with his life.

"The remainder of Roosevelt House will be devoted to the permanent work of the Association which will be carried on among the children of America. This work aims at developing in the American child a sense of civic responsibility and otherwise fitting him for a life of service to the community."

HARVARD IN THE PILGRIM PAGEANT

Several Harvard men have had a hand in the pageant, "The Pilgrim Spirit", which is to be given at Plymouth in July and August under the auspices of the Pilgrim Tercentenary Commission of Massachusetts. George P. Baker, '87, Professor of Dramatic Literature, wrote the pageant and will produce it. The verses were written by Robert Frost, '01, Hermann Hagedorn, '07, Edwin A. Robinson, '94, and one other; the music was composed by Chalmers Clifton, '12, F. S. Converse, '93, Arthur Foote, '74, Edward B. Hill, '94, Assistant Professor of Music at Harvard, and four others. "The Pilgrim Spirit" will be published in book-form by the Marshall Jones Co., of Boston.

RETURN OF PROFESSOR DeWULF

Maurice DeWulf has been appointed Professor of Philosophy at Harvard and will assume next fall the duties of his permanent place on the teaching staff of the University.

Professor DeWulf was for many years closely associated with Cardinal Mercier when the latter was Professor of Philosophy at the University of Louvain. When Mercier became Archbishop of Malines, M. DeWulf succeeded as Professor of Philosophy at Louvain.

Professor DeWulf was one of the Louvain Professors who were invited and came to Harvard after the destruction of their university by the Germans. Afterwards he went to the University of Poitiers, by appointment of the French Government. In the second half of last year Professor DeWulf again came to Harvard and lectured in the Division of Philosophy.

Limitation of Numbers in the Business School

By Wallace B. Donham, '99, Dean of the Graduate School of Business Administration.

THE current announcement of the Harvard Business School, now on its way through the press, contains the official statement of an important change in policy in that School. Concurrently with the increase in tuition to $400, the Faculty has adopted a policy of limiting the size of the first-year class. The School last year went through a period of disorganization caused by the unexpected growth in numbers after the war. The staff was not large enough to handle the situation adequately and the big courses suffered to a considerable extent. A number of new men were added to the Faculty after the year opened and in this way the problem was met so far as practicable. But new men added to the Faculty in the middle of a year of necessity go through an awkward period of transition while they are learning what has happened in their courses before their arrival. It is even more difficult for them to acquire an acquaintance with the scope and limitations of the work in parallel and adjoining courses. During the present academic year the large classes have been cut in two and in this way the quality of the work brought back to standard.

With the increase in tuition fees to $400, which goes into effect next year, it is peculiarly the responsibility of the Faculty to see that, so far as it can be provided against, no similar situation arises in the the future. After careful consideration the Faculty has determined upon the general principles under which they will operate the School in the immediate future.

Hereafter the Faculty will from time to time fix the number which shall be admitted to the first-year class, this number being fixed with reference to the size of the staff and the extent of the equipment of the School. In the year 1921-22 not over 300 will be admitted to the large first-year courses. The determining factor is the size of the staff which has to be considered with reference to the finances of the School. The present staff can effectively handle a School of 450 to 500 students, of whom not over 300 are in the large courses. If this latter number were increased to 350 or 400 in the large courses a substantial increase in staff would be required to keep the number of students in any one section within the maximum limits which have been fixed for these classes, and to allow the subdivision into small groups which is required for effective work in the second year. The increase required in the number of instructors would be substantially the same to provide adequately for 375 in the first-year class as it would be for 450 in this group. On the other hand the difference in the income of the School would amount to a very substantial figure. The School can without an operating deficit adequately provide for a first year group of 300 or for one of 450. If the number admitted exceeds 300 but falls substantially short of 450, we should be obliged, so far as we can see, to do poorer work or to incur an operating deficit.

We are unwilling, of course, to reduce the quality of the work and we expect with our $400 tuition fee to meet the cost fairly chargeable to the student. We shall therefore keep the limit on the first-year classes at 300 until we are reasonably confident that the limit may be raised to 450 and this number of students obtained. When this confidence appears to be justified we shall organize the staff with the increased numbers in mind and shall be able to maintain quality without incurring operating deficits. To use a business analogy, our situation is like that of a manufacturer contemplating a fifty per cent. addition to his plant. We cannot afford to make the extension until we can reasonably expect a market for our product which will enable us to operate on a proper financial basis.

The present prospect is that the time when we can increase our numbers to 450 in the first-year classes will be reached either in 1922-23, or in 1923-24. The enrollment in the entering class for next year is already more than half completed and the applications are coming in at the rate of from four to six a day, although the current School announcement is not yet printed. If this continues, registration will close by Commencement Day or shortly after that. The interest in the School is apparently much greater than ever before.

Two years from now the colleges of the country will graduate the first class which entered college after the war. As this class will be materially larger than the classes graduating either this year or next year, a corresponding increase in the number of men desiring to come to the Business School is then to be expected. We are planning, therefore, for the larger number not later than the year following the graduation from college of the class of 1923.

When the School reaches 450 in its first-year classes, this will be the ultimate limit on the size of the School until friends of the School and of the University come to our rescue with funds for buildings and equipment. We are already accused by the President in his annual report of emulating the example of the cuckoo and forcing other departments out of their nests. This is true not only of other departments but of the furnaces and basement store-rooms of sundry University buildings. The process cannot continue much longer or go much further. For example no more space is available for us in the Widener Library, and our tenure of part of our present quarters is extremely limited, and unsatisfactory both to us and to others. A fifty per cent. addition to numbers will crowd our library facilities to their limit and even this would be impossible except for the increasing number of case-books in business which the staff will publish in the near future. These case-books fortunately lessen the demands on the reading room by consolidating the required reading.

These limitations are not for the next few years an unmixed evil. We are working out the material for teaching business by the case system and until this task is nearer completion and we have learned how to adapt this method of approach to different fields of business teaching, it is highly desirable that the administrative and educational problems should not be over complicated by a too rapid growth in the size of the school or staff.

It will be most unfortunate, however, if we are obliged for a long period to restrict the number received annually to the extent outlined above. We have no fetish for numbers, nor should we ever try to train so many men for business that we are unable to organize the task properly, but we can hardly throw off our responsibilities at these limits of numbers. The School needs at once quarters adequate for a school of 1,000, and in all probability such a School will be filled the year its new buildings are completed.

BUSINESS SCHOOL ALUMNI MEETING

Approximately 125 alumni of the Graduate School of Business Administration attended the annual outing of the Harvard Business School Alumni Association last Saturday at the New Ocean House, Swampscott. The afternoon was devoted to sports. The following officers were elected at the business session in the evening: President, Charles F. Collins, M.B.A. '14, of the New England Mutual Life Insurance Co., Boston; vice-president, Carroll Dunham, 3d., '09, M.B.A. '11, of Rutter & Co., New York; secretary-treasurer, Archibald C. Gove, '11, M.B.A. '13, certified public accountant, Boston; executive committee for term expiring in 1924— Clinton P. Biddle, M.B.A. '20, of the Harvard Bureau of Business Research; George E. Cole, Gr. Bus. '11-12, '13-14, '15-16, manager of the Harvard Coöperative Society; Lyneham Crocker, '11, Gr. Bus. '11-12, manager of the Simplex Electric Heating Co.; Henry T. Myers, New England manager of the Studebaker Corporation; Edward G. Stacy, M.B.A. '18, general secretary of the Massachusetts State Chamber of Commerce.

TEST OF CAPACITY FOR BUSINESS

A new rating scale for use in recommending men to employers has been adopted by the Harvard Graduate School of Business Administration. The rating is made up from estimates of each individual's capacity and personal qualities as observed by members of the Faculty who have come in contact with him.

The rating scale is not intended to supplant the regular system of credits leading to the degree, but to supplement it. The adoption of the scale, say the authorities of the School, is an acknowledgment of the fact that when they have the record of a man's grades in his courses, they do not know all they should in order to recommend him for a job. Such recommendations will be made henceforward on the basis of the rating scale as well as of the man's grades in classroom work.

The rating scale is composed of two parts. The first covers the chief mental and personal qualities upon which business success is considered largely to depend. There are seven of these: native ability, personality, industry, reliability, initiative, coöperation, and judgment. Men will be rated as "exceptional", "good", "average", "weak", or "unsatisfactory", in respect to each of these qualities, the rating being done by from three to five members of the Faculty.

In judging a man's native ability, members of the Faculty are asked to "consider his inborn capacity, intellectual ability, mental keenness." The tests of personality are defined as "his personal strength and attractiveness, how he impresses others, his capacity as a mixer, his appearance and manner." In giving judgment on a student's industry, teachers will consider "his energy, endurance, application to his work, and interest in it."

The other qualities are to be judged as follows: Reliability.—"His consistency, dependability, promptness and honesty, accuracy in his work, reliability of his word." Initiative.—"His creative ability, originality and capacity to suggest and inaugurate new plans and methods." Coöperation.—"His willingness to help and coöperate with others, his capacity to learn." Judgment.—"His common sense, soundness of judgment, his ability to size up new situations, his fair-mindedness."

The second part of the rating scale consists of an estimate, also made by various members of the Faculty who know the man, of his probable fitness for different types of business careers. He is rated as an executive, both in making and carrying out plans and in handling men, as a salesman, and as an analytical worker.

"Each man," says a statement given out at the office of the Business School, "will be estimated according to this plan near the end of the first year by three to five members of the Faculty. From these individual estimates a composite will be prepared for the Dean's office, and to such extent as seems wise this composite rating will be disclosed to the student. The ratings of the first-year men will necessarily be preliminary and inadequate, but it is believed that the information given to the student will be of considerable value to him. A similar rating based on much more comprehensive data will be made by five members of the staff near the end of the second year, and this rating together with the record of work done in the School, will be used largely in making recommendations of graduates for positions.

"Generally speaking we find that there is a distinct correspondence between the men's grades and their rating on this new scale. A man who has excellent grades does not always show up well in other respects, and *vice versa*, but on the whole we find that the two methods of testing give somewhat similar results.

"Dean Donham recently offered to every man who would try rating himself according to the new scale the opportunity to get his instructors' rating of him, and many men are taking advantage of this opportunity. They sit down and estimate their own ability and personality, and when they have done it they can get from the Dean's office a line on how others see them."

LAWN TENNIS ON SUNDAY

To the Editor of the BULLETIN:

I take great pleasure in seconding the motion of Mr. T. J. D. Fuller, '15, in regard to making the tennis courts of the University available on Sunday. To those coming from a distance to Harvard, Sunday, without the opportunity for tennis and the like, becomes a day of boredom and enforced idleness instead of one of recreation and pleasure, which it should be.

Why make it like New York where even the wealthy ones must go 20 miles or more to play an out-door game of any sort? I don't know why the courts were closed, but it smacks of the "blue law" reaction to me, which is sweeping the country, and I hope that Harvard will "see the light" and help stem the tide.

F. T. FISHER, '19.

New York City.

To the Editor of the BULLETIN:

Probably the following announcement made by the Athletic Committee earlier in the spring and published in the *Crimson* and the Boston papers, and I think also in the BULLETIN, will sufficiently answer the long letter of Mr. T. J. D. Fuller, '15, protesting against the fact that the University tennis courts are not open on Sunday:

> The possibility of allowing Sunday tennis was considered and found impossible on Jarvis or Divinity Fields because both sets of courts are within 1,000 feet of regular places of worship and games thereon are therefore prohibited under the law. It was also deemed inadvisable to throw open the few courts on Soldiers Field owing to the difficulty of protecting other parts of the field and equipment.

FRED W. MOORE, '93,
Graduate Treasurer of the
Harvard Athletic Association.

Cambridge.

CAPTAIN OF GYM TEAM

M. H. Bailey, Jr., '23, of Cambridge, has been elected captain of the university gymnasium team for next year. He has performed on the horizontal bar and on the rings during the season recently closed.

HARVARD WINS TWO GAMES

The Harvard baseball team defeated both Fordham and Tufts last week. The Fordham game, played Wednesday afternoon on Soldiers Field, ran to 11-innings, when Harvard won 7 runs to 6. The winning run was the result of McNamara's hitting two Harvard batters with pitched balls, a sacrifice bunt by Crocker, and a "squeeze" play with Hobbs at the bat. Russell pitched for seven innings. He was then relieved by Hobbs who struck out six men in four innings. Except for one streak of wildness in the eleventh inning he pitched steady ball.

Harvard defeated Tufts, 11 runs to 4, Saturday afternoon on the Tufts Oval in Medford. The Harvard players made 20 hits against three different Tufts pitchers. The summary of the Fordham game follows:

HARVARD.

	a.b.	r.	b.h.	p.o.	a.	e.
Lincoln, 3b.	5	1	2	0	4	0
Emmons, 2b.	5	2	2	2	1	0
Conlon, s.s	4	2	2	3	5	1
Owen, 1b.	5	0	1	15	1	0
Murphy, c.	5	1	1	11	1	1
Hallock, c.f.	4	0	0	1	0	0
Janin, l.f.	4	1	1	0	0	0
Crocker, r.f.	4	0	1	1	1	0
Russell, p.	2	0	0	0	4	1
*Lee	1	0	0	0	0	0
Hobbs, p.	1	0	0	0	5	0
Total,	40	7	10	33	22	3

FORDHAM.

	a.b.	r.	b.h.	p.o.	a.	e.
Halloran, l.f.	4	0	0	2	0	1
Donovan, c.f.	5	1	0	1	1	0
Cousineau, c.	5	2	1	9	1	0
Schemerhorn, r.f.	5	1	1	0	1	0
McLoughlin, 1b.	5	0	1	12	1	0
Fallon, 3b.	5	1	0	2	1	0
Gately, 2b.	4	1	2	0	2	2
Malley, s.s.	4	0	1	4	4	1
McNamara, p.	4	0	0	1	9	0
Total,	41	6	6	31	20	4

Innings,	1	2	3	4	5	6	7	8	9	10	11	
Harvard,	3	0	0	0	0	0	0	3	0	0	1	—7
Fordham,	0	0	0	0	0	5	1	0	0	0	0	—6

Earned runs, Harvard 5, Fordham 4. Sacrifice hits, Crocker, Hobbs. Stolen bases, Conlon, Owen. Three-base hits, Malley, Cousineau. Bases on balls, off Russell 4 in seven innings, off McNamara 1. Left on bases, Harvard 7, Fordham 8. Struck out, by Russell 4 in seven innings, by Hobbs 6 in four innings, by McNamara 8. Hit by pitched ball, Hallock, Janin, Cousineau, Malley, Halloran.

*Batted for Russell in 7th.

ON THE ATHLETIC COMMITTEE

R. K. Kane, '22, of Newport, R. I., captain of the football team; George Owen, Jr., '23, of Newton, captain of the hockey team; and A. E. McLeish, Jr., '23, of Fort Benton, Mont., captain of the basketball team, have been chosen undergraduate members of the Athletic Committee for next year. The Athletic Committee comprises three members of the Faculty and three Harvard graduates in addition to the three undergraduates. Kane, Owen, and McLeish were chosen by ballot recently, and their choice has been confirmed.

HIGH SCHOOL MEET IN THE STADIUM

One of the largest crowds which has ever attended an athletic meet in the Harvard Stadium saw the centenary track meet of the English High School of Boston there on June 16. The program consisted of track events of the high school regimental meet, several interscholastic events, a boxing bout, a baseball game between the English High School and the Boston Latin School, and several track events open to anybody. E. O. Gourdin, '21, of the Harvard track team, won both the 100-yards dash and the broad-jump.

IN THE NEW ENGLAND A. A. A. U.

In the New England A. A. A. U. games, which were held last Saturday afternoon in the Stadium, Gourdin of the Harvard track team won the 100-yards dash, the broad-jump, and the javelin-throw. Harwood won the pole vault. Wharton took third place in a special 440-yards run which was held to decide the representatives of Harvard and Yale in the forthcoming Oxford-Cambridge meet. Chapman and Coxe of Yale were first and second, respectively.

ELECTED CAPTAIN OF RIFLE TEAM

H. H. Fuller, Jr., '23, of Lancaster, has been elected captain of the Harvard rifle team for next year. The Harvard Rifle Club has elected W. B. Darling, '22, of Roxbury, president, and Geoffrey Bolton, '23, of Shirley, vice-president.

OFFICERS OF RIFLE CLUB

Stephen Wheatland, '21, of Topsfield, has been elected president of the University Rifle Club, and W. B. Darling, '22, of Roxbury, has been elected vice-president.

CAPTAIN OF THE LACROSSE TEAM

T. C. Pratt, '22, of Richmond, Va., has been elected captain of the lacrosse team for next year. He has played goal on the lacrosse team for two seasons.

DISCUS AND JAVELIN THROWING

Members of both the university and 1924 track teams are receiving instruction in discus and javelin throwing at the Stadium in preparation for meets next year whch may include these two events. The Intercollegiate Amateur Athletic Association has recently voted to add these events to its annual track and field meet. Since the agreements under which the Yale, Princeton, and Harvard meets are operated do not expire for another year, discus and javelin throwing probably will not be added to them next year. But other meets may include them in the usual program next year, and the Harvard track men will be prepared for such competition.

DRAMATIC CLUB ELECTIONS

The Dramatic Club has elected new members to its various departments as follows:

Acting—Walton Butterfield, '20, of New York, N. Y.; J. M. Brown, '23, of Louisville, Ky.; W. B. Leach, Jr., '22, of Brookline; J. F. Lincoln, '23, of Hackensack, N. J.; W. P. Scott, '23, of Lansdowne, Pa.; F. S. Stranahan, Jr., '21, of Providence, R. I.; and Leonard Ware, Jr., '21, of Roxbury.

Business and Publicity—R. B. Farrar, '21, of Bangor, Me.; C. C. Hewitt, '23, of Minneapolis, Minn.; J. M. Kleberg, '22, of Cornwall-on-Hudson, N. Y.; Howard Phillips, '23, of Orlando, Fla.; and B. D. Williams, '21, of Newtonville.

Properties—M. F. Goldberg, Unc., of Danville, Ill.

Stage—Berwin Keyser, '21, of Brookline, and K. P. Smerage, '21, of Topsfield.

Lighting—J. F. Leys, Jr., '22, of Boston.

Orchestra—Henry Warner, Jr., '21, of Fall River.

439 STUDENTS IN SOCIAL SERVICE

According to the report of the social service committee of the Phillips Brooks House Association, 439 students have been engaged in social service work during the current academic year. They have worked in settlement houses, the Cambridge Y. M. C. A., churches, educational clubs, Boy Scout organizations, the Associated Charities, hospitals, and many other institutions.

TO REPRESENT HARVARD MISSION

The cabinet of the Phillips Brooks House Association has appointed G. P. Hayes, 2 Gr., of West Chester, Pa., the representative of the Harvard Mission at Robert College, Constantinople. He will be Professor of English at Robert College. G. W. Allport, '19, and C. E. Dickerson, '20, have been the Harvard Mission representatives in the past two years.

PHILLIPS BROOKS HOUSE OFFICERS

Officers of the Phillips Brooks House Association for 1921-22 have been elected as follows: President, Richard Chute, '22, of Boston; vice-president, R. B. Higgins, '22, of Winchester; secretary, J. S. Clark, Jr., '23, of Chestnut Hill, Pa.; treasurer, B. De L. Nash, '23, of Brookline; librarian, H. H. Reed, '23, of New York City.

THE HANDBOOK STAFF

J. R. Morss, '21, of Chestnut Hill, has been appointed editor of the "Harvard Handbook" for 1921, and L. B. Ellis, '22, of Monson, has been appointed business manager. The "Handbook" is published every summer by the Phillips Brooks House, and sent to all prospective members of the freshman class.

GRADUATE MANAGER OF THE UNION

Francis B. Foster, '17, of Milton, has been appointed graduate manager of the Harvard Union for the next academic year. He will succeed John U. Nef, '20, whose term ends with the current year.

PIERIAN SODALITY OFFICERS

Officers of the Pierian Sodality have been elected as follows: President, R. B. Ayer, '21, of New York City; vice-president, W. F. Manning, ocC., of Portland, Me.; manager, R. W. Long, '22, of Cambridge; secretary, A. M. Taylor, '23, of Albany, N. Y.; treasurer, J. D. Robinson, '22, of Oil City, Pa.

INSTRUMENTAL CLUBS OFFICERS

The Harvard Instrumental Clubs have elected the following officers for next year: President, J. T. Bradlee, '22, of Chestnut Hill; vice-president, Winsor Gale, '22, of Weston; leader, Howard Elliott, Jr., '22, of New York City; assistant leader, J. G. Flint, '23, of Boston; secretary, E. H. Smith, '22, of New Haven; manager, J. L. Walker, '22, of Boston.

NEW DEBATING CLUB OFFICERS

The Harvard Debating Council has elected the following officers for next year: President, B. H. Kuhns, '22, of Omaha, Neb.; vice-president, C. W. Phelps, '22, of Rockford, Ill.; secretary, R. S. Bowers, '24, of Brookline; manager, Manuel Weisbuch, '23, of Rochester, N. Y.

Elected Phi Beta Kappa Secretary

W. T. Salter, '22, of Milton, has been elected secretary of the Phi Beta Kappa Society for next year.

TRAVELLING FELLOWSHIP AWARDS

The Shaw Travelling Fellowship, established in 1911 "to enable one or more graduates of Harvard College upon the completion of their undergraduate studies, to pass a few months in European travel", has been awarded to Harry Nadell, '22, of Paterson, N. J. He is completing his College course in three years.

Two newly-established Paine Travelling Fellowships in Music have been awarded for next year to Virgil G. Thomson, '22, of Kansas City, Mo., who has been an assistant in Music this year, and to Melville M. Smith, '20, of New Haven, Conn., who is now studying in Paris as holder of the Elkan Naumburg Fellowship.

FOUR PARKER FELLOWSHIPS AWARDED

The Parker Fellowships, awarded each year to men of unusual ability in the Graduate School of Arts and Sciences for advanced study, have been assigned for next year to the following men: Joseph Auslander, '17, assistant in English at Harvard; D. G. Barnes, A.M. '20, of Albion, Neb., Austin Teaching Fellow at Harvard, who is now studying history in Europe and holds the Bayard Cutting Travelling Fellowship; M. T. B. Spalding, '20, of Brookline, who holds a Belgian Fellowship this year and is also studying history; H. E. Washburn, A.M. '16, who is now teaching French at Dartmouth.

FOGG ART MUSEUM

Etchings by Meryon, Zorn, Whistler, Haden, and other nineteenth century artists, are now on exhibition in the Print Room of the Fogg Museum and will remain there during the summer. Many of them are lent for this exhibition by Horatio G. Curtis, '65, of Boston.

TUTORS FOR 1921-22

Six new Tutors in the Departments of History, Government, and Economics have been appointed for next year as follows: James W. Angell, '18, James Hart, William A. Berridge, '14, Karl W. Bigelow, Elmo P. Hohman, and Norman S. Siberling.

LEAVES OF ABSENCE FOR 1921-22

Leave of absence has been granted to Roscoe Pound, Dean of the Law School, for the whole of the next academic year; and to Edward B. Hill, Assistant Professor of Music, for the first half year.

Assistant Business Managers of the Crimson

M. H. Dennis, '23, of Toledo, O., and J. R. Flather, '23, of Lowell, have been elected assistant business managers of the *Crimson*.

ALUMNI NOTES

The Alumni Association on request will give the addresses of Harvard men.

'53—President Charles W. Eliot has been appointed honorary president of the executive board of the Franco-American Union for Open-Air Schools, an organization which has recently been formed to co-operate with the French ministry of public instruction in establishing open-air schools in the devastated regions of France.

M.D. '68—Edwin H. Brigham has been elected librarian of the Massachusetts Medical Society.

'81—John S. Melcher's new office address is 54 William St., New York City.

'82—Henry W. Hardon's address is 7 Dey St., New York City.

'83—Henry B. Cabot has been elected treasurer of the Family Welfare Society of Boston, formerly the Associated Charities.

'83—John F. Moors has been elected president of the Family Welfare Society of Boston, formerly the Associated Charities.

'83—Arthur K. Stone, M.D. and A.M. '88, has been elected treasurer of the Massachusetts Medical Society.

'85—John E. Thayer has resigned as a member of the advisory board of the Country Day School, Newton, Mass.

'90—Robert F. Herrick was vice-chairman of the committee in charge of the recent celebration of the 100th anniversary of the founding of the Boston English High School.

'90—H. Barrett Learned, who has been for the past two years vice-president of the Board of Education of the District of Columbia, has been appointed acting professor of European History at Stanford University, California. He will begin his duties there in January, 1922, and will continue until July. Learned's present address is 2123 Bancroft Place, N. W. Washington, D. C.

'91—Arthur D. Hill has resigned as a member of the advisory board of the Country Day School, Newton, Mass.

'92—Daniel F. Jones, M.D. '96, has been appointed a member of the advisory board of the Country Day School, Newton, Mass.

'92—Hugh McK. Landon's address is in care of the Fletcher Savings & Trust Co., Indianapolis, Ind.

'93—Charles C. Goodrich's address is 17 East 42d St., New York City.

'95—A son, David McClure Peters, was born, June 9, to Andrew J. Peters, Mayor of Boston, and Martha (Phillips) Peters.

'95—Robert Walcott has been appointed a member of the advisory board of the Country Day School, Newton, Mass.

'98—Potter Palmer's address is Room 443, Railway Exchange, 80 East Jackson Boulevard, Chicago, Ill.

'98—Eliot Wadsworth, Assistant Secretary of the Treasury, received the honorary degree of Doctor of Laws from the University of Rochester, N. Y. at the recent Commencement exercises of that institution.

'98—Matthew P. Whittall's address is 692 Southbridge St., Worcester, Mass.

Div. '98-99—Clifton M. Gray has resigned from the Unitarian Church, Charleston, S. C., the pulpit which he has occupied for 20 years, and is now doing field work for the American Unitarian Association.

'99—Arthur Adams has been elected clerk of the Family Welfare Society of Boston, formerly the Associated Charities.

'99—James F. Curtis, LL.B. '03, has formed a partnership with Chauncey Belknap, LL.B. '15, and another, under the firm name of Curtis, Fosdick & Belknap, for the general practice of law, with offices in the Woolworth Building, New York City.

'99—Wallace B. Donham, a director of the Old Colony Trust Co., Boston, and Dean of the Harvard Graduate School of Business Administration, is a member of the board of directors of the Liberty Mutual Insurance Co., Boston.

'99—Robert M. Marsh was married at the Church of the Heavenly Rest, New York City, June 1, to Miss Charlotte Delafield. Marsh is a lawyer in New York.

'02—Joseph G. Bradley has been elected president of the National Coal Association to succeed Daniel B. Wentz, '96. The Association comprises the bituminous coal producers of the United States.

'02—Paul H. Kelsey, who has taught Spanish at Brown & Nichols School, Cambridge, since 1918, and French and Spanish at Boston University since 1919, will teach French at Simmons College, Boston, and Tufts College, Medford, next year. He expects to teach Spanish at Harvard, also, and will continue his work in Romance Languages in the Graduate School of Arts and Sciences. He has recently bought a house on the summit of Corey Hill, Brookline, which commands a view of Boston Harbor, the Charles River Basin, and the Blue Hill Range.

'02—A son, Peter Brinckerhoff Ogilby, was born, March 31, to Remsen B. Ogilby and Mrs.

Ogliby. Ogliby is President of Trinity College, Hartford, Conn.

S.M. '02—Gustave E. Behr, Jr.'s address is 246 West Evergreen Ave., Chestnut Hill, Pa.

'03—Philip Fox is an instructor of ex-soldiers in the Springfield, Mass., Vocational School. His present address is 72 Middlesex St., Springfield, Mass. His permanent address remains Cohasset, Mass.

'03—Arthur Notman's address will be Keene Valley, Essex County, N. Y., until Nov. 1, 1921.

'03—Walter M. Whitehill's address, formerly Allston, Mass., is now 47 Cottage St., Wellesley 81, Mass.

'04—LaRue Brown's address is Hotel Lafayette, Washington, D. C.

'04—Kenneth B. Lewis of the Morgan Construction Co., Worcester, Mass., has published in pamphlet form an address entitled, "The Wire Drawing Industry" which he read to the employees of the Morgan Construction Co., in December, 1920.

Div. '03-04; Gr. '04-06—Vilhjalmur Stefansson has received the Founder's Medal of the Royal Geographical Society "for his distinguished services to the Dominion of Canada in the exploration of the Arctic Ocean".

'04—Eugene M. Sawyer has been appointed a member of the Board of Regents of the New Mexico School of Mines.

'05—John de R. Storey was married on May 28 at St. Bartholomew's Chapel, New York City, to Phyllis Elwyn Moore.

'06—Roger B. Emmons's address is 214 State St., Pasadena, Cal.

'06—The engagement of Charles P. Harrington to Miss Eva Prescott Marion, of Concord, Mass., has been announced. Harrington was in France during the war as a lieutenant in the Air Service.

'07—Chapin Brinsmade, LL.B. '10, has been appointed an instructor of French at Yale University. He will enter upon his duties there in September after spending the summer in France.

LL.B. '07—Douglas M. Moffat, A.B. (Yale) '03, was married recently at New York City, to Miss Gertrude Mali, daughter of the Belgian consul general at New York City. Mr. and Mrs. Moffat have sailed for Europe.

'08—Walter M. Bird is with the Savannah Electric Co., Savannah, Ga.

'08—Edward L. Prizer, M.D. '12, was married at Southern Pines, N. C., May 19, to Miss Anna Jeanette Beattie.

'09—The engagement of Charles P. Howard, LL.B. '14, to Miss Katherine Montague Graham, Smith '20, of Winston-Salem, N. C., has been announced. Howard served during the war as a captain of Infantry in the First Army Corps, A. E. F. He is now a member of the law firm of Fickett & Howard, 53 State St., Boston.

'09—Benjamin F. Miller, Jr.'s address is Hibernian Building, Los Angeles, Cal.

'09—David M. Osborne's address is 342 Madison Ave., New York City.

'10—Paul F. Perkins has formed a partnership for the practice of law with Charles F. Perkins, LL.B. '71, and Harold C. Haskell, LL.B. '09, with offices at 161 Devonshire St., Boston.

'11—A daughter, Edith Jane Ellis, was born, Jan. 4, to Edward W. Ellis and Florence (Smith) Ellis.

'11—Nathaniel W. Hopkins's address is 4348 Locust St., Kansas City, Mo.

'11—Benjamin H. Lehman's address is 1434 Greenwood Terrace, Berkeley, Cal.

'11—Norman Southworth is in the Newark, N. J., office of the Library Bureau. His work consists of selling and installing card and filing systems and the direction of junior salesman. His permanent address remains in care of A. T. Southworth, Holbrook, Mass.

'11—The engagement of Alexander Williams to Miss Margaret Ramsay Lincoln, of Brookline, has been announced.

M.E.E. '11—Chester S. Wendell's address is in care of the Public Service Electric Co., Hackensack, N. J.

'12—Gerard C. Henderson's address is 1734 P St., Washington, D. C.

'13—Stephen Fairbanks's address is in care of the Harvard Club of Boston, 374 Commonwealth Ave.

'13—Sydney T. Guild was married at the First Parish Church (Unitarian) of Medford, Mass., on June 11, to Miss Dorothy Silvius, of Los Angeles, Cal. Mr. and Mrs. Guild will live in Medford.

'13—Nathaniel E. Paine, Jr., is with Armour & Co., packers, Milwaukee, Wis.

'13—Isadore A. Wyner's address is 354 Fourth Ave., New York City.

LL.B. '13—A. Vere Shaw, A.B. (Ohio State University) '09, is with Scudder, Stevens & Clark, investment bankers, 53 State St., Boston. His home address is 12 Acorn St., Belmont, Mass.

'14—A daughter, Margaret Louise Abbe, was born, May 30, to Frederic E. Abbe and Hannah (Tilton) Abbe. Abbe is with Pearson, Erhard & Co., investment bankers, Boston.

'14—Louis Curtis, Jr., was married, June 11, to Miss Mary Sloan Colt. Curtis is the son of Louis Curtis, '70, of Boston.

'14—William T. Gardiner has become associated with the firm of Andrews & Nelson for the practice of law under the firm name of Andrews, Nelson & Gardiner, in Gardiner, Me.

'14—Roy H. Magwood is sales representative in the southeast for the Southeastern Leather Co., leather and shoe findings for jobbers, P. O. Box 771, Atlanta, Ga.

'14—Lawrence B. Moore's address is 5 Chestnut St., Medford, Mass.

'14—Junius S. Morgan, Jr., of J. P. Morgan & Co., is a trustee of the New York Trust Co., with which the Liberty National Bank of New York is consolidated.

'14—A son, Edward Murdock Roberts, was born, May 11, at Newark, N. J., to Edward A. Roberts and Dorothy (Murdock) Roberts.

'14—Sidney L. Simonds was married in the chapel of the New Church Theological School, Cambridge, on June 10, to Miss Dorothy Hoyt Leland. Mr. and Mrs. Simonds will live in Keene, N. H.

'14—Robert T. P. Storer's address is in care of the International Acceptance Bank, Inc., 31 Pine St., New York City.

'14—A Gordon Webster, Jr's address, formerly 89 Clark St., Brooklyn, N. Y., is now 9567 111th St., Richmond Hill, N. Y.

A.M. '14—Austin A. Chute, A.B. (Acadia University) '12, has been appointed a teacher at the Country Day School, Newton, Mass., for the year 1921-22. He has been teaching at the Nichols School in Buffalo, N. Y.

S.T.M. '14—George B. Hatfield is Professor of History and Government at Grove City College, Grove City, Pa.

'15—Roland E. Allen was married, Oct. 6, 1920, to Miss Mildred Foster, of Newtonville, Mass. Allen is with the South American branch of Swift & Co., packers, 25 de Mayo, No. 195, Buenos Aires.

'15—H. Starr Ballou, Jr., was married recently in New Jersey to Miss Emily McEwen Crabbe, Smith '19.

'15—A daughter, Beatrice Baylies, was born, June 3, to Lincoln Baylies and Beatrice (Ballard) Baylies. Baylies is with Amory Browne & Co., 62 Worth St., New York City.

'15—A son, Richard Allen Durgin, was born, May 21, at Exeter, N. H., to George H. Durgin and Alice (Robinson) Durgin.

'15—Adrian Ettinger's address is 2580 West St. James Parkway, Cleveland Heights, O.

'15—The engagement of Hugh Gallaher to Miss Catharine McCollester, of Medford, Mass., has been announced. Gallaher is with the Swan & Finch Co., of New York. His address is in care of the Harvard Club of New York City, 27 West 44th St.

'15—Robert C. Hamlen was married on June 11 at St. Paul's Church, Dedham, Mass., to Miss Catherine Ames Royce.

'15—Richard M. Hersey was married at Marshalltown, O., May 31, to Miss Florence Andruss, of Berkeley, Cal. During the war Hersey served overseas as an officer in the 42d (Rainbow) Division, A. E. F. He is now with the Bemis Brothers Bag Co., Minneapolis, Minn.

LL.B. '15—Chauncey Belknap, Litt.B. (Princeton) '12, has formed a partnership with James F. Curtis, '99, LL.B. '03, and another, under the firm name of Curtis, Fosdick & Belknap, for the general practice of law, with offices in the Woolworth Building, New York City.

'16—Paul Aronson was married on May 25 at Staten Island, N. Y., to Miss Jessie Frank. Mr. and Mrs. Aronson are living at 73 Holworthy St., Roxbury, Mass.

'16—William R. Bullard is treasurer of the Package Paper & Supply Corporation, Springfield, Mass. His home address is 319 Central St., Springfield.

'16—Harold D. Holmes's address is 48 Maple St., New Bedford, Mass.

'16—Willard S. Putnam, M.B.A. '17, is with Curtis & Sanger, bankers, 33 Congress St., Boston.

'16—Harvey A. Scranton was married at West Bridgewater, Mass., June 14, to Miss Arline M. Barker. During the war Scranton was a lieutenant in the 33d Artillery, U. S. A.

'16—Ben S. Trynin is assistant advertising manager of the California Associated Raisin Co. His address is Hotel Fresno, Fresno, Cal.

Div. '16-17—Walter C. Brauer is pastor of St. Peter's Evangelical Lutheran Church, St. Joseph, Mo.

'17—Malcolm P. Bail is with A. M. Mayne & Co., New Orleans, La.

'17—Vernon H. Brown was married at the Church of the Heavenly Rest, New York City, June 9, to Miss Vouletti Proctor.

'17—C. Edward Humphrey was married on March 26 to Mrs. Violet F. Cutter. Humphrey is with Boyden & Steacie, public accountants and auditors, Beacon St., Boston. His home address is 62 Kenwood St., Dorchester, Mass.

'17—A son, Hugh Burdick Morgan, was born, May 21, to Leslie A. Morgan and Marjorie (Burdick) Morgan. Morgan is in charge of the bond department of H. W. Noble & Co., Detroit, Mich.

'17—Richard C. Paine's home address is "The Heights", Brooklyn, N. Y.

'17—A son, Thomas Chalmers Peebles, was born, June 5, at Newton, Mass., to Waldo C. Peebles and Mrs. Peebles. Peebles is an instructor in Spanish at Boston University.

'18—Edward M. Martin's address is 1420 Goodale Ave., Toledo, O.

'18—The engagement of Gaius W. Merwin to Miss Margaret Hubbell, of New York City, and Darien, Conn., has been announced.

'19—Rufus H. Bond has resigned as master in mathematics and coach of the football team at the Country Day School, Newton, Mass., and will teach next year at the Winchester, Mass., High School, where he will also have charge of the football and baseball teams.

'19—Lawrence B. Geyer is the representative of the Zain Advertising System of Boston in the advertising contest running in the New Haven, Conn., *Register*. His permanent address is 18 Mt. Auburn St., Cambridge.

'19—The engagement of Lawrence P. Hall to Miss Blanche W. Milliken, of Watertown, Mass., has been announced.

'19—Livingston Hunt, Jr., is with the Houghton, Mifflin Co., publishers, at the Riverside Press, Cambridge. His address is 1590 Massachusetts Ave., Cambridge.

'19—Francis Parkman was married on June 11 at the First Parish Church (Unitarian) of Brookline, to Miss Eleanor Bremer, daughter of Theodore G. Bremer, '92. Parkman is the son of Henry Parkman, '70, of Boston.

'19—James R. Parsons was married recently at St. Mark's Church, Orange, N. J., to Miss Margaret Chubb. During the war, Parsons served overseers as a lieutenant in the Ninth Infantry, Second Division, A. E. F.

'19—Richard L. Strout has returned from Ireland where he was a correspondent for an English newspaper.

M.D. '19—Forrest B. Ames, A.B. (University of Maine) '13, was married at the Second Congregational Church, Codman Sq., Dorchester, Mass., on June 8, to Miss Mildred M. Wilder.

'20—Frederic K. Bullard is pitching on the Detroit University Club baseball nine. He has won all his games thus far.

'20—Bradford S. Field is with the American Manufacturing Co., rope, twine, and cordage, 172 Atlantic Ave., Boston. His home address is 13 Hilliard St., Cambridge.

'20—John R. Gardner is the representative of the Zain Advertising System of Boston, in an advertising contest running in the Worcester, Mass., *Telegram-Gazette*. Gardner's address is 26 Converse St., Worcester.

'20—F. Whitney Hall is a traffic clerk for J. P. Squire & Co., East Cambridge.

M.B.A. '20—F. Gregory Medcalf, A.B. (University of Minnesota) '18, is with Noyes Brothers & Cutler, wholesale drugs, St. Paul, Minn. Medcalf's address is 945 Hague Ave., St. Paul.

'21—The engagement of Ralph D. Joslin to Miss Constance Allis Smith, of Winchester, Mass., has been announced.

'21—Hector Lazo is in the merchandise department of the United Fruit Co., Nipe Bay, Preston, Cuba.

'21—The engagement of Stephen Wheatland to Miss Dorothy Parker, of Longwood, Mass., has been announced.

OBITUARIES

A.M. '74—Marshman Edward Wadsworth, A.M. and Ph.D. '79, A.B. (Bowdoin) '69, A.M. (*ibid*) '72. Died at Pittsburgh, Pa., April 21, 1921.

Law '74—Oliver Perry Vaughn Bryant. Died at Independence, Mo., May 2, 1914.

Sp. '77-79—Richard Hathaway Morgan. Died at Plymouth, Mass., June 7, 1921.

'98—Frederick Lothrop Ames. Died at North Easton, Mass., June 19, 1921.—For two years after graduation he was in the offices of Oliver Ames & Sons, of North Easton, after which he entered the office of the Ames Estate, 96 Ames Building, Boston, where he had had offices since that time. He had been a director in the Old Colony Trust Co., of Boston, and the First National Bank of Easton, and in the American Agricultural Chemical Co., the Western Power Co., and a number of other manufacturing concerns. He was interested in farming on his estate, "Longwater Farm" at North Easton and bred blooded cattle and horses there. He is survived by his wife, who was Miss Edith Callender Cryder of Long Island, N. Y., and a son and daughter.

'11—Graves Ole Graveson. Died at Springfield, Mass., Oct. 26, 1920.—During the war he was a sergeant in Company B, 101st Military Police, 26th Division.

HARVARD ALUMNI BULLETIN.

Published weekly during the College year (from October to July) by the Harvard Bulletin, Inc., for the Harvard Alumni Association.
PUBLICATION OFFICE, 50 STATE ST., BOSTON, MASS. EDITORIAL OFFICE, 18 PLYMPTON ST., CAMBRIDGE, MASS.
Entered as Second Class Matter, October 7, 1910, at the Post-Office at Boston, Mass., under the Act of March 3, 1879.

Annual Subscription, $4; Single Copies, 12 Cents; foreign postage, 40 cents a year. Remittance should be made by registered letter, or by check or postal order to the order of the Harvard Bulletin, Inc. A subscriber who wishes to discontinue his subscription should give notice to that effect before its expiration; otherwise it will be assumed that he wishes it to continue.

Send to Dr. Martin,
Please return to Paul F. Voelker

The Tenth Generation

By

HARRY STILLWELL EDWARDS

MACON, GEORGIA

Harry Stillwell Edwards is the author of many books widely circulated throughout America and is one of the best known and most beloved writers the South has produced. In this article he has written a romance without hero or heroine, not a love story, but a romance of the power and possibilities of educational work from an entirely new standpoint, so far as we know never covered before. It is a story that grips the mind and the heart of the reader with an intensity that compels him, when once he has started on the story, to go straight through to the end. People who are interested in the welfare of boys and girls, in educational opportunities for them, in the responsibility of wealth to safeguard their future and all future generations, will find in this presentation of Mr. Edwards a story of tremendous power. Its widest circulation throughout the country would do an immense amount of good. Though Mr. Edwards has written many books and many newspaper articles, all of commanding interest, and one of his stories, "Aeneas Africanus," has had a circulation of about one million copies, he has probably never written anything that will make a deeper impression upon the minds and hearts of the readers than this story, "The Tenth Generation."—Editor MANUFACTURERS RECORD.

Reprinted from March 1931 Issue, Liberal Arts College Bulletin.

LIBERAL ARTS COLLEGE MOVEMENT,
815 Fifteenth Street, N. W.,
Washington, D. C.

(*With Permission of the Author*)

Price 15 cents a copy

"The Tenth Generation" is a unique and tremendously strong appeal for larger endowments for educational work in this country. Among some enthusiastic commendations of this article are the following:

Dr. J. H. Kirkland, president of the Vanderbilt University, Nashville:

"It is the most convincing argument for educational endowment. * * * Put in briefest form the lesson of the article is that in the present generation is wrapped up the whole future of humanity."

Dr. Paul Eaton, associate professor of preventive medicine, University of Georgia:

"It is an extraordinary presentation of the facts."

Dr. Horace D. Taft of The Taft School, Watertown, Conn.:

"The imagination shown in it will wake up people, and certainly we need it. * * * A very striking article."

Rev. O. C. S. Wallace, D. D., Baltimore:

"Harry Stillwell Edwards has written nothing more fascinating or with greater potentialities for usefulness than 'The Tenth Generation.'"

Dr. Chase S. Osborn, Sault Ste. Marie, Mich.:

"Everything you can do to spread the Edwards doctrine will be a blessing."

Mr. Mark O. Prentiss, New York City:

"It was good of you to send me the inspiring story of 'The Tenth Generation.' You are doing a great work when you publish such, giving widest circulation to it."

Mr. S. O. Bond, President, Salem College, Salem, W. Va.:

"It is one of the most remarkable pamphlets I have ever read. By chance the letter containing it was the first one in the day's mail and I read every word of it before I opened another piece."

Dr. A. N. Ward, President of Western Maryland College:

"It is the greatest plea for education that has ever been written."

The Tenth Generation

By Harry Stillwell Edwards

(Copyright 1928)

THE old lawyer hung up his telephone receiver and turned slowly back to his deep-seated leather chair. His appearance and every motion betokened the Southerner of a type almost extinct. The message he had received disturbed him not a little. A prominent capitalist and bank officer had asked permission to call and discuss a personal matter with him. For privacy, as he had explained, and to avoid interruption, he preferred to come to the lawyer's residence. Their names are not important in this record.

Seated again, the old practitioner crossed his long, thin legs, leaned back and matched his fingers in thought; a characteristic habit. He had granted personal interviews in his home on other occasions and always with serious aftermath. The gentleman who had just 'phoned him was, by common consent, a man of vast wealth. But you can't always tell. There had been serious disturbance in financial circles lately, far-reaching in its results. And there were always speculation and dishonest employes. And divorce. He wondered what there was in the air of importance sufficient to send this busy man across the city for an interview with one but slightly known to him, and not at all professionally. Presently, he arose, drew an easy chair into the strong light of his hooded lamp, and resumed his own in the twilight, which half concealed the luxuriousness of the spacious Colonial room. Fifteen minutes later a car door slammed outside and an aged negro butler ushered in his visitor.

The capitalist was a man of about fifty; short, strong of frame, vigorous, quick of motion and alert; the opposite, in all, of his host. But he had the face and eyes of the dreamer. Or so the lawyer decided after the customary courtesies of speech had been exchanged, and the visitor was seated.

"First, I wish to thank you," began the latter with perceptible embarrassment, "for giving me some of your leisure, and permitting this invasion of your home. Perhaps, in a business way later, I may be enabled to show my appreciation."

The lawyer smiled, lifted a hand slightly and shook his head.

"Let us proceed without regard to business. You spoke of some personal matter. I am glad, sir, for this opportunity of meeting you socially. Our paths have not crossed often. How may I serve you, sir? Will you smoke?" His hand fell on a box of cigars.

The visitor declined with a gesture.

"I am at a loss, Colonel," he began, looking into the shadow and hesitating, "just how to introduce my subject; but for an opening I might say that I have an heir coming, ten generations away, and I'd like to devise some plan to protect him financially; together with his forbears back to my six-year-old son. Can it be done?" A playful but appealing smile, accompanied the odd question. "Sounds a little foolish, I am afraid."

The old Southerner, round-eyed with surprise for a moment, flashed him a message of appreciation.

"On the contrary, sir, the issue is of tremendous import. And I have never heard it better framed." The other hastened to add:

"I should have said in advance that while I come to you as a lawyer deservedly noted, I come, mainly, because I have read with full appreciation and deep interest your recent articles on sociology. I have derived much from them." Again the face of the lawyer wore its slow, friendly smile. He nodded, but did not speak at once. After a moment or two he said:

"Before I answer your question, do you mind telling me, briefly, something of your family and of yourself? Not to gratify mere curiosity; I have a reason."

"I think I understand. Well, I'll make it as brief as possible, under the circumstances. I am the product of eight Colonial families that figured more or less actively in the Indian and Revolutionary Wars"—

"Eight?" The shaggy eyebrows of the host went up.

"Yes. There are quite a number of names on the record, as I learned through some newly discovered relatives in the North. I have had them looked up, too, by a genealogist—my wife aspires to the Colonial Dames. They came over from England, Scotland, Ireland and Wales in the latter half of the Seventeenth Century."—

"Say about two hundred and fifty years ago; two hundred and fifty before your boy was born."

"Yes, about. By the way, counting twenty-five years a generation, that was just ten generations back, wasn't it? Funny that we should have started to figure that distance ahead and have landed back there."

"It is, indeed!" The Southerner was smiling broadly. "Perhaps you now understand my request better. You, yourself, are the boy of the tenth generation, one of your Colonial ancestors may have wished to provide for. Well, one of them, maybe, did, but unknowingly. Proceed."

"Between then and now I don't know much of what happened to my family. As far as I have been informed, I am the only one that ever amassed any considerable fortune. They were mostly improvident and spenders, I suppose."

"And now, about yourself."

"Why, and how, I succeeded is still a mystery to me. We were desperately poor and ignorant; mill people usually, I understand. The fact does not disturb me, but there is no use to spread it. My wife cares very much. Of my sisters we won't speak. They were servants, and lived according to their lights, I suppose; but the lights went out, here and there. The boys took any job that offered when they worked at all; and mated without marriage. Our father was—well, just a sot, spending on drink what he could take away from the family. One brother died in a penitentiary out West; one in a bar-room fight. Another just vanished. But my mother was good. I was the youngest and she clung to me until death ended the unequal struggle. Her people were good people, she said. She was fond of telling me traditions of what they did in America's three wars. I was proud of them Possibly I was, in reality, her only son. When she died I ran away from the others—a boy of nine—and lived a hard life for years, selling papers, shining shoes, doing whatever offered if there was a dime in sight. But always I carried a hope and ambition. With a steady job at last, I took on night study and got a start. There were helping hands, of course. Years after, I was prosperous—highly so. I had made a character for myself and was a trusted bank officer. Then came the great war. I had a chance at contracts and low priced stocks that advanced five or six hundred per cent. And I struck it rich in Florida. And then my oil stocks proved good. Before I realized it the millions had come.

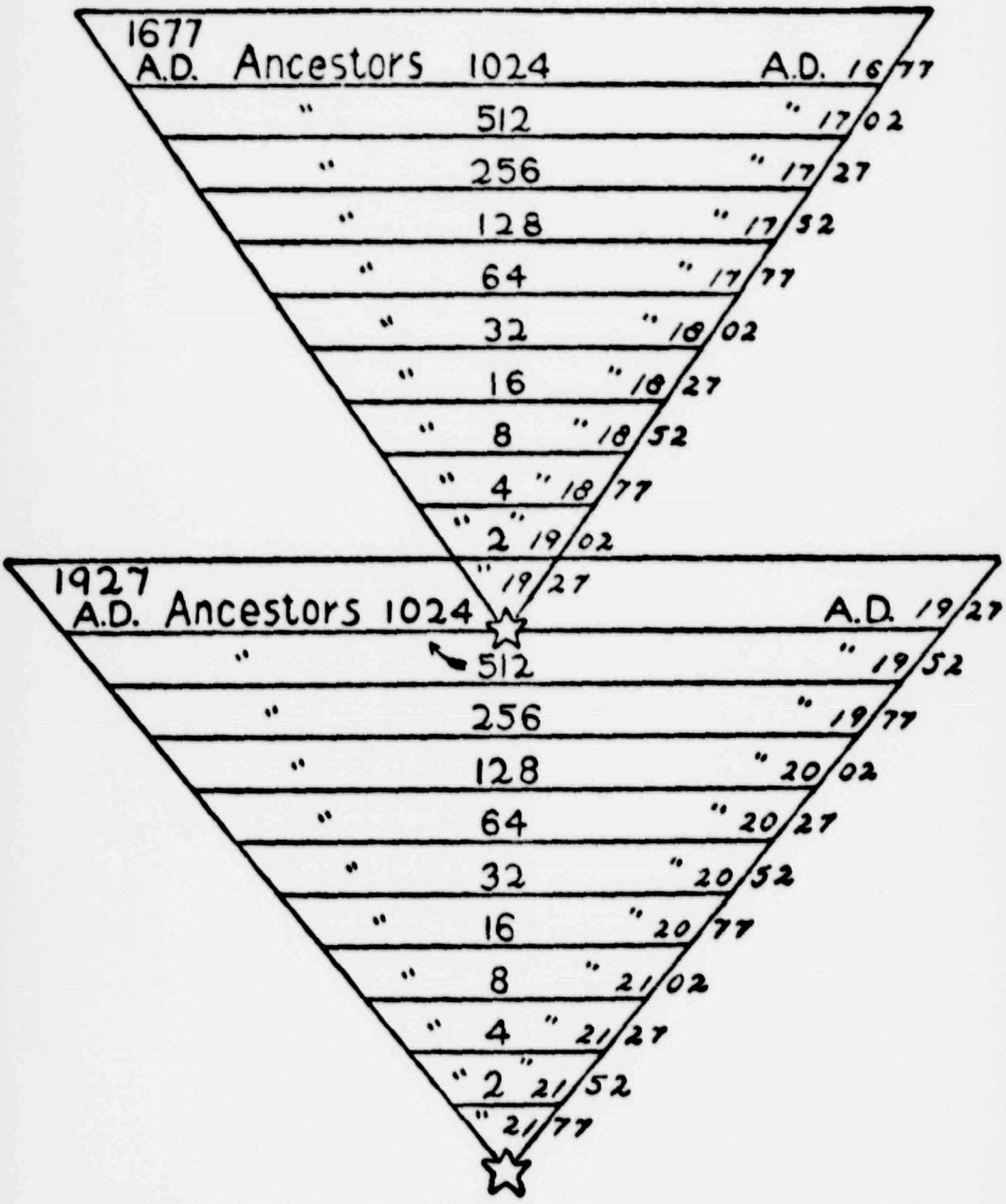
"And now, sir, perhaps you, too, understand my question better. God helping me, my boy, and the boys and girls who are to follow him, shall never travel the hard road my little feet trod, the way by which I came. It is thought that money can do anything. Can it protect the boy two hundred and fifty years away? And those between him and me? Can it? Can it? If so, how? The matter has become almost an obsession with me. I lie awake at night and dream of those unborn children. I see them starving, stealing, slouching in the shadows, haunted by fear, hunted by the police—the boys, the girls diseased, in the gutter, objects of charity—Good God! It is not imagination with me, it is a picture from memory—it is real. Show me the way out, my friend." He arose and began to pace the room.

The Southerner, his hands matched before his face, but shaking a little, sat rigid, otherwise, until the burst of emotion had spent itself, and, with a muttered apology, his guest had resumed his seat. Then, suddenly, without reference to what had been said, the old lawyer straightened in his chair and began to talk:

"There is in the death chamber of our pententiary tonight, awaiting electrocution, a young man. The picture of his unshaven, animal face pressed against the bars, his staring eyes, is before me as I speak. His name does not matter. In fact, the courts do not know him. He was convicted as 'Billy, the Rat,' and is known to the underworld as such. He illustrates some theories of mine, and I have taken pains to investigate his history and, in fact, to seek leniency for him. I have his real name under a pledge of secrecy, as he is an escape from another prison. The Rat is still a young man; a hopeless degenerate; an overgrown boy with a mind so utterly untrained as to be incapable of lofty purpose or ideal. Without education, this man zig-zagged through society seeking food and the gratification of other physical cravings; engaging in every sort of crime that promised drink or dope until, in a moment of desperation, cornered by the law, he slew one of its officers. I have made quiet search into his heredity and find that he is the natural product of ignorance and vice. The generation ahead of him held several criminals; and beyond them his people were of bad repute. One of his kinsmen in this generation, however, is a preacher; a fine type.

"It seems strange that out of the same soil, apparently, two such different men should have come. The explanation is, they came by different routes. Back of this preacher, somewhere, were education and morality and trained minds. Back of the other weakness and crime; absence of rightful environment. One was to be lifted, the other cast down. In the case of the latter bad blood, freighted with error, had trickled down through the centuries, following the lines of least resistance; ignorance mating with ignorance; crime with crime. But both preacher and prisoner are natural products of pre-existing causes and environment. Whether Billy, the Rat, should be electrocuted is at least open to debate. Personally, I am not in favor of electrocuting any natural product."

He had arisen and was slowly making his way back into the shadow as he laconically delivered himself of his conclusion. Without apology or explanation the old man seated himself before a desk over in a corner, turned on a light, and for ten minutes or more busied himself over a large sheet of paper. Finally, he turned off the light and came back to his guest. Drawing a chair beside him, he seated himself and held up the paper on which were two triangles, one above the other, both composed of lines, and each poised on its apex. At each apex was a star, the upper star being in the



middle of the longest space of the lower triangle.

"I am going to ask you," he said, "to imagine that the star between the two triangles is your six-year-old son; you and his mother the line above it; his four grandparents the line above that; and his eight great-grandparents the next line up. And so on to the top line, which is the tenth and longest, and represents all of the boy's ancestors in the generation of two hundred and fifty years ago; that is, in 1677. Each line in the triangle represents a generation, and on each I have written the number of the boy's ancestors in that generation. They are ascertained by simply doubling the number from him up. I am holding the star that represents the boy on a level with your eyes to assist your imagination to climb the ladder, for we always speak of ourselves as descended from, though in the scale of life we really ascend. Assuming that you have scaled the ladder, you are now at the top, and in the generation of 1677 two hundred and fifty years ago. Are you satisfied that every individual on that top line is a Colonial ancestor of your six-year-old boy?"

"Undoubtedly." But the capitalist spoke with hesitation, frowning in bewilderment.

"You spoke of being the product of eight Colonial families. Remember? Well, in that top generation you had a thousand and twenty-four ancestors. You were descended from five hundred and twelve families then in existence. Or, to be exact, from five hundred and twelve couples then, or afterwards mated.

"Now, let's travel the other way, down to that boy two hundred and fifty years off, through the generation of other children you dream of at night. The second triangle, or diagram, is a copy of the first, differing only in the years named. The first thing that will strike you is that in the generation of your six-year-old son there are a thousand and twenty-three other boys and girls who are going to mate and produce that remote heir of yours. On the principle that the oak is in the acorn, he already exists in them, if they are living. These thousand

and twenty-four youngsters are going to grow up, and each will contribute something to that boy coming in 2177. Because of some of them, maybe, he is going to succeed nobly; or, because of some, he is going to fail miserably, perhaps. You say this is admitting too much for heredity. We shall not stop to argue it. Our prize stock—chickens, dogs, race horses—answer the objection. But for heredity, races of men could not have been built up. Let us just recognize that a man is inevitably the sum of all his ancestors and pass on.

"It is impossible to deny that **in this generation of boys and girls, to which your six-year-old belongs, are a thousand and twenty-three more whose blood will mingle with his,** about two hundred and fifty years from now, just as certainly as the sun will rise tomorrow; provided your son's line extends that far, and we have assumed that it will.

"I see you are startled; and well you may be. You will hardly pass a child on the street from now on without seeing in him or her, possibilities of blood-union at some remote time, if not during your life. The boy of 2177 is going to number you among his ancestors with pride, perhaps, if someone keeps the record; but he is going to have in him the blood of more than two thousand children; the sum of the generations between him and you. They will represent a cross-section of society; descendants of lawyers, doctors, engineers, firemen, merchants, laborers in mines and workshops and mills; sailors, soldiers, farmers, preachers, tramps and crooks.

"Now, my friend," and the old man wiped his glasses and smiled into the troubled face by his side, "I ask you, as one sensible human being of another, why, looking only to the little lad of 2177, you should be more concerned with your six-year-old and his direct heirs **than with the thousand and twenty-three around him, whose blood is going to mingle with his, and who are today playing around somewhere?** One thousand and twenty-four who are to be the direct ancestors of the boy of 2177.

"And I am going to ask you further, wouldn't you say, knowing as you do, that it takes more genius, more fine qualities to conserve wealth than it does to amass it, that the chances for doing anything for that far-away boy with your money, kept as money, are rather infinitesimal? You speak of that boy of 2177 as yours; why, there is to be less than a thousand and twenty-fourth of you in him; and every one of his ancestors in the generation of your six-year-old will be closer kin."

"I think," said the hearer, gently, "I am beginning to see light. But go on, if you please."

"You will see the sunrise if you face the East, presently. There is only one inevitable conclusion. **You can only endow that far-away boy, that tenth generation and those heirs between him and you, by endowing the whole generation to which your living son belongs.** Only in this way may you stand a chance to benefit the thousand and twenty-four who are to produce the boy of 2177, and the generations of your blood and his blood to precede him. Dismiss the idea that you can tie your money to the line of little lives that will run straight down from you to him. You would have no guarantee of good, if you could. The value of money is not an inherent element; the value lies in the handling of it. Specialized education, in fact, with something added. Money is but a tool, a weapon, an agent. Neither money, sword nor wrench is effective in untrained hands. You cannot transmit your skill. It is the history of money that one generation assembles it, the next separates it, and the next dissipates it. The Spanish say, 'Butcher, caballero, don, butcher!' we say: 'Three generations from shirt-sleeves to shirt-sleeves.'

"Place your reliance and your money on education. It is your one chance to endow your descendants with happiness. You cannot, by any possible means, know the thousand and twenty-three boys and girls to the right and left of your six-year-old, who are to share with him the honor of bringing into being that little chap ten generations away, and another thousand of his ancestors. You must work for their whole generation, and thereby for the generations that follow to avoid missing the life vital to that boy. You can only defeat the human law against entail by endowments of institutions of learning and of uplift, whose charters are renewable indefinitely. Yale, I understand, has funds more than two hundred years old. A Colonial was, maybe, looking forward to his remote descendants when he gave it. Colleges, hospitals, churches, laboratories of scientific intent, conservatories of art and music, these are the channels through which your wealth may flow to complete entail, and give wealth of mind, body and soul to the unborn.

"I have spoken of those thousand and twenty-four living ancestors of your far-away boy, the boy of 2177. Let us picture them playing now around the parks and waste places; or working in fields, mills, shops and streets; children of the rich and poor, of the righteous and the erring. When your six-year-old reaches young manhood one of these may shine his shoes, another shave him, another drive his car, another serve his meals, another take his dictation. He will dance and flirt with others. Then one day, out of the mystery will come a girl with shining eyes to lay her hand in his. It may be the little waitress, the stenographer or the daughter of a millionaire. She may be of the slums. You can't tell. You, yourself, illustrate how quickly changes occur in this great country. Whoever she may be he will see her with new vision as the gift of the centuries. This little girl, possibly not yet born, is as inevitable as the tide. She, with your son, will stand at the head of the ladder, nearer of kin to the boy of 2177 than you will be. And she will provide little feet for the second round; at least, she will provide two of them.

"Here is your field, the workshop of your dollars. If you have the new vision look around you and reflect. Your great interests are, to a large extent, here in Georgia; your hundred thousand dollar home, your shares in mills, factories, public utilities, banks. This is the growing end of the Union. People are coming in much faster than they are going out. Georgia has gained 500,000 citizens since 1900, a twenty per cent increase in one generation. It is certain that hereabouts will be the home of generations of those whose blood will unite with yours; it is more than likely that most of the thousand and twenty-four I have been talking about are within this and adjoining States. Your millions are as yet idle to their education, but not the money, the labor, the sacrifice of others, thank God! For those thousand and twenty-three children, sons and daughters of God, are working while you calculate interest to benefit a thin line of direct heirs. Martha Berry in North Georgia, with her great school, it may be, has endowed your boy of 2177, through gifts of education and Christian training, while you waited; that already he is indebted to philanthropy, to charity. Make it positive that he is so indebted for his full chance in life; for stretching down through the Virginias, Kentucky, Tennessee, Arkansas and the Carolinas are now great schools, born of philanthropy and Christian charity, lifting the virile mountain people to a higher plane of usefulness through education, free of charge. It does not seem possible, or at least likely, that the descendants of these, spreading out as a fan through ten generations and aggregating hundreds of thousands will miss all the lines leading into your distant grandson.

"You may take it as certain that some of the two thousand of his ancestors between you and that boy will be crowned in the great colleges of the South. If they were all there now, in these colleges, the boy of 2177 would be amongst them, brain of their brain, blood of their blood, bone of their bone, the inevitable heir! Figure it out—others have—a North Carolinian had the vision. He divided his great wealth between a little daughter and the boys and girls around her, whose blood is to mingle with hers in the unborn centuries, the usage to pass into countless lives as education. This was James B. Duke. He backed his love for his unborn descendants and their ancestors' collateral with his daughter with forty millions of dollars,—possibly more.

"But if no inheritance born of charity is traveling toward that little grandson of yours, the general proposition is not disturbed. The underlying principle is general and unescapable. What is true as to yourself is true of and to every individual of means in New England, in the North Central States, the Middle West, the West, the Southwest and the whole of the South. None can hope to make his money a blessing to his descendants except through Christian education that will elevate each generation as it arises. **'E pluribus unum'** fits the family as it fits the Union. The one of 2177 will represent the many as a product. You cannot slight any one of them without risk to that one, and your care of the many may not wait on a day, for half of them are here now, around you, some, perhaps, hungry, some stumbling in the dark. And it may be, as your dreams foretold, already in the gutter or heading toward a prison.

"My friend, we are builders, all of us, without realizing it. We are building such a nation here in America as the world has never before seen, nor any man dreamed, except here and there a poet. Our wealth aggregates four hundred billions of dollars and increases by fifteen billion annually. We have over one-third the wealth of the world, and of the great industries based on coal, iron, oil. We have more than fifty per cent of the world's output from these sources, and are consuming more than fifty per cent of what the world is consuming of these things, cotton the exception. We are top heavy with wealth. Philosophers predict a fall. They tell us every country of antiquity has come a cropper, and that our turn must come. I disagree with them. Absolutely! Positively! Eternally! I denounce the lie!" The old lawyer's fist smote the table thrice, till the windows rattled. "We are not here to fail, because we are building for eternity, for God. And our tools are the hearts and souls of good men and saintly women. The prophets of evil have never heard of a nation where Christian education extended to every individual. No such nation has ever before risen. If you should object that Christian education is not a guarantee against crime, the answer is, that through it, the world has advanced thus far toward the salvation of the human race. And back of every ruined nation that history records was always one irresistible, ever-present cause of failure—Ignorance.

The ideal to which we work in this country and which we approach steadily every day is universal education of the highest possible character. A vast majority capable of understanding and valuing the laws of life, of health, of reproduction, of nature, of psychology, of morality, of government, of finance, of exchange. No such nation has ever flourished on earth; but around you is one in the making, a nation whose members are bound to each other by the principles of justice and religion and by love. It is within the power of every man of wealth to speed its perfection; and if one needs anything more of stimulus than the thought that he is building for God, for posterity, for eternity, let him consider that hoarded wealth is dangerous and endangered, and use a generous part to insure the rest. The best insurance at last for wealth, personal and national, is Christian education. For wealth can exist only by sufferance of the majority. When that majority is swayed by knowledge and righteousness the holdings of the individual are safe, the wealth of the nation is safe. Then, and then only.

"There, sir; if you will pardon my earnestness and the personal application, there is your field, your mission; the mission of your dollars. Perfection in one, or even ten, generations is not humanly possible. Too many ancestors' ghosts have to be laid. But we may, we must work at it and to it—to the ideal. Give and give and give to the cause of education; hundreds, thousands, millions, as you may. Do not let the converging lines of heredity that are to unite in that far-away boy of yours, and the children ahead of him, flow to him, to them, through ignorance and the crimes born of it."

The guest, fascinated, had hung on the words of the speaker, expressed with the fervor of soul and music of voice that made the Old South famous for its oratory. The pictures summoned up flashed before him vividly. So vivid, so real were some of them that, awed and shaken, he touched the table for support. For the speaker had unconsciously risen and he, himself, had been almost literally lifted to his feet. The two men stood facing each other in silence for the moment. They seemed to have just returned from far scenes, to have met for the first time. The capitalist broke the silence, his voice almost a whisper:

"That ideal, that perfection of mind, body and soul of all in the generation of my little son; those thousand and twenty-four who are to meet two hundred and fifty years away; and the other thousand between; that ideal—suppose it were humanly possibly, what then?" The eyes of the old man in answer shone with a sudden light, as though somewhere behind them in the depths, home of his soul, abiding place of immortality, a flame had kindled.

"Ten generations of God-loving beings, sound of mind, body and soul, and full of the beauty of holiness, would give us back Jesus Christ on earth! And that is just the way He will come—the product of His own laws. Any other way would be illogical."

"At least," said the visitor gently, reverently, and with a singular, new-born humility, his face aglow with spiritual light, "at least I have my problem reduced to simple terms; it is Billy, the Rat, or Jesus Christ!"

▲

Copies of this pamphlet may be obtained from the Liberal Arts College Movement, 815-15th St., N. W., Washington, D. C.

Lots of 200 copies, 5 cents each
Lots of 500 copies, 4 cents each
Lots of 1,000 copies, 3 cents each
(Postpaid)

COLITIS—THE SPASTIC TYPE *

E. L. EGGLESTON, M.D.
BATTLE CREEK, MICH.

A discussion of any type of colon dysfunction is apt to elicit differences of opinion, especially since the lower part of the gastro-intestinal tract has not been as carefully studied as the stomach and duodenum, with the result that our information has not been so accurately summarized. In the literature, the older classifications have been clung to, but in practice they are being found unsatisfactory and not in keeping with more recent observations. The work of the roentgenologist completely changed the ideas of colon function, and it is now recognized that the majority of cases of intestinal stasis result not from atrophy but rather from undue muscular tonus secondary to abnormal nervous stimuli, this being particularly noticeable in the distal portion. Atonic changes may be observed at times in the proximal colon, as indicated by dilatation of the cecum and ascending colon.

Employment of the term colitis in describing this condition invites criticism, as in many cases definite inflammatory changes are not observed by sigmoid examination or found on examination of the stool; nevertheless, the clinical manifestations are such as to warrant the use of the term if only for convenience. Hurst [1] would apply the term enterospasm to this group of cases and reserve the term colitis for the ulcerative types. In my use of the term I am in accord with many of the recent observers. Dawson [2] is of the opinion that, if the condition is primarily due to disordered function and inflammation is only an added and not a constant feature, and if the disturbance is not limited to the colon, it might be objected that colitis is

* Read before the Section on Practice of Medicine at the Seventy-Ninth Annual Session of the American Medical Association, Minneapolis, June 13, 1928.

1. Hurst: Essays and Addresses on Digestive and Nervous Diseases, 1926.

2. Dawson, B.: The Colon and Colitis, Brit. M. J. **2:** 31 (July 9) 1921.

a misleading name. No name, however, has been suggested to take its place, and for complex clinical conditions comprehensive titles are difficult to devise, and convenient labels have often had to serve; meanwhile, colitis has the advantages of usage, brevity, and therefore of convenience.

ETIOLOGY

The etiology of spastic colitis has not received the attention by the profession that it deserves, though the persistence of symptoms and the resulting incapacity are so serious as to demand careful consideration. My observations lead me to conclude that an unstable nervous condition is the most prominent etiologic factor. I have reviewed a large number of cases showing symptoms of spastic colitis and find that the majority exhibit a definite neurosis, while a careful history warrants the conclusion that exacerbations in the severity of symptoms practically always follow some nervous disturbance. There appears to be a fear complex which must be taken into consideration before the trouble can be thoroughly understood and treatment properly outlined. To anticipate relief by attempting to correct only the intestinal stasis is usually doomed to failure, as with the neurosis still persisting it is but a little time until the symptoms recur.

The patient may be inclined to attribute his nervousness to constipation, and in all probability obstinate constipation may frequently be the cause of a psychoneurosis; but I am of the opinion that a nervous instability is always a precursor of this trouble. However, there are many observers who still believe that the symptoms of spastic constipation result from the irritation caused by retained fecal matter in the distal colon. There are others who believe that the trouble has its origin in the use of drugs, particularly purgatives. It is true that in this trouble drugs have been employed and in many cases for a long time, and there is no doubt that they do have a disturbing effect locally; but I would consider them as a factor in causing exacerbations of the trouble rather than as being a true etiologic factor.

The close relationship existing between spastic colitis and the so-called mucomembranous colitis, a condition generally recognized as having a definite neurologic basis, would further warrant this conclusion as to its etiology. The presence of mucus is observed at times in a large percentage of these cases, as at least 18 per cent of the patients mentioned this in their histories and mucus was found in abnormal amounts in the fecal analyses in a much larger number; yet in none were the symptoms such as would warrant a diagnosis of a typical mucous colitis. I sometimes find it difficult to differentiate between mucous colitis and spastic colitis except by the amount of mucus observed in the examination of the stool. It is true that the patient suffering from mucous colitis frequently passes nothing but mucus, often in the form of molds or casts, usually following an attack of rather severe abdominal pain, but I would conclude that these are the more severe cases of spastic colitis and that the only differentiation between them is in the severity of symptoms. The subject of mucous colitis has been so thoroughly studied by those believing it to be a disease entity that to repeat that discussion here is unnecessary. The reader may be referred to the works of Herschell and Abrahams,[3] Hemmeter,[4] Woodward,[5] DaCosta,[6] and Nothnagel.[7] These authors arrived at their conclusions on what would now be considered insufficient evidence to make a proper diagnosis. It may be concluded today that spastic colitis simulates very definitely a mucous colitis, and probably the etiology in both cases is a disturbance in the equilibrium of the sympathetic and parasympathetic nervous effect on the distal portion of the colon.

There is a noteworthy difference in the sex incidence in this trouble. In my experience females preponderate, the ratio being about 75 to 25, although other authors do not find so marked a variance. It is to be noted that this ratio is practically reversed in relation to peptic ulcer. Both of these conditions are probably diseases of modern life and it is not entirely apparent why women should be so susceptible to colitis and men to peptic ulcer. It has been suggested that the preponderance among women may be due to visceroptosis. In some cases I do observe visceroptosis, but I am of

---

3. Herschell and Abrahams: Chronic Colitis, New York, Longmans Greene & Co., 1914.
4. Hemmeter: Diseases of the Intestines, Philadelphia, P. Blakiston's Son & Co. **1:** 483, 1909.
5. Woodward: Medical and Surgical Report of the Civil War **2.**
6. Da Costa: Am. J. M. Sc., October, 1871, p. 37.
7. Nothnagel: Diseases of Intestines and Peritoneum, Philadelphia, W. B. Saunders Company, p. 224.

the opinion that it is a result rather than a cause. In a recent article Carslaw[8] discusses right-sided visceroptosis exhaustively, and while recognizing the nervous element in the causation, he is still of the opinion that the intestinal dysfunction may be responsible for the nervous instability in a certain proportion of cases. The trouble may have had its inception in a fear complex acquired in infancy or early life, and if recognized early much can be done to correct it; but when the symptoms are so severe as to annoy the patient almost constantly and these patients begin to notice on inspection of the feces the presence of mucus, relief is much more difficult to obtain. This is the type of case in which the patient becomes so introspective, and so analytic of his abdominal symptoms, as gradually to abandon interest in everything else and live only for his lower bowel.

There has recently been a craze among women of all ages to acquire a silhouette figure. Reduction in weight has been sought in many ways and has resulted in a weakened physical and nervous resistance and an undermined abdominal support; frequently a spastic colitis has developed with a coincident visceroptosis. Moreover, the intemperate indulgence in intestinal irrigations has in some parts of the country been a decided factor in aggravating the colon irritation and may also be a factor in the causation of spastic colitis. It is possible that the irritation resulting from retained feces may be a factor in producing the enterospasm and, as a result of absorption in the proximal colon, toxins may have a local irritating effect and may also be disturbing to the nervous mechanism both centrally and peripherally. In many of my cases a polyneuritis has been observed, the intercostals being especially involved. The age when the condition is most frequently seen is early and middle life, though it may also be encountered late in life if there is sufficient disturbance of the vagosympathetic nervous mechanism. The third and fourth decades, when the individual encounters the greatest stress and strain of life, apparently produce the larger number. It has also been observed in the very young, some cases being reported as early as at 4 or 5 years.

SYMPTOMATOLOGY

A complete review of the symptomatology of spastic colitis would extend the limits of this paper unduly;

---

8. Carslaw, R. B.: Brit. J. Surg. **15**: 545 (April) 1928.

therefore, only a few of the more prominent symptoms will be mentioned. A history of chronic constipation, averaging more than ten years in duration, was noted in a series of 100 cases recently reviewed. Cathartics and enemas had been used with unsatisfactory results. Abdominal pain was a more or less constant symptom, simulating organic conditions such as chronic appendicitis, cholecystitis, and gastric ulcer. Twenty-two per cent had been subjected to appendectomy with little or no improvement, and in many instances the nervous and abdominal symptoms were more severe following surgery. Five per cent had submitted to cholecystectomy with no improvement. It is true that these cases had not been satisfactorily studied; an x-ray examination of the gastro-intestinal tract had been neglected in many of them and cholecystography had not been resorted to in any of them. Many of the women had submitted to pelvic operations—dilation and curettage, shortening of the ligaments—for relief of a dysmenorrhea complicating the spastic colitis, with but little relief.

The majority of these patients complain of chronic fatigue and usually exhibit a low blood pressure. They are apt to be underweight and complain of chronic indigestion with abdominal flatulence. The abdominal pain, usually located in the lower abdomen along the course of the pelvic colon, is at times cramping in character and very severe, or it may be a persistent dull aching discomfort. Borborygmus is present in many cases and is very troublesome. The patient reports lead pencil stools, which may be unduly dry or putty-like in consistency, and complains of abdominal distress and irritation following the use of cathartics, especially in the later stages. Mucus is found in abnormal amounts in the majority of cases. It may be mixed with the feces and not readily observed, or it may be found as an envelop covering the stool, and frequently is passed in the form of a pure mucous cast. Introspection and insomnia are complained of in at least 50 per cent of the cases, and periods of depression are common and may lead to a diagnosis of manic-depressive psychosis. Because of the low blood pressure, lack of libido or menstrual disorders, endocrine disturbances probably exist. There is a low basal metabolic rate, indicating a hypothyroidism, and a certain number of these patients respond satisfactorily to thyroid medication.

PHYSICAL OBSERVATIONS

The physical observations are very important. The patient is apt to be below par in general nutrition, exhibiting cold, perspiring extremities, coated tongue, bad breath, low blood pressure, and frequently a disturbance in pulse rate. In practically all cases there is a spastic, ropelike pelvic colon observed on palpation, and the sensitiveness over this area is very definite, the pain under pressure being frequently referred to the region of the cecum. In a certain proportion of cases, in addition to the general tenderness along the pelvic colon, there is marked tenderness over the cecum and ascending colon, the contraction of the pelvic colon causing a dilatation with possibly a catarrhal irritation resulting. It is because of this tenderness involving the cecum and ascending colon that so frequently a diagnosis of chronic appendicitis is made and the patient referred to the surgeon for appendectomy. The operative results are not satisfactory; the constipation is not relieved; the tenderness is made worse; the patient's nervous instability is aggravated, and there is often a loss of confidence in the profession on the part of the patient. Brown [9] thinks it a wise rule never to diagnose chronic appendicitis and never to operate on such a patient without a history, definite or perhaps even indefinite, localized or with referred symptoms, which may be regarded as a probable attack of acute or subacute appendicitis. Frequently the cecum is found to be very low—the so-called mobile cecum—and also markedly dilated.

The x-ray study of these cases is very essential, as it tends to rule out other organic disturbances that might prevent proper diagnosis. A contracted distal colon in which the haustral markings are frequently lost, and in chronic cases a dilated cecum and ascending colon, are the usual observations. There is disturbed motility in the majority of cases and an emptying time longer than fifty hours following the barium meal is the rule. An incompetent ileocecal valve is noted, probably due to the dilated cecum, and in some cases a barium-mixed mucus can be discerned, while in others a diverticulosis is obtained particularly involving the pelvic colon.

---

9. Brown, T. R.: Internat. Clin. **3**: 24 (Sept.) 1927.

The observations by the proctologist are not striking; nevertheless, it is essential that each case have the benefit of his study. He may find some rectal changes, such as hemorrhoids, cryptitis or a spastic sphincter, but in many cases the rectum is practically free from disease. A sigmoidoscopic examination usually reveals a contracted rectopelvic junction, which, according to Soper [10] and others, is a decided factor in producing the intestinal stasis.

In making a diagnosis of spastic colitis great care must be exercised, as in many organic conditions there may be a disturbed colon function simulating this condition. Moreover, there is frequently a neurosis or psychoneurosis complicating many of the more chronic diseases, so that a spastic type of constipation exists at least temporarily. With the subsidence of the organic trouble the spastic state of the colon may persist, because of a neurosis incident to the unstable nervous condition following the primary trouble. Many patients feel that if they could obtain relief from constipation they would regain a normal state of health, but in my experience, unless with the temporary relief of the constipation there is an improvement in the nervous condition, the trouble promptly recurs. I frequently encounter this condition following operations, especially those on the pelvic organs of the female, and it is most essential that the care of the patient under these conditions be assiduously followed up.

TREATMENT

The treatment of spastic colitis presents a problem which in many cases is difficult of solution. Because of the chronicity, the intestinal stasis, which frequently amounts almost to an obstipation, and the neurotic mental state of the patient, there is a tendency for the symptoms to persist in spite of the most careful therapeutic management. One of the difficulties is to relieve the intestinal stasis satisfactorily. I frequently find patients that obtain an evacuation only once in three or four days, and at times they may go a week or ten days without a bowel movement. They have discovered that laxative drugs cause a severe irritation and have usually discarded them of their own volition. Enemas have not proved to be of permanent value, as the patient is either unable to take a sufficient quantity of water on account of the spasm of the pelvic colon or, if able to take it, finds he is unable to expel it. A great deal of discussion relative to the use of the water enema has failed to settle the question as to whether it is a valuable measure. Some authorities feel that it is as harmful as laxatives; but I have found it advantageous to have the patient resort to it at least temporarily. The so-called colon irrigation has frequently been tried, sometimes with temporary relief but rarely with permanent benefit.

In those patients suffering from almost complete obstipation, I find heat to be most valuable in relieving the spasm of the pelvic colon. The enema given slowly at a temperature of from 110 to 120 F. will usually prove efficient in relieving the spasm temporarily, but it may also be necessary to apply heat locally over the descending colon. At times it is necessary to place the patient in the knee-chest position and resort to the use of the colon tube. Soper [10] advises dilation by means of the sigmoidoscope and then applies magnesium sulphate to the rectosigmoid junction for its relaxing effect. I have used the oil enema advantageously. From 6 to 8 ounces (178 to 236 cc.) of cottonseed oil at a temperature of 100 introduced into the rectum in the knee-chest position and retained over night, or for several hours, has a tendency to relax the pelvic colon and produce satisfactory movements. This may have to be supplemented by agar-agar or psyllium seed by mouth.

DIET

Diet is a very important therapeutic measure in all cases of colon dysfunction, and particularly in cases of spastic colitis. Since many of these patients are decidedly reduced in nutrition and practically all of them have such symptoms of indigestion that they have of their own volition reduced their diet much below that required for nutritive equilibrium, it is essential that a liberal diet be prescribed. There is a decided difference of opinion as to whether the diet should be bulky and contain much roughage or, on the contrary, very bland and devoid of all bran and uncooked vegetables. My experience indicates that, in the more acute stages of the trouble, bulk should be avoided. After the acute tenderness and irritation have subsided, bulkier articles

---

10. Soper, H. W.: Am. J. of Roentgenol. **11:** 503 (June) 1924.

may be gradually added until the patient is on what might be considered a normal diet. The patient may be annoyed by the excessive accumulation of gas, which is usually attributed to the use of some specific type of food, but my experience is that this is usually a result of the intestinal stasis, as it promptly disappears when constipation is relieved. In certain cases it may be necessary to change the intestinal flora, and in accomplishing this acidophilus buttermilk and lactose are very valuable.

DRUGS

Spastic colitis may be treated without resorting to drugs, but in the acute stages much help can be obtained from two types of drugs, the antispasmodics and the sedatives. Belladonna is of considerable value in relieving the spasm, as is benzyl benzoate, although to a less degree. Since the majority of these patients suffer from insomnia and undue anxiety, it is impossible to accomplish any great improvement until these have been relieved. In the past bromides have been used extensively, but of late the barbituric group (barbital, phenobarbital) has been considered of greater value. These should not be used over too long a time and should be changed from time to time.

Of the nonmedical measures, hydrotherapy is particularly useful. The abdominal tenderness and the spasticity of the colon may be relieved by the application of fomentations, the use of the sitz bath, the Scotch douche to the abdomen and the lower part of the spine, care being taken that the treatment is not too vigorous or exhausting to the patient. The tonic effects of the cold rub or short cool baths are beneficial in bringing about an improvement in the nervous condition, especially in institutional cases. Massage is also advantageous, as the patient is chronically fatigued and does not respond satisfactorily to active exercise. Electrical measures, such as diathermy to the pelvic colon, or high frequency applied by the rectal electrode, may be helpful in selected cases.

Because of the neurotic condition it is advantageous to have these patients removed from home surroundings to an institution where a satisfactory program can be followed and every effort made to relieve their anxiety. Psychotherapy is an essential part of the treatment. Dawson [2] is of the opinion that the profession needs to take up in a large-minded spirit the question of psychic treatment; that the patient with colitis who is in danger of being crushed by his illness is not helped by being dubbed "neurotic;" that the patient's mind can be trained and helped to detach itself, to control what it contemplates, to temper rather than reinforce in consciousness the aches and ills of the body, and thus establish the benign rather than the vicious circle. It is not necessary that the patient be referred to a neurologist, provided the internist has the confidence of the patient and has at least a working knowledge of psychotherapy. It is sometimes difficult to determine the underlying fears of these patients, but in time they will confide in the physician, thus giving him an opportunity for doing the greatest amount of good.

In some cases it is necessary to prolong treatment over a considerable period. I have patients at present who have been under observation for over a year but who have not acquired such satisfactory nervous reserve as to permit of their getting along without medical supervision. They have gained materially in weight and are free from constipation under normal conditions, but, when they become introspective and alarmed relative to their condition, the constipation immediately recurs. Anything that tends to excite or unduly fatigue the patient always results in an aggravation of symptoms.

In the treatment of the misbehavior of the gastro-intestinal tract, the same measures as used by a group of psychologists spoken of as the "behavior group" may have to be resorted to. They believe that emotional states are largely responsible for disordered function of the viscera. In the child they are able to remove fear states and, as the same emotional disturbances continue on into mature life, the same need exists to eliminate fear states from the emotions in order that certain functional gastro-intestinal disorders may be relieved. I find in the great majority of my cases an underlying neurosis which frequently escapes the attention of the physician entirely. We are too prone to observe pathologic change without attempting to explain it. In these cases of dysfunction I have reason to believe that until the emotional life of the patient and his ability to live above his fears are corrected, little hope of complete relief can be seen. In many cases the trouble has its incipience in early childhood and may continue during the greater part of life.

Since the number of people suffering from this trouble is much larger than has been supposed and apparently is increasing, it is essential that the problem be given the most careful attention. My observation warrants the belief that many by persistent effort may be practically restored to health, or at least sufficiently so to permit their earning their own livelihood. I feel that more can be accomplished for their relief through a careful study of their nervous condition and a rational adjustment of their emotions than by the use of any other therapeutic effort. They are the type of individuals who have found the stress of life too hard and have broken under the strain. Sympathetic understanding of their trouble may lead to a restored confidence which will be of assistance in relieving their digestive complaints and their chronic intestinal stasis. Surgery is of little assistance and usually tends to lower further their resistance and to aggravate their nervous instability.

SUMMARY

1. The principal etiologic factor in spastic colitis, or enterospasm, is nervous instability. The spasm and secretion of mucus are due to disturbance of the sympathetic and parasympathetic effects on the distal portion of the colon. Unless this is taken into consideration, all attempts to relieve the intestinal stasis are doomed to failure. The mucomembranous type of colitis is an aggravated form or end-product of the spastic type.

2. The following therapeutic measures are suggested as of the greatest value: Heat is the most effective measure for relief of the spasm and may be applied in the form of the hot enema (from 114 to 120 F.), fomentations or sitz baths. The oil enema given in the knee-chest position and retained all night is advantageous.

3. Diet is important. A liberal diet is indicated and in the more acute stages of the disease should be bland and devoid of bulk or roughage, which may be added as the patient improves. The gas with which these patients are troubled is usually due to the stasis and will disappear as the constipation is relieved.

4. For general improvement the tonic effects of the cold rub massage and, in selected cases, diathermy are of value. If drugs are needed, belladonna is serviceable as an antispasmodic, and the barbituric acid group as sedatives.

5. Psychotherapy for the removal of those emotional or fear states that are responsible for the disordered function of the viscera is an important part of the treatment.

Battle Creek Sanitarium.

GENERAL AND SPECIAL PATHOLOGY OF THE DIAPHRAGM

BY

DR. HANS EPPINGER,

VIENNA.

Alfred Hoelder k. and k. court and university bookdealer.

Dealer in books for the imperial academy of sciences.

1911

PHYSIOLOGY OF THE DIAPHRAGM.

The diaphragm as the name indicates forms a complete transverse wall between the thoracic and abdominal cavity, making an independent action of the organs in the two cavities possible.

A. THE DIAPHRAGM AS A RESPIRATORY MUSCLE.

1. Mechanic:

The most important function of the diaphragm is that of acting as respiratory muscle. The relaxed diaphragm has the shape of half a globe, which is pulled up in its center by the negative pressure in the thorax, thus stretching the muscle. When the muscle contracts it may be almost straight, but the central tendon is in close connection with the d mediastinum and its organs, which are well fixed by the great vessels, so that the diaphragm can contract only to a certain extent. The length of the thorax as well as the elasticity of the ligaments will cause variations. The intra-abdominal pressure also will prevent the descent of the diaphragm as well as the negative intrathoracic pressure. (The last expression, negative pressure, requires a certain correction.)

2. Negative pressure in the thoracic cavity:

According to TENDELOO and BRAUER there is normally no negative pressure in the space between the parietal and visceral pleura. It is a cavity only when air or fluid is between the two layers. The visceral and parietal pleura is in close apposition normally. The atmospheric pressure is transmitted thru the bronchial tree to the visceral pleura. An elastic equilibrium is thus established, causing an equal expansion of the lung in the thorax. On the surfaces of the two pleural layers are opposite forces acting, but yet they remain in contact due to adhesions and the atmospheric pressure, thru which alone the fixation of the lung is obtained under ordinary conditions. BRAUER proved that the adhesions are stronger than the tension forces, which have a tendency to cause a collapse of the lungs, but the retraction force of the parenchyma plays an important role also in the static of the position of the diaphragm. We can draw the final conclusion that there is no free space and therefore no negative pressure in the thoracic cavity, but only the adhesions and the retraction force of the lungs will pull the diaphragm up.

Besides that the tonus and force of the diaphragmatic muscle is antagonistic to the adhesions and the elasticity of the parenchyma of the lung. The diaphragm is pulled up and by the atmospheric pressure the lungs are kept in extension, causing an equilibrium between elasticity of the lungs, the negative intra-thoracic pressure and the tension of the muscle fibers of the diaphragm as well as the other muscles surrounding the thorax.

When the diaphragm contracts the equilibrium between the elasticity of the lung and the tension of the diaphragm is disturbed. The negative pressure is increased, so that the external air pressure in the lungs becomes greater in proportion to the descend of the diaphgram. With the diaphragm other muscles will contract, also causan enlargement of the thoracic cavity and aiding the diaphragm in its action.

3. Movements of the centrum tendinum and the sinus phrenicus costalis:

The diaphragm does not consist entirely of muscle tissue but it has also a strong central tendon, which increases the capacity of the diaphragm as respiratory muscle. When the muscle is relaxed the fibers of the muscle tissue ascend almost vertically, suddenly bending to the horizontal position. On that account the greater part of the muscle fibers are in contact with the costal pleura. Even in the relaxed condition of the diaphragm the pleura diaphragmatica and the pleura costalis form a wedge shaped space all around the thorax. In expiration this space is narrow, while during inspiration it becomes wide and the angle less acute, and the diaphragm separates from the inner wall of the thorax. The increase in negative pressure will push the lower margin of the lung into the costal sinus, finally completely filling it. The capacity of the lungs is thus much increased, especially since the diaphragm descends. The increase in the capacity of the lung occurs even in pure abdominal breathing, without the action of the thoracic muscles, not only in the lower parts but thruout the entire lung even if the dimensions of the thorax remain the same. In the upper parts of the lung the distension is much less marked, probably due to the relative small range of motion of the apex of the lungs.

In moderate contraction of the diaphragm the enlargement of the thorax is due to a broadening of the space mainly, while in forced inspiration the central tendon will descend considerably. Only in strong dyspnoea the central tendon will move markedly, in quiet respiration the portion around the central tendon is immovable. Extreme contraction of the diaphragm may change the muscle into an almost straight horizontal layer. At times the contraction may become so strong that the origins of the diaphragm become shorter and produce a reverse action of the diaphragm in narrowing the circumference of the thorax.

The costal inspirations and the increase in abdominal pressure does not only act regulating but at times also overcorrecting. That the abdominal pressure plays an important role was shown by the experiment by DUCHENNE. As long as the abdomen of an animal is closed, the irritation to the phrenic nerve will cause a separation of the ribs which will disappear as soon as the abdomen is opened.

4. Active and passive motions of the diaphragm:

The movements of the diaphragm were not completely understood until the Roentgen method was known. A few facts however were known, that the muscular part of the diaphragm was in contact with the thoracic wall and that the muscle fibers near the center and its tendon took a horizontal direction. In common respiration the muscle fibers of the diaphragm contract mainly, the central tendon remaining in the same position. In costal and abdominal breathing at the same time it often appears to be difficult to distinguish on the X-ray picture the changes in position of the ribs, which represent the passive motion of the thorax and the active motion of the diaphragm. Both forms are combined in quiet and forced respiration. In the female the active motion of the diaphragm is not as pronounced as in men, the extent of motion being in men about 2-4 cm in women about 1-2 cm. The costal type of breathing in European women is not always due to wearing of a corset, also the belief that the women lose the motility of the diaphragm on account of pregnancy is not true. MOSSO'S observation that in men the costal type of breathing during sleep is the most pronounced is very interesting. After a few exercises one succeeds in using only the diaphragm during respiration. This is best done in pressing on the abdomen during respiration. Luciana claims that the diaphragmatic breathing is very tiresome. This can be explained by the fact that all new exercise are apt to tire a person out. SEE-WALD and POLLARD claim that the costal and abdominal breathing can be made to be independent from each other. It is interesting to know that low tones sound stronger and purer in costal breathing, while high tunes sound better in abdominal breathing.

Under normal conditions the function of the diaphragm should even in the man be less than that of the intercostal muscles. Hultkranz calculated that only 35% of the entire inspiration air of a person was due to the function of the diaphragm, the remaining 65% was due to the action of the intercostal muscles. In older persons the motility of the ribs becomes impaired, the cartilages become calcified, thus making the diaphragm the most important respiratory muscle, but also in these cases there are exceptions. If the diaphragm is moved only passively on account of pure costal breathing one can notice with the use of the X-ray that the central tendon may even rise on inspiration to a small degree.

The appearance of the diaphragm in active contractions however is entirely different. The ventral muscle fibers will increase the tension of the central tendon and are placed almost horizontal. The lowering of the central tendon is accomplished by contraction of the lateral and dorsal muscle bundles. The convexity of the right side of the diaphragm is at a much higher level than that of the left side due to the position and size of the liver.

The muscle fibers of the right half of the diaphragm are longer than those of the left side. In expiration the ventral muscle fibers are the most active on the right side, while on the left side the center of the diaphragm is the most active. In inspiration the liver not only is pushed down but also rotates around a horizontal-frontal axis. In pure costal breathing the diaphragm is also activated, at least it has to prevent its being pulled up. Its force is not great enough to increase the intra-abdominal pressure, but strong enough to produce a retraction of the scrobiculum cordis. The abdominal muscles will often contract with inspiration, probably as aid to the diaphragm. The examination with the X-ray will show that we don't have to deal with a paradox action of the diaphragm.

The liver influences the intra-abdominal pressure, this is shown by the fact that the intra-abdominal pressure decreases in lowering the head.

5. Ordinary and forced respiration:

In ordinary respiration the equilibrium is maintained by the attempt of the diaphragm to draw together the lower part of the thorax and thru the opposite action of the abdominal pressure as well as thru the tension of the anterior abdominal muscles on the thorax. This seems to be present only in ordinary respiration. Deep inspiration which almost always becomes costal in type shows little change in the lower part of the thorax, while the upper part now is the expanded portion. With this the anterior abdominal wall retracts due to a contraction of the muscles itself, less due to the action of the diaphragm. The muscles of the ribs are much more efficient in causing an enlargement of the thorax, especially in young and elastic chests. The diaphragm is using most of its force in trying to keep from being pulled up and only secondarily enlarges the thorax thru its contraction.

With the X-ray one not seldom has a chance to see that the convexity of the diaphragm is at a higher level in inspiration that in expiration. If however the movements of the diaphragm are put in relation to the shadow of the elevated ribs, one will find the upwards displacement of the diaphragm is only apparent, as the passive motion of the diaphragm is the most pronounced and thus only imitating the lack of muscle tone. (HOFBAUER).

6. Changes in the position of the diaphragm in different positions of the body.

HOFBAUER and HOLZKNECHT studied these conditions which are exceedingly important in the pathology of the diaphragm. By means of the X-ray it shows that the convexity of the diaphragm is at the highest level when the patient is in the horizontal position, it is placed lower while standing up and lowest while in the sitting position. The motions of the diaphragm are more extensive while in the lying down position, the stronger or weaker contractions of the abdominal muscles may be the cause of the change. In lying on one side the lower part of the diaphragm is in expiration at a much higher level, then the upper one. It is the lower half of the diaphragm that is active in breathing, while the upper half remains almost inactive. This phenomen occurs in ordinary and forced respirations. The conditions of the intra-abdominal pressure and the displacement of the organs probably are the cause for these changes. The farther a muscle is removed from its fixed insertion, the greater is the excursion it has to do during the following contraction. The higher the diaphragm is pushed passively the greater is its excursion on contraction and thus its general action. In the sitting position the contraction of the ventral abdominal muscles does not take place and the insertion points of these muscles approach each other passively. The abdominal contents can push against the lax anterior abdominal wall, decreasing the pressure in the upper part of the abdominal cavity. On that account the position of the diaphragm is lower in the sitting position.

Finally we have to mentionthat the diaphragm is lowered when the arms are raised up. A physiological explanation for this fact has not as yet been given.

7. The diaphragm during expiration:

As a rule expiration is a purely passive process without the activity of the muscles, all the muscles even relax making a general narrowing of the thorax with its elastic walls possible. Since this process as far as the lungs are concerned depends upon the intact elastic fibers of the lung and thus cannot be hastened nor prolonged, a certain time is necessary for an economical emptying of the lung. At the same time the muscles of the thorax and diaphragm have a chance to relax. A. FICK and LUCIANI claim that in common expiration a few muscles are active like the internal intercostal muscles, the triangularis sterni, serratus posticus inferior. It is a fact that after a few exercises one can produce voluntary active expirations, without using the abdominal muscles. If the abdominal muscles are used a considerable pressure can be obtained. From the ability to interrupt the expiration one cannot draw the conclusion that it is due to a voluntary inhibition of active thoracic expiratory muscles.

It is different however with the expiratory function of the abdominal muscles, that are able to aid the relaxation of the diaphragm.

It is a well known fact that one can push up the diaphragm in using the abdominal muscles. Whether under normal conditions the favorable influence of the contraction of the abdominal muscles upon the relaxation of the diaphragm is an active process or only due to changes in the muscle tone has not as yet been proven. It is possible that the action of the diaphragm extends to the abdominal muscles to increase the contraction of the lungs when the diaphragm relaxes.

B. THE DIAPHRAGM AS AID IN CIRCULATION.

The diaphragm not only has the function to produce a vacuum in the thorax and thus causing the lungs to expand but it also plays an important part in the circulation. It is clear that the inspiration causes an emptying of the upper vena cava. This is seen in the physiological emptying of the cervical veins on inspiration, due to a suction action of the diaphragm. The circulation of the inferior vena cava as well of the portal system can not easily be watched, but one can draw the conclusion that the blood from the abdomen is sucked into the thorax under the active motions of the diaphragm.

1. Mechanic.

We will first discuss the developmental conditions, which are in favour of the important influence the diaphragm plays upon the circulation. KEITH especially has devoted much of his time to work out this problem. In some animals that only have gills the trunk has only one cavity for the pericardium and one for the belly organs. In the amphibium there are the lungs besides the gills, which are placed in the belly. The higher the stage of development of an animal the nearer towards the cranium are the lungs placed. The lungs rise thru openings which are formed by the already formed diaphragm. As soon as the lungs are in the thorax and have had a chance to become enlarged the openings become closed thru the formation of the dorsal portion of the diaphragm. The muscle forming the diaphragm in lower animals can easily be divided into an anterior and posterior part, which have their own independent origins. The dorsal portion coming from the vertebrae, the ventral portion from the sternum and the lower ribs. The function of the diaphragm varies in animals and depends upon the stage of development of the animal. In the lower animals where the lungs are in the belly the action of the diaphragm is to compress the lungs during contraction. The opposite is true in higher animals and human. We find that the same muscles that aid inspiration in higher animals act in the lower animal only in aiding expiration.

Keith has proven that the diaphragm is one of the main factors in aiding the heart and the general circulation. Even in the lowest animals it has to compress the organs and thus empty them from blood. In animals, with a horizontal body axis there are relative less forces necessary to keep up the circulation. The human being in an upright position most of the time has to use more force to work against the gravity of the blood in the vessels. If one considers that the aortic and vena cava system really present a "U" tube the statement just made has a certain limit. HILL has shown that the position of the body has much influence upon the blood current.

-

The low blood pressure of an animal put in the vertical position will return to almost normal if the feet and the abdomen are put in water. In individuals, that almost constantly are in the upright position there must be some forces to overcome the factors that are so unfavorable for the circulation. That the diaphragm plays a a role in that seems to bee proven by many anatomical examinations. KEITH has mentioned the arrangements of the muscle bundles in relation to the heart and the inferior vena cava, in approaching the right auricle and the liver in each contraction of the diaphragm, thus making a more rapid filling possible.

2. What teaches the topographic anatomy?

In considering the works of HASSE the importance of the function of the diaphragm as aid in circulation is made extremely clear. The inferior vena cava is placed in a groove of the dorsal margin of the right liver portion going thru the diaphragm in its tendinous part (Foramen venae cavae). The wall of the veine is grown together with the margin of the diaphragm. HASSE has proven that the hepatic vein does not terminate into the vena cava in the groove in the liver as is shown in many anatomy books but that this occurs above the diaphragm. In that place the inferior vena cava forms a bulb. The course of the right hepatic vein is more vertical, almost parallel to the vena cava, while the left hepatic vein runs almost in a horizontal direction. The conditions of circulation of the right hepatic vein are thus much more favorable than that of the smaller left vein. The hepatic artery is behind the pancreas at first then it runs ventrally and to the right. After having formed an angle it goes upward penetrating the liver with its two branches

2. The conditions of circulation in the different forms of respiration:

In pure costal breathing there is a retraction of the abdominal wall during inspiration, which is more pronounced below the umbillicus than above. At the same time the thorax expands. The pericardium is lifted up and widened, which also increases the lumen of the lower part of the superior vena cava. The anterior pericardial wall is attached to the ribs and sternum on the left side below the region of the fourth rib. These changes during inspiration improve the continuous circulation of the portal system and cause an emptying of the veines terminating into the inferior vena cava above the diaphragm. In costal breathing the diaphragm is not entirely inactive as we have seen, it becomes flat, pulling down the pericardium and enlarging the inferior vena cava.

The retraction of the abdominal muscles during inspiration increases the intra-abdominal pressure. There is less blood at that time in the inferior vena cava, this facilitates the flow of the blood from the hepatic veines into the vena cava at their termination above the diaphragm where the intra-abdominal pressure does not influence the hepatic veins.

In expiration the pericardium returns to its original size and position the inferior vena cava is no longer under tension. The intra-abdominal pressure diminishes thus facilitating the circulation in the inferior vena cava and that of the lower extremities. LEDDERHOSE observed that a deep inspiration will cause an enlargement of the veines of the leg, while the veines of the neck are emptied.

In pure abdominal breathing the circulation of the upper vena cava is unfavorably influenced, while the inferior vena cava has the advantage. The intra-abdominal pressure is much increased and the liver is compressed by the lowering of the diaphragm and the pressure within the abdomen. The blood in the liver cannot flow back on account of the intra-abdominal pressure and the anatomical condition of the hepatic artery behind the pancreas and on account of the constant new current. The blood within the liver thus can be pushed up only, this is facilitated by the enlargement of the veines. WENKEBACH said: If one can compare the liver with a sponge sucking up the blood one should call the diaphragm the hand that presses the sponge.

4. Conditions of circulation in the newborn.

The diaphragm does not only improve the circulation in causing a negative intrathoracic pressure but it also compresses the liver. The infant is born with a relative large liver, a short time after birth its size decreases. If one considers that during intra uterine life the contraction of the heart alone has to keep up circulation, one should not be surprised that the blood will accumulate in the liver as the current is very slow in the capillary system. HASSE thinks that the decrease in the size of the liver is due to the action of the diaphragm, which also produces a more rapid circulation. The liver decreases in size less rapidly; this is explained by the fact that before birth the hepatic vein empties into the inferior vena cava below the diaphragm. Apparently the action of the diaphragm causes an atrophy of the liver cell between the termination of the hepatic vein and the diaphragm, which is done during the first year of life, at that time the function of the diaphragm to compress the liver begins.

In a very similar way HASSE explains the physiological icterus neonatorum. The vessels leaving the hilus of the liver are between the quadrangular lobe, the spigelian lobe the pancreas and the beginning of the duodenum, first horizontal running forward then running down and finally taking a downwards and backward course. Even under normal conditions the secretion of the bile depends upon a relative narrow opening. The hyperaemia of the liver at birth, which does not disappear until the diaphragm descends may cause such a pressure upon the vessels of the liver that the outflow of bile is prevented.

5. Influence of the heart beat volume.

The volume of the heart beat is very much lowered when the diaphragm is relaxed, while a contraction of the diaphragm increases the volume markedly.

C. TONUS OF THE MUSCULATURE OF THE DIAPHRAGM:

MOSSO claims that the inspiration of small amounts of carbon-dioxide or bad air will increase the tonus of the diaphragm. The tonus is also increased when the inhibiting action of the vagus is destroyed. The tonus of the diaphragm decreases when the muscle is treated with cocain directly or in allowing an animal to inhale ammoniac. Young persons with narrow chests can press the diaphragm much higher than old persons.

D. NERVUS PHRENICUS:

We now will attempt to analyse the motions of the diaphragm in their dependence upon the nervous system. The contraction of the diaphragm occurs at the same time as that of the thoracic muscles being caused by a common nervous stimulus. This stimulus acts periodically and automatically, but can be modified, stopped or hastened voluntarily. In holding the breath the diaphragm is in a state of a tonic contraction. DITTLER showed that the phrenic nerve transmitted centrifugal oscillating impulses during inspiration, but not during expiration.

One can inhibit the contraction of the diaphragm in any stage of contraction as has been shown by the X-ray, without causing it being pulled up by the retraction force of the lungs.

Apparently movements of the diaphragm can be produced by emotions or sensations starting in the organs that are connected with the diaphragm. Sinc the phrenic nerve has some sensory fibers it probably is connected with these centripetal irritations. It is a well known fact, that during defecation sensations are transmitted to the entire abdominal musculature and also to the diaphragm. The smell or sight of disagreable food may start contractions of the diaphragm thus causing vomitting, the same is true in cases of sneezing.

GENERAL SYMPTOMATOLOGY.

With no other means can one become so well orientated about the form, position and motion of the diaphragm as with the X-ray method. The great advantage that we have in the X-ray method in the pathology of the diaphragm consists in the possibility of seeing the convex points of the diaphragm. Since the picture of the diaphragm is made by the rays that strike the body tangential it is of great importance to get the right position of the patient in order to obtain a good view of the form, heighth and range of motion. If the X-ray tube is at a higher level than the upper convex surface of the diaphragm the rays will strike only those parts which are near to the anterior thoracic wall. If the tube is placed too low down only the posterior parts of the diaphragm is shown. Besides that the diaphragm changes its position constantly, which complicates the estimation of the heighth of the diaphragm. If the X-ray tube is near the thorax in median height, the parts closest to the tube are taken while the diaphragm is ascending, while the diaphragm is descending the more distant parts are taken. This shows that if the diaphragm is exposed too close to the tube the different parts of it are seen, changing with the motion of the diaphragm. Considering these facts one should always take the pictures with rays that are parellel to each other. An apparatus built that way will always only show the parts of the diaphragm that are free against the wall. If one wants to get a picture of the posterior or lateral parts, the patient has to turn or oblique rays have to be used.

Pictures taken with the Roentgen apparatus or even with the orthodiagraph may give rise to errors. Most of the pictures are taken with a long exposure, this will not enable one to judge the respiratory motion of the ribs and the diaphragm. A picture of the diaphragm taken while holding the breath is not natural as the phase of the voluntarily moving muscle. For that reason the pictures of COWLS are so valuable because by means of suitable technical devices only certain phases of respiration are seen on the picture. From the new apparatus with which pictures can be taken with only a moments exposure finer details of the motion of the diaphragm are expected to be seen.

Finally one should consider that the lower part of the thorax in inspiration with the insertions of the diaphragm are raised, while at the same time the muscle of the diaphragm is pulled down, this motion is opposite to that of the ribs. In orthodiagraphic examinations the shadow should not be drawn on the wall of the chest as this moves at the same time as the ribs do. This error is prevented in keeping a device that the picture found orthographically can be drawn outside of the thorax. The position of the ribs is to be considered also as it will passively move the diaphragm.

DIETLEN states that the right side of the diaphragm is at a higher level than the left side, that in females the position is higher and that the size of the body does not cause any marked variations in the position of the diaphragm. In long and narrow chests the diaphragm seems to be placed a little lower than in wide short chests.

In older people the diaphragm is placed about one intercostal space deeper than in the young. This condition may be produced by the decreased retraction force of the lungs. In the standing position the right part of the diaphragm becomes more flat than the left, this is supposed to be due to the traction of the liver. (Jamin)

A phenomena often noticed during deep inspiration in both sick and healthy individuals is the inspiratory retraction of the upper part of the abdominal wall. This phenomena is best noticed in the lying down position. DE LA CAMP analysed these motions and noticed that in lateral views the upper parts of the diaphragm work normally, while only the anterior fibers of the muscle in strong respirationwill contract, causing a lifting up of the insertions of the muscle and the lower part of the thorax. In feradic irritation of the phrenic nerve the diaphragm will form an almost horizontal line. This method causes an action of the diaphragm that is independent from the costal respiration. In bilateral irritation the response may be so strong that the lower ribs are caused to project on account of the resistance in the abdomen due to the organs.

General pathology.

The most important disturbances of the diaphragm are the too high or too low position of the diaphragm.

The too high position of the diaphragm:

This condition may be unilateral or bilateral. It may be produced by increased tension within the abdomen, increased retraction force in the thorax and finally by disturbances of the muscle tone of the diaphragm itself.

The intra-abdominal pressure makes itself evident as soon as the relation between the abdominal organs and the wall is changed. Physiologically the muscle tone of the diaphragm is the only force acting against the negative pressure in the thorax. If the increased abdominal pressure becomes evident it will cause a stronger traction on the muscle fibers. In expiration the pressure may aid in the contraction of the lung tissue. Since a muscle removedfrom its normal position will gain in strength the high position of the diaphragm would be able to take care of the change, this occurs in temporary changes in the position of the diaphragm as in meteorism. This is especially the case in relaxed muscle walls. If the abdominal wall is strong the diaphragm meets with a greater resistance. In these cases it does not reach the same depth in inspiration than normally, and its excursions are smaller than normally. The longer this condition lasts the less extensive become the motions of the diaphragm. We know that relatively slow occuring increase of the abdominal pressure as a growing tumor will not push the diaphragm up but father increase the width of the lower thoracic cavity. The peripheral insertions of the diaphragm are thus separated, so that the entire muscle is under tension and less able to yield to the intra-abdominal pressure. The change in position can be ascertained by percussion and the X-ray. The increased pressure will render the pleural sinus much smaller. By LITTEN'S sign the altered position is soon noticed. In cases of accumulation of pus, gas or transudate all portions of the diaphragm are pushed up but the left side usually is more affected being at the same level as on the right side.

While the diaphragm is pushed up the space between the thoracic wall and the anterior part of the diaphragm is decreased. The heart is

The heart is thus partially lifted up and pushed against the wall of the chest. The apex beat in these cases is 1-3 intercostal spaces higher up and placed more laterally, the action of the heart is increased due to the compression and its superficial dullness may simulate a hypertrophy or a dilatation.

The anterior border of the liver may be pushed up and the posterior border down.

The degree of resistance of a tense diaphragm can be shown by the fact that it is in an almost normal position in pregnant women until a few weeks before the birth of the child. Immediately after the birth of a child, when the ribs return into their normal position the diaphragm is about 1-2 intercostal spaces higher.

As far as position is concerned the diaphragm is pushed up more when the patient is lying down as long as there is any free fluid in the abdominal cavity. Even under common conditions one finds when enteroptosis go hand in hand with a lax abdominal wall that the diaphragm changes its position greatly with the position of the body.

On account of the increased intra-abdominal pressure the thorax is stretched to its maximum capacity and the diaphragm so tense that it can not move very much if at all. One even has a chance to notice the retraction of the thorax on inspiration during quiet respiration. The entire activity of the diaphragm may be a paradox one. The high position of the diaphragm is apt to influence unfavorably the circulation, the heart and the abdominal vessels. In a high position of the diaphragm the absolute dullness of the heart is increased because the lungs have not a chance to push into the pleural sinus and in front of the heart thus the vertical diameter of the heart is increased.

Only in considering the exact position of the apex beat this condition can be distinguished from hypertrophy and dilatation. The position and shape of the heart depend largely upon the diaphragm. In an X-ray picture with a stomach dilated by gas the heart is in a more horizontal position, the apex seems to dip into the stomach, while in reality it is placed in front of it. A similar condition can be observed after a very excessive meal.

Inactivity and high position of the diaphragm will influence the liver function, producing a congestion of the liver, the portal system and the inferior vena cava.

There is a rise in blood pressure with a high position of the diaphragm (JUERGENSEN, SCHREIBER, HIRSCH, ROLLY)

The displacement upward of the diaphragm on only one side is a more common event.

The displacement upward of the diaphragm on only one side is a more common event. It is in a physiological way produced by a person lying on one side. Pathologically it is produced by gases accumulating on one side of the body. The left side is more apt to be thus affected. The liver on the right side prevents the upward displacement of the diaphragm. Renal tumors and enlargement of the spleen will produce a high position of the diaphragm. The position of the diaphragm is very much altered in cases of pus between the liver and the diaphragm.

High position of the diaphragm due to thoracic tension. Shrinking conditions in the thorax prevent the active lowering of the diaphragm and secondly the decrease or complete loss of extension of the pulmonary parenchyma will cause a lasting high position of the diaphragm.

A typical example for the shrinking of lung tissue which may produce a high position of the diaphragm is the chronic pneumonia. The shrinking of the connective tissue is sometimes so strong that it will cause a sinking in of the thoracic wall. Chronic tuberculosis is very similar to that condition. Not every chronic inflammation of the pleura even when adhesions are present will cause a change in the position of the diaphragm. It is found where the chronic adhesive inflammation of the pleura becomes interlobular, affecting the lungs. The end result of the pleuritis consists in adhesions and the formation of connective tissue, which is apt to cause marked changes on contraction. The motions of the lungs are unfavorably influenced. The bands of connective tissue will connect the bony thorax with the lungs and the diaphragm and are more apt to follow the strong contractions of the respiratory muscle than the diaphragm, this being pulled up on inspiration acting in a paradox way. Bronchiectasis may give rise to a change in the position of the diaphragm. In normal inspiration the convex part of the diaphragm is lowered about 2-7 cm. In a high position of the diaphragm this excursion is much less. This is noticed best in unilateral affections. The side moving less is always considered to be the pathological one as there is no unilateral pathological increase in the mobility of the diaphragm. (HOLZKNECHT).

WILLIAM'S PHENOMENA:

In 1897 WILLIAMS stated that in tuberculosis of the apex of the lungs the diaphragm on that side will move much less than on the non-affected side. The motion of the affected side may also be somewhat delayed, this is only noticed on deep inspiration. The correctness of this symptom was confirmed by man. DE LA CAMP found this phenomena in one third of all the sure cases of tuberculosis of the apex of the lungs.

The etiology of this symptom is as yet obscure. The WILLIAMS phenomena is often seen in tuberculosis incipicens, where the affected areas are still very small. In more extensive areas the diaphragm may be normal in its action. HOLZKNECHT considers this in a theological sense a curative process as the attempt of the diaphragm to keep the affected side at rest. DE LA CAMP and MOHR think it is due to a pressure upon the phrenic nerve in the upper part of the lungs. They attempted to prove this by experiments. In lower animals the phrenic nerve is by far not as important as in higher animals. The 7-12 intercostal nerves have a motor significance in the lower animals, while in the human their action is unimportant. On that account experiments on animals upon the action of the phrenic nerve will not give correct results. But yet it has been shown that compression of the phrenic nerve will produce a phenomena similar to that of WILLIAMS. Besides it was shown that in persons where the diaphragm was not acting alike on both sides the response to foradic stimulation of the phrenic nerve was different. It was much less on the affected side so that DE LA CAMP and MOHR DECIDED THAT IT WAS DUE TO a partial paralysis of the nerve. HOFBAUER'S view is very similar to that of WILLIAMS. The affection of the lung will lessen the retraction force of the lung. A normal lung has the best advantage in being able to pull the diaphragm up. If this tension is lessened the diaphragm is at a lower level and besides that the musculature of the diaphragm may cause a smaller degree of excursion of the convex parts of it. I consider the view of HOFBAUER and HOLZKNECHT as correct as I have never been able to notice a neuritis or atrophy of the phrenic nerve in cases of tuberculosis of the lungs not in primary nor advanced stages. Besides that the phrenic nerve is not in close relation to the apex of the lung so as to be affected. Not the diminished inspiration is the cause but the lack of relaxation and retraction force is the reason to decrease the excursion of the diaphragm.

A high position of the diaphragm is also found in stenosis of the trachea as well as that of the bronchi. These cases may be called inspiratory stenosesis. The diaphragm only lowers slightly on inspiration and takes up its normal place on expiration, and may be called an inspiratory high position.

We will mention in this place that in chlorotic persons the position of the diaphragm is as a rule high. The reasons for this are obscure. The cardiac dullness is transversely increased, which seems to be due to a retraction of the margin of the lungs, that normally are in front of the heart. The lungs are thought to be hypoplastic in these cases, and not able to fill the space of the thorax, but this statement is not correct as the retraction of the margins of the lungs and the high position of the diaphragm at the same time are only temporary symptoms.

They can be caused to disappear after a few deep respirations. In watching the rhythmic of the breathing one can notice that the pause between respirations is prolonged. This may give the lungs a better chance to retract. But nevertheless there is a high position of the diaphragm and a displacement of the apex up, this probably is not caused by changes in the abdomen but by changes in the retraction within the thorax.

High position of the diaphragm due to lack of muscle tone. Strong people always show a stronger muscle tone as others. It is interesting to state that the side of the diaphragm where an inflammation of the lungs has been which is perfectly healed up the tone is much less than on the side that has not been affected. The highest degree of lack of tone is shown in cases of paralysis of the diaphragm.

LOW POSITION OF THE DIAPHRAGM

The arching up of the diaphragm depends upon the retraction force of the lungs and the negative pressure between the pleura and the diaphragm. If the lungs lose their elasticity or an obstacle will prevent their collapse or when the negative pressure in the pleural cavity is absent or when fluid is pushing down the diaphragm it may be placed lower than normally.

The diaphragm is all the time in an inspiratory position as far as the convex parts of the diaphragm are concerned and the widening of the phrenico costal angles. This position causes an increased amount of work to the respiratory muscles. The active contraction of the diaphragm to the horizontal position is hindered by the organs in the abdomen. The diaphragm thus has to use much more force without getting a very favorable result. One has to consider the fact that the mediastinum is no obstacle. BOHR says that in the low position of the diaphragm the vital capacity is increased, the complemental air, which in forced inspiration can be taken in after the ordinary inspiration is much smaller if compared with the vital capacity of the lungs.

As a rule the low position of the diaphragm is connected with a decrease in the respiratory motions. This is especially well noticed in the phrenico costal sinuses.

The low position of the diaphragm is usually connected with dyspnoea. The feeling of lack of air will stimulate the center of respiration, and the forced contraction of all the respiratory muscles takes place. Since the retraction of the lungs is limited they cannot handle the increase in air, the residual air is increased causing a constant distension of the lungs. The diaphragm and the other respiratory muscles still attempt to contract. The action of the diaphragm may become paradox because the horizontal portion of it may try to pull the insertion points toward the center, thus causing a narrowing of the lower part of the thorax.

In chronic low positions of the diaphragm the thorax is wind widened and a flattening of the muscle produced with a larger space between the insertions of the muscle fibers. But even in moderate low positions of the diaphragm the lower part of the thorax may be pulled together.

Physiologically the diaphragm may be lowered after hard work. BOHR showed that the vital capacity of the lungs becomes less while the residual air is increased. Only gradually the residual air becomes normal in its amount. Increase in the residual air with the same vital capacity means an increase in the capacity of the thorax.

The volumen pulmonum auctum is noticed most frequently in emphysema of the lungs. This disease is always accompanied by a low position of the diaphragm. Similar conditions are present in cases of asthma. WINTRICH and BAMBERGER thought that the asthma was started by a tonic contraction of the diaphragm, so that the distension of the lung was only secondarily to the low position of the diaphragm. But is has been shown that even during the attack there are motions of the diaphragm, so that the theory of a tonic spasm does not prove to be true. TROUSSEAU, BIERMAR and others now believe that asthma is due to a spasm of the bronchioles, which may be artificially produced by stimulating the vagus. The X-ray picture reveals the following facts: After the beginning of the subjective symptoms the diaphragm will contract slowly and less powerful in expiration.

After 50-100 respiratory cycles one will find that the diaphragm does not reach its normal height in expiration. The costo-phrenic sinuses are widened and the diaphragm lowered in the center. The inspiratory motion of the diaphragm becomes less and may at the height of the attack disappear. If the attack subsides by itself or if adrenalin has been given, which will almost immediately stop the attack, the subjective symptoms and the secretion of mucous will stop, after a while the motions of the diaphragm will begin again and within a few hours reach their normal degree.

In almost any condition with subjective or real dyspnoea a paralysis of the lungs may be produced due to inspiratory over-ventilation as the expiratory forces will soon be at the limit of their power. It has been shown by means of the spirometer that even in normal cases the respiratory volume will not return to its normal amount after a few deep inspirations have been taken, but that it requires a certain length of time until the volume returns to its normal condition.

HOFBAUER thinks that the logical therapy in distension of the lungs should consist in a prolongation of the expiration. The patient should at first expire naturally and then at the end of normal expiration use his accessory muscles to prolong the process. At the same time there should be some pressure applied to the abdomen to push the diaphragm up and thus to facilitate the new inspiration. HOFBAUER has made an apparatus along this line of treatment. He opposes the followers of the physical method that recommend a compression of the thorax in expiration. This is harmful as it may produce a further descent of the diaphragm. As well as the ventilation of the lungs is unfavorably influenced by the low position of the diaphragm the circulation of the abdominal vessels also shows the evidence of impaired circulation. In distension of the lungs one often notices an enlargement of the liver this may be due to the decreased action of the diaphragm to compress the liver at regular intervals and to force the blood out of it. Often people with a slight insufficiency in the heart action will start to breathe rapidly on account of a slight dyspnoea, not having any signs of obstructed circulation then. The rapid breathing will cause a distension of the lungs, the diaphragm is pushed down and on account of its diminished motion and poor circulation in the portal system the heart is not receiving sufficient nutrition. Regulation of the respirations would be very valuable in the beginning of this condition.

Pneumothorax on one side may give rise to a low position of the diaphragm on one side. The negative pressure in the thoracic walls will pull the lungs as much as possible towards them and to push other organs in this cavity toward the center. One also has to consider the adhesion force exerted upon the two layers of the pleura by the interpleural capillary moist layers. (TENDELOO) If air gets in between the two pleural layers and if this air communicates with the outside atmosphere the pressure within these layers ceases. The lungs are no longer pulled out and on account of their own elasticity they pull together leaving a wide room between the lungs, diaphragm and the thoracic wall. The diaphragm is not pulled up on account of its tone. If the negative pressure is absent the diaphragm will contract on account of its muscle tone and thus produce the low position.

SCHREIBER and WEISKER have found that the pressure in the stomach is positive while the patient is in the lying down position. While standing up it will be negative. The abdominal pressure is the cause of this change and its action can be shown in examining a patient with an open pneumothorax in the lying down and standing position. In the horizontal position the diaphragm is arching up while in the standing up position it becomes entirely flat. In closed pneumothorax with an increased pressure in the thoracic cavity the diaphragm is apt to be curved down. The motions of the diaphragm in these cases are apt to be paradox. JAMIN considers them to be due to passive motions of the ribs and the sternum.

Pleuritis: In accumulations of fluid in the thoracic cavity the diaphragm may assume a low position, so much so that it might be palpated in the abdominal cavity. With the X-ray it is hard to find the border of the liver and that of the fluid, the position of the diaphragm ~~on that~~ here is not easily seen. The position of the lower border of the liver will enable one to judge the position of the diaphragm on that side. Exudates on the left side are easier recognized, especially when the stomach is dilated with air. One can tell the presence of adhesions if the distension of the stomach does not cause the fluid to change its position. Small amounts of exudates are better determined by X-ray than by percussion. To distinguish a subphrenic abscess from exudates in the pleura the X-ray pictures are especially valuable. In the beginning of the pleurisy the diaphragm may be higher placed than normally and rather immobile. This may be due to reflex. In pneumonia of the lower lobes of the lungs the diaphragm is usually affected.

The motility of the diaphragm in common hydrothorax whether uni- or bilateral is still more complicated as this condition usually goes hand in hand with hydrops ascites and with disturbances of circulation.

Low position due to increased tonus of the muscle of the diaphragm. Very little is known about this condition. There was a young girl that suffered from tonic spasms of the diaphragm. These occurred every 3-4 weeks, in the meantime a marked low position of the diaphragm was observed.

All processes causing a widening of the lower part of the thorax will cause a low position of the diaphragm.

Low position of the diaphragm in decreased abdominal pressure as in enteroptosis, thorax pyriformis and so on. The motion of the diaphragm will also produce a motion of the viscera. One can say that all organs of the abdomen and thorax are pushed up and down between the muscles of respiration. One force is represented in the diaphragm the other one in the wall of the abdomen with its muscles.

ARTHUR KEITH attempted to explain the importance of the diaphragm in the right manner: It is true that the diaphragm separates the thoracic from the abdominal cavity but its presence does not make the action of the abdominal muscles unnecessary. The diaphragm even is an addition to the respiratory muscles and its evolution causes an increased activity of the abdominal muscles.

In most persons the organs are in the same position at the end of life as in the beginning, in some cases the inspiratory muscles may come out ahead and disturb the normal balance of the respiration causing a displacement downwards of the organs of the thorax and especially of the abdomen. This condition is called enteroptosis.

There are marked changes in the position and motility of the diaphragm as well as of the abdominal musculature. If the abdomen does not produce enough counterpressure in inspiration on account of lax muscular walls the diaphragm and the entire viscera has a tendency to assume a lower position. The diaphragm has the tendency to pull its insertion points toward the center and thus to cause a flattening of the thorax antero-posteriorly. In enteroptosis the position of the ribs is peculiar.

The musculature of the diaphragm is divided into a spinal and costal part. The function of the spinal portion always remains the same and is not affected by the position or action of the ribs. It always will pull the central tendon down and with it the viscera in connection with it. The activity of the costal part of the diaphragm depends very much opon the position of the ribs. In the new born baby where the ribs form an angle of 25-35 degrees according to KEITH the fibers of the muscle run almostparallel with the ribs. The sternal fibers have a tendency to pull the organs that are placed in the concavity of the diaphragm toward the anterior abdominal wall. A more oblique position of the ribs will cause an entirely mechanism of action. The costal fibers then will work with the spinal ones and pull the organs down. In the pathogenesis of enteroptosis it is important to realize that the ribs take a very oblique course downward from the spine. (MATHES)

These individuals usually have a very small degree of lumbar lordosis and tilting of the pelvis. This causes a further relaxation of the abdominal muscles as the distance between their insertion points is decreased.

All these conditions will cause the typical position of the patients affected with enteroptosis. The thorax is pear shaped: thorax pyriformis. We know that normally the ribs take a position down gradually. We must ask here for the cause of this position at an early period of time. Besides the lack of tone in the abdominal musculature one should also consider the type of breathing. If the force opposing the action of the diaphragm is missing the insertion points of the diaphragm can be pulled more toward the center thus rendering the lower part of the thorax smaller, and causing a more oblique position of the ribs. The more oblique position of the ribs will give all the muscle fibers of the diaphragm a good chance to act and to pull the viscera down. The change in the location of the organs will also alter the shape of the diaphragm. Taking a picture from it transversely one can diagnose the presence of the nephreptosis by the shape of the diaphragm. In normal diaphragms the transverse view would reveal a sichel shaped muscle, its highest point being at the sternum going to the lumbar vertebrae in an "S" shaped manner. In cases of nephroptosis this "S" shaped curve is straight toward the posterior part.

According to my opinion it is the shape of the diaphragm that causes the nephrotosis. The kidneys have no support except the intra-abdominal pressure and a few bands of connective tissue. If the diaphragm becomes flat due to the position of the ribs or other conditions there it is apt to press the kidneys down and loosen them on inspiration. Besides that the widening of the costophrenic angle is apt to push the kidneys a little down.

In enteroptosis the abdominal muscles and the diaphragm have a paradox motion on forced inspiration.

The upper part of the thorax becomes wide on inspiration the lower part remains narrow. A diaphragm that is not active can be pulled up by the stronger respiratory muscles.

In the true and pure kinds of enteroptosis the conditions for the diaphragm can be much improved by suitable abdominal binders, in some other forms however this will not reveal any good results.

Connected with the low position of the diaphragm is the "Tropfenherz" and the Oliver-Cardarelli symptom, which is also found in enteroptosis. The heart hanging on the great vessels of the thorax looses its ground when the diaphragm descends. The apex beat is displaced forward and to the median line. This atypical position of the heart probably has also an unfavorable influence upon the function of it. During eachcontraction the heart has to pull itself up, this is connected with a systolic pulling down of the trachea and is manifested by a slight motion down of the pharynx. (Oliver-Cardarelli symptom) This symptom which was noticed first by WENCHEBACH is found frequently in the more mild cases only on inspiration, even when the diaphragm stops moving. This condition may also be found in a very long and narrow thorax, when the heart looses the support of the diaphragm. The inspiratory swelling of the cervical veines is another symptom of enteroptosis as WENCHEBACH noticed. While the heart looses the support of the diaphragm it hangs only on the big cervical vessels, on account of the traction resulting from it the circulation is hindered. A curvature of the cervical vertebrae is a common sympton and was observed by WILLIAM. The entire mediastinum hangs in low position of the diaphragm on the rest of the branchial clefts and the 7 vertebrae.

SPECIAL PATHOLOGY OF THE DIAPHRAGM.

Congenital defects of the diaphragm.

The musculo-tendinous part only or with it the serous coat covering the diaphragm may be affected. They vary greatly in size and form but regularly give rise to a displacement of the intestines. Since such a condition in one or the other form means a hernia of the diaphragm, we shall consider this separately.

Excess formations of the diaphragm: these malformations do not occur very often, except the possible double formations in twins. The excess formations of the diaphragm in a single normal person can consist in the Musculodiaphragmatico-retromediastinalis, which was described by EPPINGER. This muscle was frequently found in primary defects of the auricular ventricular septum of the heart and on that account connected with the pathogenesis of the condition. This muscle has its origin from the part of the diaphragm surround the oesophageal foramen at the place of insertion of the ligamentum pulmonum sinistrium. Between the two layers of the ligamentum pulmonum it goes to the external surface of the left side of the pericardium up to the hilus of the lungs, corssing subpleurally the pulmonary vein, running then behind the pulmonary artery to be inserted in the retromediastinum near the bifurcation of the trachea with a tendon. The importance of this muscle as persistent rest from the transverse masse with an addition of muscular tissue was worked out by Eppinger.

PROGNOSIS AND THERAPY IN DIAPHRAGMATIC HERNIAE.

The prognosis depends upon the form, size and localization of the hernia as well as upon a traumatic or non-traumatic cause of hernia. Typical hernia produced by intestines pushing thru the physiological openings of the diaphragm have a relative favorable prognosis. Especially the sternal hernia has never caused death. More dangerous is the hernia paraoesophaga as single parts of the gastric wall may become incarcerated. If this condition is complete and lasts for a long time gangrene of the stomach may be the result of the pressure produced. If this kind of a hernia is present in a child with symptoms of oesophogeal obstruction the prognosis is usually bad. It is difficult to give a definite prognosis as there are many cases like that which will run a symptomless course and that never were discovered until at the post mortem examination. Other cases of the same anatomical condition however will early give rise to grave symptoms. One of the surgeons considers it to be a good plan to mark the abdomen of the patient that has a diaphragmatic hernia so that in cases of an incarceration the physician will know what to do. I like to mention that situs inversus has often been diagnosed in infants while later on one observed that it was a diaphragmatic hernia (LIOBET). One can say that as a rule people with a congenital diaphragmatic defect do not become very old.

The prognosis in traumatic hernia depends upon the cause and the involvment of other organs. Injuries of the lung are of relative less severity than of other organs. Severe hemorrhages of the torn diaphragm do not take place as the intestines will form a regular tampoon.

There are cases of severe injuries to the diaphragm that healed completely, but yet one should take every injury to the diaphragm as a serious condition, as one may expect the occurrence of an infection, severe hemorrhages or an incarcerated hernia. Even if the wound in the diaphragm heals the scar may not be strong enough to prevent the intestines from pushing thru. Of the three cases that I have seen one died from sepsis after an operation on the colon, another one died from carcinoma of the lung and the third one from a gastric carcinoma.

If surgical interference is indicated the diaphragm may be approached thru the thorax as it is more difficult to do so in opening the abdomen. But in opening up the abdomen injuries to the stomach will be noticed, while in approaching the diaphragm from above such an injury is apt to be overlooked.

In many cases the wound in the diaphragm was closed thru an incision in the thorax afterwards the abdomen was opened and the viscera examined. (RIEGER, NEUGEBAUER.) The pneumothorax produced is not dangerous as it will heal soon. Death in injuries to the diaphragm occurs mostly on account of injuries to the stomach or intestines.

In cases of incarceration the diaphragm should be approached from the thorax, while in chronic cases a laparotomy may be indicated.

The therapy of the intern consists in chronic forms in prophylaxis. The patient is to be told about the danger of an incarceration and too much food or fluids are to be avoided. Vomiting should never be attempted, constipation is to be carefully treated.

HYPERTROPHY AND ATROPHY OF THE DIAPHRAGM.

Hypertrophy and atrophy may affect the entire or only parts of the diaphragm. Only very marked abnormal changes are to be considered as the thickness of the diaphragm varies greatly in different individuals. A true muscular hypertrophy is observed after temporary or permanent increase in the function of the diaphragm. Since the diaphragm is mostly activated during inspiration we can expect a hypertrophy of the diaphragm in diseases of the respiratory system, especially where inspiration is increased. The same is the case where expiration is hindered in some way, because the diaphragm there is in a constant position of inspiration of a greater or lesser degree. In chronic emphysema a hypertrophy of the diaphragm is very common, unless there are adhesions preventing the motions of the diaphragm. A very pronounced local hypertrophy is noticed at times in cases of loose adhesions with the base of the lun , this shows that the diaphragm attempted to loosen the adhesions. A very rare form of local hypertrophy is found in thickenings of single muscle bundles, which fit exactly in the respiration grouves on the sides of the liver.

Atrophy of the diaphragm is shown by abnormal thinness of the muscle tissue which is partly replaced by connective tissue and at times filled with fat. This may be produced by an excessive pushing up of the diaphragm in cases of ascites, tuberculous serous peritonitis, diffuse carcinoma of the peritoneum with transudate, abnormal large liver. In cases where the diaphragm is pushed down suddenly and lastingly we notice the same condition. There is always a lack of blood supply noticed in the diaphragm in cases of atrophy. In examining the diaphragm microscopically in cases of atrophy one will find that the parts that have been stretched most will reveal torn muscle fibers, which are glued together by a hyaline substance. Atrophy occurs frequently in cases of marasmus or with senile emphysema, it is found in cases of paralysis of the diaphragm and in chronic conditions of inactivity.

DISTURBANCES OF CIRCULATION OF THE DIAPHRAGM.

The diffuse phlebectasis is especially interesting, it is found in cases where the outflow of venous blood from the upper or lower half of the body is disturbed. This may occur in obstructions of the inferior vena cava between the termination of the renal vein and the right auricle, or after obstructions of the portal system. In both cases the diaphragmatic veins take part in the colateral circulation, they are in connection with the intercostal and mamary veins, which send the blood to the azygos and hemiazygos veins from the lower part of the body into the upper vena cava.

In an obstruction of the superior vena cava the colateral circulation is established by the intercostal, mamary inferior epigastric and the azygos veines emptying into the inferior vena cava. The collateral circulation is less perfect when the superior vena cava is obstructed at the termination of the azygos vein, but the diaphragmatic veins are in these cases the most active. This collateral circulation may cause varicose conditions of the veines, which are apt to burst.

The arteries of the diaphragm may be in a similar condition. If the aorta is obliberated near the isthmus an arterial collateral circulation is established. People with this kind of collateral circulations may reach a high age, without suffering from a marked distress. In rare cases a diaphragmatic aneurysm is formed of one of the superficial branches of the diaphragmatic artery, which may break, causing death.

Hemorrhages of the diaphragm may take place within the musculature or beneath the serous coat. They occur in general diseases like infections, intoxications, very often in eclampsia and phosphorous poisoning. During the convulsions caused by these diseases the diaphragm seems to be stretched more than any other organ or tissue. In leukemia and scorbut the hemorrhages may be much greater, they are mostly intramuscular, often destroying the muscle tissue. We can draw the conclusion that even severe hemorrhages may produce no symptoms.

There is not much known about oedematous conditions of the diaphragm. In cases of diphtheria with paralysis of the diaphragm there was found a swelling of the musculature. It is not probable that the toxic oedema and the post-diphtheritic paralysis of the diaphragm are connected. Oedema due to obstructions or nephritis will affect only the subserous connective tissue.

THE INFLAMMATORY DISEASES OF THE DIAPHRAGM.

A primary inflammation of the diaphragm is denied by most authors except in cases of trauma. A local or general inflammation of the pleura will at times affect the diaphragm, but the symptoms are not observed as those of the pleurisy are apt to make them obscure. In cases of pleuritis with a large amount of exudate the action of the diaphragm is affected, this is early shown by the absence of the LITTEN phenomena. If the exudate continues to accumulate the respiratory motions of the diaphragm are partially or completely inhibited. Similar conditions take place in acute inflammations of the pericardium, after a large amount of exudate has been allowed to accumulate. The part of the diaphragm upon which the pericardium rests is pushed down which can be shown by the X-ray picture. In chronic inflammations of the pleura or pericardium with excessive accumulation of fluid there are two conditions that may be present: the formation of adhesions or thickenings of the pleura or pericardium with fluid in the cavities. The serous surfaces of the diaphragm are usually affected at the same time. Inflammations within the thorax cause a displacement upward of the diaphragm more so than in cases of exudates in the peritoneal cavity but in the last mentioned cases the motion of the diaphragm is more affected.

PLEURITIS DIAPHRAGMATICA

This form of pleuritis affecting the diaphragmatic pleura mostly will vary in its symptoms from other forms of pleuritis. The symptoms like pain and disturbances of respiration are thought to be due to affections of the diaphragm. In some cases the diaphragm was affected but yet these symptoms were missing. The diaphragmatic pleuritis may develop primarily or secondarily in cases of infections or f inflammations of the neighboring organs. This affection may be unilateral or bilateral. The diagnosis is based upon clinical appearances like fever, pain at the region of the diaphragm, which do not seem to depend upon the motions of the diaphragm that occur voluntarily or unvoluntarily. The pain is often localized in the region of the hypochondrium, in the flanks and the lower parts of the dorsal thorax. They are very acute and may radiate toward the shoulder, they may be continuous and unbearable in abdominal respirations or during swallowing, where the diaphragm really is not moved very much. The pains are most intense on coughing, vomitting or in gastric eructations. Pressure upon the abdomen towards the diaphragm will start the most intense pain. Pressure points are often found. The following points are as a rule the most painful: The point between the two tendons of the sterno-cleido-mastoid where the phrenic nerve runs over the scale-costal spaces. 3. The diaphragmatic bouton which is found where an imaginary line from the outer margin of the sternum and one from the imaginary prolongation of the tenth rib will meet.

4. Insertions of the diaphragm on the margin of the thorax. 5. Point near the plexus cervicalis and the spinous processes of the cervical vertebrae. These points may remain sensitive to pressure even after the original pleuritis has healed. Abdominal breathing in these cases is extremely painful and is changed to costal breathing. The hypochondrium and the ribs of the affected side do not move unless the patient is coughing or talking. On account of the pure costal breathing the respiration is hastened, the voice is low, the patient avoiding to speak as much as possible. The upright position of the body is preferred and every motion of the thorax attempted to be avoided. If no complications are present the cough is dry and painful, if there is any secretion, the patient tries to avoid expectoration. Dyspnoea and orthopnoea with a rapid pulse occur even if the patient has no fever. Singultus is present at times and is very annoying. With the inactivity of the diaphragm there is usually a tympany of the upper abdomen. Icterus is present at times if the inflammation is on the right side one may think that the jaundice is due to insufficient massage of the liver by the diaphragm. The temperature varies greatly, rigor or delirium may be present. These septic symptoms with this condition make the prognosis much more unfavorable.

Objective symptoms may be absent. Large amounts of exudates may cause a displacements of the organs. In cases where percussion gives an almost negative result there may be a slight disturbance of the pectoral premitus and a high position of the diaphragm. In auscultation breathing sounds are feeble. At times crepitus may be heard. Most of these symptoms and the lack of respiratory motion are in the first place due to the inactivity of the diaphragm.

A new phenomena was described by R. SCHMIDT which is characteristic of pleuritis diaphragmatica. This is the so called respiratory abdominal wall reflex, it is a momentary contraction of the upper part of the rectus abdominis when inspiration is attempted. In abdominal as well as in costal breathing this reflex contraction is found. This is more marked in the rectus abdominalis of the affected side. This may disappear if the patient is obliged to use the diseased side in breathing, but will reappear upon pressure upon the painful intercostal spaces.

The X-rays have not been of much value as far as we observed.

Pathogensis: Only the accumulation of serum or pus in the region of the diaphragm will not cause all these symptoms, if that was the case the diaphragmatic pain would occur in all cases of pleuritis. Considering this fact the cause for the symptoms were considered to be in the phrenic nerve itself. DE MUSSY and his friends emphasize the pressure pain along the course of the nerve. ZIEMSSEN does not believe that the phrenic nerve has any sensory fibers, but after anatomicalas well as experimental examinations we drew the conclusion that such really is true. Changes in the nerve in these cases have not as yet been found, this however is not of much importance as the methods for demonstrating changes in the nerve fibers of dead bodies are as yet very imperfect. Besides an increased irritability of a nerve does not necessarily produce anatomical changes. (NOTHNAGEL) Even the clinical course of the disease does not indicate a change in the nerve as paralysize hardly ever occurs, which however would be the end result of neuritis.

Differential diagnosis:

Muscular rheumatism: The sensitive points along the course of the nerve will be sufficient to make the diagnosis, but at times this symptom is not present. Pleuritis diaphragmatice will then easily be confused with rheumatism or neuralgia, if no fever is present. Pericarditis with pain in the scrobiculum cordis and near the origins of the diaphragm can be distinguished by its other characteristic signs. Localized peritonitis in that region is very rare but may present similar symptoms. One will have to watch for general signs of peritonitis and examine the retroperitoneal organs near there.

Prognosis depends upon the primary cause. If there are symptoms of irritation of the phrenic nerve and diaphragm without a general exudative pleuritis the prognosis is the same as in primary cases. These conditions however may become harmful in causing a compression and atelectasis of the lung on account of the immobility of the diaphragm. If the circulation has been poor in the first places this condition will increase the symptoms.

As far as therapy is concerned similar conditions as in prognosis have to be considered. If it is a septic condition this will have to be treated first and a thorough examination for pus-pockets is to be made. An exploratory puncture is not always of much value but should be done in all cases. If no symptoms of pus formation are present the treatment is symptomatic. In severe cases opiated may have to be given, in milder cases mustard plaster, leeches (natural and artificial) cold packs and codein may be used.

SUBPHRENIC ABSCESS.

Every accumulation of pus near the ventral surface of the diaphragm is called a subphrenic abscess. This kind of an abscess does not occur primarily, it is usually secondarily to an infection or more frequently due to a perforation of one of the abdominal organs and connected with the external world. Infections usually start in the abdominal cavity, rarely in the thorax.

Anatomy: the liver is fixed to the diaphragm by the falciform ligament, which thus forms two divisions of the surface. These parts areagain divided into an anterior and posterior part by the coronary ligament. Besides that there are two extraperitoneal spaces one on the right and one on the left side, where pus may accumulate.

The right anterior intraperitoneal space has the following extensions: Up to the diaphragm, back to the right coronary ligament, mesially to the falciform ligament, lateral to the thoracic wall. It opens into the general peritoneal cavity anterior, posterior and laterally. Infections from below or anteriorly are not very easily closed in by adhesions and may reach to the colon.

The right posterior intraperitoneal subphrenic abscess. The largest part of this space is subhepatic. When filled with pus it forms a pyramidal shaped place. The base of this pyramid is formed by the lateral wall of the abdomen near the last rib. The point often reaches around to the vertebrae. Anteriorly the margin of the liver is the limit, posteriorly are the kidneys and the diaphragm. Pus cannot go thru above on account of the coronary ligament, and not below on account of the fixation between liver and wall of the stomach or colon. Pus from here may go thru the foramen of Winslowi.

The left intraperitoneal anterior subphrenic abscess is limited above by the diaphragm to the coronary ligament, mesially to the falciform ligament, to the left by the thoracic wall and the spleen, inferiorly by the liver. Anteriorly and below this space communicates with the abdominal cavity.

The left posterior intraperitoneal subphrenic abscess is placed laterally to the spleen to the coronary ligament. Above, the diaphragm is the limit. Between the surface of the spigelian lobe and the rising crus sinistrium of the diaphragm a pocket leads up to the central tendon. The posterior wall of the abscess is formed by the pancreas, the left kidney and suprarenal gland. Inferiorly the abscess may extend to the transverse colon. Thru the foramen of Winlow pus may go to the right side, this however is usually prevented by early formed adhesions.

The right extraperitoneal subphrenic space is placed between the liver and the diaphragm along the falciform and coronary ligament. Adhesions form between the peritoneum and the diaphragm, pus may spread along the ligaments over to the anterior part of the abdomen. Posteriorly it may spread to the retroperitoneal tissues.

The left extraperitoneal subphrenic abscess has a tendency to spread downwards.

NERVOUS AFFECTIONS OF THE DIAPHRAGM.

An organ that is supplied with motor and sensory nerves may be expected to have five kinds of nervous disturbances: Paralysis, irritation, anesthesia, hyperaesthesia and spasm. In the diaphragm only paralysis and spasms have so far been observed. We know from the anatomical standpoint that the diaphragm has a sensory nerve supply but the physiology of these nerves has not been worked out. Some authors suppose to have observed symptoms of irritation of the diaphragm.

PARALYSIS OF THE DIAPHRAGM

The only motor nerve to the diaphragm is the phrenic nerve. One has to distinguish paralysis due to central and peripheral verves lesions. The phrenic nerve comes from the fourth cervical nerves usually receiving fibers from the third and fifth pair of cervical nerves. On the way to the diaphragm they unite with some fiber of the brachial plexus from there they take a more isolated course. The phrenic nerve on each side arches over the anterior surface of the scalenus anticus and in front of the subclavian artery, goes behind the innominate vein thru the upper part or inlet of the thorax runs over the anterior part of the apex of the lungs or rather the pleura taking then a more inward course toward the hilus of the lungs. One the left side it is placed more ventrally than on the right side. Finally between the pericardium and mediastinum it goes down and back to the convex part of the diaphragm to break up into several branches there. The right nerve is near the inferior vena cava, the left one near the apex of the heart.

Occurrence and etiology.

Paralysis of the diaphragm due to an injury to the motor center in the cervical swellings is not so very rare. It is found relative frequently in anterior poliomyelitis. In general paralysis as well as in anterior poliomyelitis death may occur due to bilateral involvement of the phrenic nerve. It is known that in anterior poliomyelitis even a paralysis of the diaphragm can be cured.

Swelling, tubercles, syphilomata lepra-nodes, abscesses of the vervical portion of the vertebrae, fractures and dislocations of the vertebrae and affections of the spinal column in that region may be the cause. The anterior horns of the spinal cord may be injured by hemorrhages or trauma and may give rise to paralysis of the diaphragm. In cases of trauma to the plexus in the Duchenne-Erb's paralysis their is an involvement of the diaphragm.

Within the thorax the nerve may be injured by tumors of the mediastinum and aneurysms. It is surprising that in tuberculosis where the thoracic lymph glands are so much affected an on healing leave scars that will contract and pull on surrounding tissues the phrenic nerve is so seldom affected. Quite often paralysis of the diaphragm follows a neuritis of the phrenic nerve. During or after infectious diseases especially diphtheria a neuritis of the phrenic nerve may be the result. In acute as well as chronic cases of poisoning the diaphragm may become paralyzed. In this place must be mentioned the polyneuritis in alcoholism with neuritis of the phrenic nerve. DUCHENNE states that paralysis of the phrenic occurs in lead poisoning. The same is said about arsenic, opium and oxide of carbon.

In these cases it is hard to tell whether the poisonous action started in the brain, cord or in the peripheral nerves. In central paralysis one should distinguish between respiratory paralysis and local paralysis of the phrenic. EULENBURG claims that a rheumatoid paralysis of the diaphragm due to catching cold can occur. Many are in favour of considering a relationship between articular rheumatism in its etiology and polyneuritis. The improvement after a treatment with salicylates seems to prove the relationship of these conditions.

Acute and chronic inflammations of the diaphragm itself may cause a paralysis. In tabes, syringomyelia and progressive muscular atrophy the diaphragm may also be affected. We also have to mention the eventration of the diaphragm from the anatomical and clinical standpoint, this condition belongs to the paralysis of the diaphragm. The phrenic nerve as a rule is found to be intact. In hysteria also a paralysis of the diaphragm may occur. These cases should be examined by the X-ray as well as those of hemiplegia and acquired porencephaly in young persons.

Symptomatology:

The affected side of the diaphragm does not descend on inspiration, but is passively pulled up into the thorax. Thru this atypical condition the intestines are displaced, disturbances of circulation and ventilation of the lungs are observed. On inspiration one can see that the upper part of the abdomen sinks in on account of the failing contraction of the diaphragm and the normal activity of the abdominal muscles. The upper part of the thorax on that side however will expand very much.

The sinking in of the abdominal wall is due to the upward displacement of the diaphragm and the separation of the ribs, producing more space for the abdominal organs. These symptoms are not easily noticed when the patient is used to costal breathing. On pressure at the region of the diaphragm the abdomen will protrude. If one side of the diaphragm is paralyzed the protrusion will not be symmetrical. Dyspnoea is common in these cases and the thoracic respiratory muscles are used more strongly. During sleep where the costal breathing is prevalent these symptoms are not noticable. On exertion these symptoms are very much exaggerated. Complications like pulmonary or cardiac diseases are very dangerous where one side of the diaphragm is paralyzed. The danger does not lie in the interference with breathing but in the impossibility to get rid of the expectoration on the affected side of the diaphragm. Usually the breathing in paralysis of the diaphragm is more rapid, the speech is hesitating and the voice low and often interrupted. These symptoms are so much more noticeable in bilateral lesions. It seems surprising that a bilateral paralysis is not fatal, but one can presume that with the paralysis the muscle tone not necessarily has to be lost. If the paralysis lasts for a long time the diaphragm becomes lax and is pulled up into the thorax.

Increased pressure in the abdomen as in coughing, sneezing and defecation may cause dyspnoea because the intestines are pushed up against the diaphragm, this being paralyzed is not able to resist and is pushed still more upward. The absence of Litten's phenomena or even a moving up of the shadow is a common symptom.

Physical examination: By means of percussion the lower limit of the lungs is displaced up. In quiet respiration the margin of the lungs does not change, but in forced respiration the motion of the lungs is paradox. The lower margin of the lung of the affected side is at a lower level when the patient isstanding up, it is higher up anteriorly and lower in the back when the patient is in the horizontal position. At times the entire lung is somewhat dull to percussion. Pressure upon the abdomen will displace the lung about one intercostal space higher up. On palpation the abdominal wall on the affected side is much more lax than on the other side.

Diagnosis: The symptoms previously mentioned and the etiological factors are to be considered in distinguishing this affection from others. Typical unilateral lesions are easily diagnosed by the X-ray. The atypical condition of the abdomen during respiration the paradox percussion notes the Litten phenomena and the subjective symptoms like dyspnoea, low voice fealing of choking are noticed. If these symptoms are well pronounced there is no trouble in making the diagnosis. History of an injury may be of great use to make the diagnosis. One of my teachers used to say: If anybody ever saw a paralysis of the diaphragm he will soon find another one. Some authors claim that the pain on pressure upon the outer margin of the scalenus anticus is a sign of a diseased condition of the phrenic. This probably is true only in cases where the paralysis developed from a neuritis. An electrical test of the phrenic nerve is of great value. It is a very difficult to judge the paralysis of the diaphragm in central lesions. These kinds of cases have not been observed since the X-ray is used. WERNICKE claims that costal breathing is due to an insufficiency of the phrenic nerve, but this statement will yet have to be proven by the X-ray method.

Eventration or atrophy of the diaphragm has a certain relation to paralysis of the diaphragm. Probably there is a smg congenital weakness of the diaphragm.

Prognosis: this depends very much upon the etiology. Paralysis due to infections and intoxications have the best prognosis. Lead and alcohol poisoning will often be cured. Paralysis due to dyphtheria is more rarely cured, but at times much improved. The involvment of the phrenic nerve in polyneuritis gives a rather doubtful prognosis as it speaks for the progressive character of the disease. Paralysis of the diaphragm due to tumor depends upon the malignancy, the size of the tumor and the duration of the paralysis. Paralysis due to tearing and stretching of the nerve have a very unfavorable diagnosis. I believe that in some cases the anterior part of the diaphragm is supplied by the intercostal nerve as a motor nerve. This was shown by SCHRODER and GREEN where the phrenic nerve during an operation was cut but yet the diaphragm was moving. When the diaphragm is paralyzed diseases of the respiratory system are very dangerous to life. Diseases of the respiratory tract may cause paralysis of the diaphragm, with a degeneration of the muscle and of the nerve. This condition of the diaphragm will prevent expectoration. The most favorable prognosis is in cases of paralysis due to hysteria. A rapid cure in those affections would make one always suspicious of hysteria. The rheumatoid form of paralysis also has a good prognosis. Bilateral paralysis will destroy life either on account of the lesion or complications arising from it after some time.

Therapy: In some cases the treatment is surgical as in removal of tumors, correcting displacements or the removal of fractured bone. But these operations are not without risk just because the diaphragm is paralyzed. In paralysis due to diseases of the center of the phrenic nerve xx as in tabes, progressive paralysis, poliomyelitis one cannot do very much. Treatment with foradic current may be attempted. Foradic current is the best means to improve a beginning paralysis. In the neuritic form counterirritation and production of blisters are to be recommended. (SUCKLING). In paralysis due to diphtheria injections with strychnia often will reveal good results. Complications in those cases are to be treated first. If there is no degeneration of the phrenic nerve the foradic current should be used. In sudden occurrences of bilateral paralysis as in diphtheria and poliomyelitis one should attempt artificial respiration first., and later on the foradic current. ZIEMSSEN recommends real strong foradic currents. If it is necessary to stimulate the auxillary muscles to forced action one should not use too small an electrode. They areto be applied to the outer margin of the sterno-cleido-mastoid. The unilateral lesions one can find the most favorable point of stimulation on the unaffected side. The head, shoulders and upper arm should be fixed. The duration of the stimulation should amount to 1-2 seconds, and be at the same rate as moderately rapid breathing. Thru pressure upon the abdomen the diaphragm should be pushed up in expiration. Internally are the same medicines used as in other motor paralyses.

THE TONIC SPASM OF THE DIAPHRAGM.

Symptomatology: DUCHENNE (1853) noticed that tonic contractions can be produced by faradic stimulation of the phrenic nerve. He also described the condition of a patient that had taken cold and after intercostal neuralgia had some spasmodic contractions of the diaphragm, which started without any warning and was felt as a colic pain at the region of the diaphragm with the sensation of having the lower part of the thorax pulled together, the abdomen was distended at the same time, especially at itsupper part, the lower thorax then became distended secondarily. The shape of the abdomen remains unchanged even during the forced respiration. The attempt to press together the lower part of the thorax by pressure on the abdominal muscles is not successful but increases the pain. Such a patient can use only the upper thoracic muscles for breathing. Even if the thorax moves freely dyspnoea makes itself evident soon. Respiration becomes rapid and superficial, the patient can not lie down nor sit, he is standing up and tries to fix the upper thorax to make use of the accessory respiratory muscles. Cyanosis soon appears, the voice is low and interrupted. The pain is severe. This condition may become fatal if it lasts too long. The very severe attacks are rare but in the lighter form they are often noticed in nervous persons especially in hysteria.

The objective symptoms consist in low position of the diaphragm, the lungs are placed low and in the lower parts are immobile, the heart is at a lower level and the liver can be palpated below the ribs. This condition may resemble bronchial asthma, but there one will hear the rhonchi and notice the difficult expiration.

In asthma there are some movements of the diaphragm, only during the height of the attack they stop, the pain in asthma is much less the beginning and end does not occur as suddenly. Some authors consider the tonic spasm of the diaphragm the cause of bronchial asthma. But now we concluded that in bronchial asthma the distension of the lungs is primary to the low position of the diaphragm, in tonic spasm of the diaphragm the process is just the reverse. The cases of tonic spasm are very rare and I want to tell about one case that came to my observation: A man of 25 years from a neuropathic family had been treated for headaches since years, suddenly an aphonia developed and disappeared after three days. On account of anamnese he had a temporary paralysis of the right foot. Four weeks before I saw the patient he suddenly developed pain at the region of the heart and dyspnoea. His family talked about his face getting blue, the protrusion of the eyes, the distension of the cervical veines and the intense pain. We could not remain in bed but had to get up. The first attack occurred after the patient had visited the grave of his parents and became excited. After five minutes the symptoms disappeared. These attacks recurred and the patient thought that he could produce one in touching the region of his heart. When I saw him first he was very quiet and told me about his condition. He was a large man of the appearance of Basedow. The pulse and respiration were moderately increased the heart of normal size and function. When he was asked to remove a small piece of leather that he imagined protected him from the attacks and I palpated the apex beat he began to have an attack. At first slight opisthotonus was noticed. The abdomen protruded and became immobile, respiration became rapid. The pulse became slow and small. The respiration was forced but yet cyanosis soon developed, and the patient had to ~~xt~~ sit up. After three minutes a large amount of air was expelled and the attack gradually subsided. At first a few extreme irregular contractions of the rectus abdominis occurred and then the abdominal musculature became active again. When the heart was touched by the hand the diaphragm at once took the position of inspiration until it reached the horizontal position. The heart followed the diaphragm for some distance and became of the shape of the typical Tropfenherz, which was watched by the X-ray. After the attack the diaphragm contracts rapidly for a while and gradually returns to its normal condition. Only after 4-5 minutes the diaphragm returned to its normal position. "The inactivity of the diaphragm decreases the volume of the heart beat."

Differential diagnosis: The diagnosis is easily made if the condition occurs with muscular or articular rheumatism, in tetanus, tetany or hysteria, as these conditions are apt to produce tonic contractions of the muscles. Acute distension of the lungs is hard to be distinguished from tonic contractions of the diaphragm when the attack has not been watched in the beginning. There are cases of increased pulse and distension of the lungs without the typical symptoms of bronchial asthma. Besides that there are cases of acute distension of the lungs with a slow pulse. If the diaphragm moves only moderately so that its motions can be seen only with the X-ray one may confuse such a case with a tonic spasm of the diaphragm. Moderate stenosis of the trachea may also lead to distension of the lungs and apparent immobility of the diaphragm. Spasm of the glottis is not easily confused with this condition.

Therapy: The etiology is to be considered. The symptomatic treatment consists in irritation to the skin, strong smelling salts, attempts of an artificial respiration by rhythmic massage of the abdomen and thorax, morphine for pain and so on. Hysterical conditions require special treatment.

CLONIC SPASM OF THE DIAPHRAGM.

The most common and best known spasm is the clonic spasm of the diaphragm, caused by stimulation to the phrenic nerve. The singultus is one example. This is a short contraction of the diaphragm, a short and sudden inspiration and a protrusion of the abdomen. The sudden low position of the diaphragm causes a suction of inspired air by the stomach accompanied by a choking noise. The person experiences a sensation of a clap which can be felt with the hand. The noise seems to be formed in the cavity of the mouth. The rapid and strong inspiration renders the cavity of the mouth almost free of air, the posterior part of the tongue is pulled back and the space thus rendered empty the air will push in from the nose and mouth. If the air thru the nose has to pass mucous the sound of the noise may become greatly modified. If this condition is not lasting one does not notice any discomforts but if it occurs several times during the day for several minutes, about 50 times per minute these spasms will shake the body and cause a great distress. At times they will recur for months every day. These spasms are not painful unless in combination with sneezing, coughing, vomiting or spasmodic contractions of the arm and leg muscles. Pain then is localized along the insertion points of the diaphragm. The lower cervical vertebrae and the course of the phrenic nerve is sensitive. This is found usually where the spasms are so numerous that they cannot be counted, dyspnoea often occurs in these cases and render the attack very serious. Hiccough is not due only to spasm of the diaphragm but also to an irritation of the inspiratory center. Reflex irritation may be started by different causes. There is hardly any disease of the abdominal organ that was not said to be due to cause hiccough. Especially the digestive and degenerative organs are said to cause this condition when diseased. STRUMPELL mentioned a case of hiccough where the phrenic nerve was in an exudate of tuberculous masses in the mediastino-pericarditis. In two cases where the left subclavian artery came from the the inominate artery hiccough was noticed for years. In diffuse dilatation of the oesophagus the same condition was present. A cervical rib was removed in one case and stopped the hiccough, but this does not prove that the rib has been the cause of that condition as the phrenic nerve was not see at all. Aneurysm of the aorta may cause hiccough.

If one applies to the exposed contracting heart muscle a fresh nerve-muscle preparations (Frog's gastrocnemius) the muscle will contract with each contraction of the heart as long as the nerve touches the heart muscle. The cause of this phenomena is the jumping over of the action current of the heart to that nerve. LANGENDORF thinks it possible that the action current of the heart under suitable pathological conditions may be transmitted to nerves near it. He thinks that these stimulations may be transmitted to the phrenic nerve and cause contractions of the diaphragm. In sewing the nerve to the heart muscle in the living animal this condition can be produced but yet this theory is doubtful when one considers that the contractions of the diaphragm are usually bilateral. One should consider that action currents may come from anywhere, even from the vessels. For the majority of cases the theory of an irritation of the center of the center of the inspiration may be the most correct one. The occurrence of singultus in diseases of the brain and spinal cord may prove that. Cerebral excitements and violent mental stimulation in nervous persons, especially in children and old people may cause hiccough. That the cause is of central origin may be proven by the fact that the unconscious imitation of this process may cause a regular epidemic. In some persons the hiccough is started by pressure upon the epigastrium. Anemia, chlorosis, and cachexia may cause this condition. The singultus of alcoholics is a well known occurrence. In peritonitis it is of frequent occurrence. In peritonitis it is of frequent occurrence. Irritation to the peritoneum where it is reflected over to the diaphragm will cause a spasmodic contraction of the diaphragm. It is possible that the hiccough after a heavy meal or in distension of the abdomen will be caused for the same reason.

Uncomplicated cases of hiccough are not dangerous, they are apt to become so if in connection with other diseases. The attacks of singultus may last for years. The frequency, duration and the number of contractions in a certain time vary greatly. The idiopathic singultus will stop during sleep, which can not be said about the symptomatic hiccough.

Prognosis varies.

Therapy: only if these attacks become too frequent and painful a treatment may be necessary. A pretty sure remedy to combat the singultus is the morphine, but as soon as the action ceases the hiccough will begin again. Opium, codeine, and chloroform inhalations are used with great advantage. Atropin and scopolamin also is of use in some cases. Hippocrates cured the hiccough in causing the patient to sneeze. Foradic irritation to the skin of the abdomen and medicines to produce vomiting are often of great benefit. Galvanisation of the neck sending the current thru the mastoid process is recommended. Introduction of metal probes into the eosophagus, plasters and ointments, leeches, holding and pulling the tongue out of the mouth, sudden shock and things like that may be tried. The authority of the doctor and certain suggestions are very valuable. In this way one can explain why old women and quacks are able to cure the hiccough, while physicians are unable to do so. In nervous people the treatment is more satisfactory. In women one will always think of uterine disturbances as well as menstrual troubles, in men of bladder and affections of the prostate. In anemia and chlorosis the primary cause has to be treated.

There has one case been reported where the clonic contraction of the diaphragm was unilateral and present since infancy.

I now intend to relate about a case that does not often come to one's observation. There was a man, 35 years of age, that was admitted to the hospital on account of an injury to the thorax, probably fracture of the rib. On percussion no fluid could be noticed to be present on the left side of the thorax. He was complaining of pain in the chest although we could not find a definite cause for it. An X-ray picture was taken. On the left side at the region of the pleural sinus a small exudate seemed to be present. Besides that the left side of the diaphragm showed repeatedly small contractions about60-70 per minute, at the same time as the contraction of the heart took place. A probe was introduced into the stomach but no pulse like waves could be obtained from there. The next day more fluid was present, but the same oscillations continued. There was no reason to think of a pyo-pneumo-thorax that might transmit the heart beat to the diaphragm. Not counting the small excursions of the diaphragm it was immobile during breathing. After two weeks I heard that the same picture was present on examination with X-ray. In this case we probably had to deal with a unilateral permanent clonic spasm of the diaphragm, with the transmission of the action current of the heart to the phrenic nerve.

NEURALGIA PHRENICA

VON SIEMSSEN does not believe that the phrenic nerve contains any sensory fibers at all and one has not been able until lately to demonstrate the condition analog to that of the sensory nerves: a neuralgia. FALOT was the first one that studied that disease as "Nevralgie du nerf phrenique." A few years Peter confirmed the results adding a few more characteristics. He came to the conclusion that neuralgia of the phrenic nerve is of common occurrence. The patients usually come to the physician complaining about pain in the cardiac region and shoulder. One finally finds that there are painful points in the lower jaw, the posterior and anterior part of the neck. The following points on pressure were found: The ventral insertions of the diaphragm along the 7-10 rib, farther back at the region of the last rib, along the course of the phrenic nerve, between the two origins of the sterno-cleido-mastoid, lateral to the sternum in the 2 and 3 intercostal spaces. Radiating pains are complained of at the region of the cervical and brachial plexus. The clavicle, inner side of the upper arm, the elbow and the little finger may be painful to touch. There is often a tingling sensation in the arm of the affected side. The spinous processes of the second till fifth cervical vertebrae are tender on pressure. These are the same symptoms described by GUENEAU DE MUSSY in pleuritis diaphragmatica. Patients are apt to press their hands against the base of the thorax to prevent coughing and all forced respirations. PETER mentions the diseases in which the neuralgia of the diaphragm is most common: anemia, chlorosis, cold, hysteria, epilepsy, angina pectoris, cardiac and aortic affections, heart troubles and angina pectoris, Basedow's disease, diseases of the spleen, liver trouble. New authors describing the same condition confirm this statement. Nothing new is known about this condition since the work of PETER.

Clinical experience has proven that there are really pains that coincide with the description of PETER. One can easily find the points painful on pressure. For differential diagnosis it is important to distinguish between idiopathic and symptomatic neuralgia. If the cause is not permanent the affection also will in time disappear. The therapy depends largely upon removal of the cause. In general it should be treated as any other kind of neuralgia. In connection with this one should mention HERZ'S neurosis of the diaphragm with disturbed breathing, cardiac pain, palpitation of the heart. HERZ calls it a spasm of the diaphragm as it usually occurs inferiorly to the mamary gland. The pain is similar to that in lumbago. It has not as yet been decided however whether this Phrenodynic belongs to the neurosis of the diaphragm.

Abstract of Herbal Simples

By

W. T. Fernie M. D.

Acorns.

The early inhabitants of Greece and southern Europe lived in the forest and subsisted on acorns. They are described by classic authors as being very well nourished and were called "balanophagi" or acorn eaters. (Acorns are a highly nourishing food, containing a large amount of starch. They contain a considerable amount of tannic acid which can be removed by soaking in water. The acorn also contains a special sugar known as quercit.)

Almonds.

The Jordan almond is so named because it is a cultivated or garden tree; the word Jordan being a corruption from jardyne.

Apples.

The ancient custom of serving apple sauce with roast pork is doubtless due to the recognition of the corrective value of the apple. (Fruits of all sorts contain bases which tend to neutralize the effect of meats in lessening the normal alkalinity of the body fluids.)

The value of the apple as a laxative is intimated in the distich

"To eat an apple going to bed
Will make the doctor beg his bread."

The pomades of the pharmacy derive their name from the apple, poma.

The pulp of apples was in former times much used in the preparation of ointments to beautify the complexion.

A milk and apple cure was practiced in 1562 by a clergyman by the name of Attwell. His success was so great that great numbers of invalids were attracted to his home in Cornwall.

The core of the apple derives its name from the French word caeur, meaning heart

Apples were introduced into England by the Normans in the thirteenth century.

The word "apple" is said to be derived from two Sanskrit words meaning water and fruit, referring to its juiciness.

The Latin word pomum may easily have been derived from poto, meaning to drink.

Apricots.

Egyptians make a delicious paste by a combination of apricots and almonds.

Asparagus.

Asparagus was known to the Greeks and Romans.

Asparagus is said to have been first used about 200 years B. C. The Roman emperors were very fond of it.

Barley.

The Roman gladiators lived chiefly on barley, on account of which they were known as Hordearii, from the botanical name of barley, which is hordeum.

Barley has been less used for bread than wheat because it sometimes produces purging.

Cabbage.

The cabbage was in great favor among the early Greeks and Romans.

Some of the Latins valued the cabbage so highly that they swore by it just as the Egyptians did by the onion.

Only in comparatively recent times has the cabbage come into general use.

Three hundred years ago a Dutch cabbage was regarded as a valuable present.

"The Scotch make much use of cabbage and kale, one of its derivatives. A dish which is highly prized in Scotland is Scotch brose, which is oatmeal cooked in water in which kale has been boiled.)

Cabbage was a favorite dish of Pompey.

(Sauerkraut renders great service as a source of raw food during the long winters of northern Europe when fresh vegetables naturally become very scarce. It is a highly valuable remedy for scurvy. It is rich in vitamines and vegetable salts.)

Remarks by Prof. Irving Fisher and Prof. F. W. Roman at the Faculty Banquet, Friday evening, March 7, and to the Faculty and students Friday afternoon.

Prof. Fisher: As a teacher or leader one should know something about everything and everything about something. One should never be so thoroughly specialized as to be really ignorant of everything except his one specialty. A college professor who has devoted his whole life to the study of the Latin genitive and dative cases remarked shortly before he died that he felt that he had made a great mistake. He thought he should have concentrated his attention exclusively upon the genitive case instead of dividing it between the genitive and the dative. It is quite possible he was right although in addition to concentrating his attention upon the subject of the genitive case, he should have given enough attention to other subjects to have a good all round equipment of information in addition to his highly specialized knowledge of the Latin language.

Teachers in a college in which health is made a fundamental ideal should be paragons of health. Their example will be followed rather than what they teach. I think this to be highly important. Every teacher in Battle Creek College should exemplify the ideals and aims of the College.

Dr. Roman stated that he felt there was considerable evidence of improvement in the morals of the German universities and gave as an example of the effort that is being made to improve morals in these institutions of learning the fact that when a student matriculties in a German University he is handed a slip on which is an appeal to students to live clean moral lives, to which is appended a statement signed by as many members of the faculty as are willing to do so to the effect that the undersigned live moral lives and have always done so.

In his address to the students and faculty in the afternoon Professor Fisher made the following statement: The establishment of Battle Creek College marks an important milestone in educational progress. President Roosevelt said that our colleges are twenty-five years behind the times. This is especially true in matters pertaining to health. My admiration for this great institution is based upon the fact that it is always years ahead of the times instead of being behind.

v-m 3/11/24

An Address to Guests of the Battle Creek Sanitarium, Sept. 5, 1938

By

Irving Fisher, Professor Emeritus of Economics,

Yale University

Dr. Kelligg has requested me to speak to you, and I always accede to his requests because I owe so much to him and to this institution. I asked him if I should speak on economics, but he thought you would be more interested in health.

Some of you will wonder how an economist can teach how to live, or what he may have learned on that subject, which seems so foreign to his own field. I can answer that in various ways, bridging the gap between economics and hygiene.

Perhaps you will remember that Ralph Waldo Emerson said, "The best wealth is health." While he meant that in a poetic sense, it is true, I believe, in an economic sense.

I might entitle my talk tonight, "The Best Investment in the World." It has been to me the best investment, and I think everyone who has made it properly, however rich he may have become in this world's goods, will concede that investing in one's own health is the best investment.

I was instrumental in establishing the Life Extension Institute in New York City, of which many of you doubtless have heard. So far as I am concerned, the suggestion which led to the establishment of that institution really came from this institution; for I saw the need of such an organization as the Life Extension Institute. It has made now some million medical examinations, and our first customer, the Metopolitan Life Insurance Company, after six years of experience in having their policyholders examined by the Life Extension Institute found that the investment that they had made in the lives of their policyholders by paying the expenses of their examinations had brought back already in those six years over 100 per cent on the cost. That is, it was a good investment even for the life insurance company to prolong the lives of its policyholders; yet what they received was only a small fraction of the benefit that was received by those whose lives were extended, and I want to congratulate you on being here which is one of the greatest health centers now in the world and one of the greatest health centers that ever existed where you can make this investment.

Besides thus bridging the gap between my professional work in economics and my interest in hygiene, I want to confess, and many of you probably suspect already, that I have had a personal interest in the subject because of personal experience. Dr. Kellogg thought you might be especially interested in that. As a matter of fact, 40 years ago this month I broke down with tuberculosis. I was away from my work at Yale three years, and when I finally came back, I was a semi-invalid for three more years, so that tuberculosis practically cost me six years out of my life. It came just as I was about to start on my career as an economist. It seemed at the time as though I would have no career, that all hopes of that were blasted, and that I would die as my father had before me of this dread disease, for tuberculosis was at that time regarded as incurable and called consumption. At any rate it seemed certain that I would be so impaired in health and my life so shortened that I could never do very much work. As a matter of fact, however, I think I have done more work than I would ever have done had I not had this experience. On that basis and on other bases I can say, with conviction, that I believe those six years I then lost out of my life were the best investment I ever made.

When I came back I determined to try to learn how to live; for I became keenly sensitive to the fact that I did not know how, and the more I have studied the more I have concluded that those who tell you here in the Battle Creek Sanitarium that most people do not know how to live are correct.

There is nothing more important to anyone than to learn how to live. Educators like myself find in the class room that education largely consists not in learning something new, but in unlearning something old; and that is what hygiene really amounts to. It is going back to nature. It is unlearning what civilization has taught us as to how to live and going back to what Nature taught us before civilization came. We have come to realize more and more that man is the only animal that does not know how to live, and that it is civilization that has taught him those things which have prevented his having a normal length of life and a normal breadth and depth of life. As the prayer book says, "We have done those things that we ought not to have done and left undone those things we ought to have done and there is no health in us." When it said that there is no health in us, it meant what it said.

There is no bigger word than <u>health</u>. We have narrowed it down until we think it means merely keeping out of a sickbed, because we think of it in terms of disease, hospitals, cancer, tuberculosis, and everything disagreeable. But health means something more than the negation of disease; it means something positive; it means vitality; it means power to work; it means enjoyment of life.

I was watching my grandchild the other day learning to walk. He is one year old and as he toddled along after he had just found he could step more than ten times and still keep on his feet, he was waving his hands. I said to my son, his father, "What does that waving mean?" He said, "Don't you see, it means ecstasy." That baby was enjoying life. You have heard poets say of children that they feel "dancey," which is one expression for that positive health achievement far beyond merely keeping out of a sickbed. One of the things we most need in our learning how to live is to make health positive and so to associate it not with hospitals and sanitariums and sickbeds and diseases but with athletics, poetry, and beauty. That is what the Greeks did and their attitude has descended to us in imperishable marble and the Olympic games that now pass around the world from Greece to Japan and to Germany to the United States, reminding us that there once was a civilization where health meant something such as the prayer book describes.

When we say, "How are you?" or "How is your health?" we seldom realize what a big question that is or ought to be.

The first thing I tried to learn was how to get over tuberculosis. The great advantage of having tuberculosis is that there is no cure for it except learning how to live. Some one said that the prescription for a long life is to catch an incurable disease and then to cure it. I took that prescription-- not intentionally, of course-- but yet, as I said, I can rejuoice in the fact that I did, and can now regard it as a blessing in disguise.

In those days, 40 years ago, very little was known on this great question of how to live, and the pioneers in the treatment of tuberculosis, not having any specific, not having any medicine and not really knowing what to do, simply said, "Well, this is a disease of the lungs. The lungs are diseased for lack of air, probably. So you must get plenty of oxygen, live out of doors and breathe the purest air you can get." They really had practically two things to offer us; fresh air and rest. Now, rest was right. It was understood. Fresh air was right and it was not understood. It is only in recent years that we have learned the real nature of so-called "fresh air." These early pioneers did not know what they were talking about. The benefit that you get from the outdoor life has little to do with the lungs. The outdoor life is just as good for bone tuberculosis as it is for lung tuberculosis. As a matter of fact, it has almost nothing to do with breathing. Undoubtedly pure air is better than impure air; germless air is certainly better than infected air, yet it is not at all true that you get more oxygen simply by being out of doors. It was at least a quarter of a century after I had tuberculosis that I became convinced that what I am now telling you is correct. Even though one of my colleagues at Yale, Professor Winslow, was a pioneer in proving that fact, I was very slow to accept it. I had been brought up on the old theory that "fresh air" meant literally "fresh air," but it does not. I am now convinced that Professor Winslow and other investigators are right. So one thing we ought to learn in "learning how to live" is what fresh air means. It is a misnomer.

So-called fresh air is not a chemical proposition; it is motion of the air, or dryness of the air or coolness of the air acting on the skin, not the lungs. When a lady is feeling faint or feels that the room is "close," she will fan herself. But she does not get any more oxygen. It is the same air, but it is in motion and its effect upon the skin is different from still air. The good that you get from being out of doors is to put the skin in more contact with the breezes and you could do the same thing indoors with an electric fan. Dryness and coolness also help in air conditioning. But motion of air is perhaps that chief quality of "fresh air."

This experiment has been made: A person has been put in a box like a telephone booth and after being there some time he feels that it is very "close." The air must, he thinks, be very "foul," "bad," "contaminated," "short of oxygen." "full of carbon dioxide," "poisonous." But you can not use up the oxygen even in a rather small box. There is plenty of oxygen practically everywhere. Turn on an electric fan in the box and immediately you feel that you are in "fresh" air.

Another experiment: As soon as you are in the box if you connect with the outdoor air which you know to be fresh chemically, by means of a tube and breathe you will feel that it is "close" just the same. That is, you do not feel relief from breathing that outdoor air which you know to be pure compared with the indoor air which you believe to be impure. On the other hand, if you get out of that box after it has been "befouled" as much as possible by constant rebreathing and then breathe, through a tube, the air inside of the box while you are outdoors so that your face is in contact with the moving air, you will feel relief at once through you know you are breathing the "impure" air of the box.

Breathing has nothing to do with it. We live in an ocean of oxygen. There is never any shortage of oxygen unless you go into the stratosphere or up a very high mountain. There is oxygen enough in a room for people that would pack it full. The air would never become so chemically impure as to make any trouble. That is important to know. Tuberculosis is not a question of curing the lungs by having chemically pure air. It is a question of seeing to it that you keep the air moving and in contact with your skin. If you do not know this then you do not get very much benefit from living out of doors, because it is only your face that you expose to the air, whereas that is only a small part of your skin. What you want is to have as much of your skin exposed as possible. So living in the outdoor gymnasium is indicated where you have as little clothing as possible. "Fresh air" is more a clothing proposition than anything else. To put it in a paradox, tuberculosis is a skin disease rather than a lung disease, and it is a clothing disease rather than a housing disease.

That is a revolutionary statement compared with the creed that I was taught 40 years ago. Nevertheless I got a great deal from living and sleeping out of doors. I would have gotten a lot more if I had known that I should have reduced the amount of clothing I wore, that I should have made it more porous and should have exposed as much of my nude body to the air as I possibly could and as far as the law allows.

So what tuberculosis has amounted to is an indictment of civilization so far as the clothing of civilization is concerned. This does not mean we have all got to go nudist; but it does mean that almost everybody should have some kind of clothing reform. There is no objection to draping oneself, and in this climate one can not live as one could in the torrid zone, completely nude. But we pay a tremendous price for our clothes which, especially if heavy, tightly woven, and tightly worn, shut out the air from our skin.

This is all detailed in the book <u>How to Live</u>, which is now in its twentieth edition. It is a good book; I know it because I wrote it! I do not need to apologize for praising the book, first because the royalties from it do not go into my pocket. They go to the Vitality Records Office which I am going to tell you something about and which I hope a great many of you will wish to join. I also do not apologize for praising the book because it is not altogether mine. It was written by me and Dr. Haven Emerson, who, by the way, is a remote collateral descendant of Ralph Waldo Emerson and who was formerly Health Commissioner of New York City and is now Professor of Public Health Practice in Columbia University and one of the leading authorities on hygiene and especially on alcohol. He is the author of one of the 34 appendices of How to Live. He and the other authors of 34 appendices have constributed so much to the book that it is only to-day, in small part, my book.

Dr. Kellogg, the head and founder of this institution and the greatest figure, I think, that ever lived on individual hygiene, has contributed two of the appendices to this book.

Four hundred and forty-nine thousand copies of previous editions have been sold or distributed. In this edition we divided the book into three parts. The first is on the subject of fresh air, but it is not entitled "Air" as in the earlier editions. It is entitled "Our Exterior." It means really primarily our skin and the clothing that encases it.

The book is summarized in 18 rules. Five of these rules refer to our exterior. I will read them.

The first rule-- you might call it almost the first rule of health-- is to "wear light, loose, and porous clothes."

The second is to "ventilate every room you occupy" in order that the air may be moving.

The third is to "keep outdoors as much as possible" because unless you have electric fans and make a special effort you can not, when indoors, get the thorough contact of the air with the skin that you can outdoors.

The fourth is to "perspire daily, either by exercise or by application of heat." One of the great objections to clothes as we have them is that they interfere with this function of the skin. If there is any animal in the world that ought not to wear clothes it is man because man is the only animal of any importance besides the horse that perspires and that needs contact with the air in order that the perspiring function shall be correctly performed.

5. "Bathe frequently in air (especially cold air), water (especially cold water), and sunlight."

Now, the skin is a very important organ. It is not simply a paper bag which envelopes us. It is an organ which has almost as many functions as the liver, and one of its functions is very much like that of the kidney, an excretory function.

You know that sometimes when a person is full of poisons and has been greatly constipated or has had something that has made him sick and he vomits, one of the first things Nature does is to make him perspire. If it can not get rid of those poisons out of any other outlet it gets them out through the pores of the skin. And we are perspring all the time. The skin is a sieve through which the water from the blood is flowing all the time. This is "insensible " perspiration, although there is no glandular action when that occurs. It is somewhat different from the action of the glands when we really have "sensible" perspiration, as it is called. If your heart is weak, and most civilized people do not exercise their hearts enough to have them as strong as the hearts of our savage ancestors were, who were on their feet most of the day hunting or otherwise in the food quest or whatever it was that occupied them, then the function of the skin should be supplemented by the application of heat, and you will find places in many civilizations where there are these "sweat baths" as they are called. Today they are famous in Finland and other Scandinavian countries. They are used in Mexico and many other countries besides the Turkish baths which are familiar in this country; and, in such institutions as this, the electric light bath which Dr. Kellogg invented.

The skin performs the function of a thermostat in order to equalize the temperature all over the body. When cold comes against the skin anywhere it telegraphs, so to speak, through the nerves to the spinal cord to bring some relief from that cold and normally the skin reacts to that cold in a manner which is peculiar to cold. The skin thickens and becomes a better protection against the cold. The hairs of the skin rise up perpendicularly and the heart pumps more slowly but with more force. First of all, the blood goes out of the skin to the interior in order that it shall not get too cold, and then with the help of the heart it comes back again in order to warm up the skin-- a very complicated but important process.

On the other hand, when heat comes it acts in a different way. The telegraph states "It is hot outside," and then the heart acts with more rapidity and the perspiration comes in order to cool off the skin and the blood comes to the skin, this time in order to let out the heat just as the water in an automobile radiator is constantly circulating in order to keep from getting the engine too hot.

There are a lot of other complicated things the skin does for us when it is in good condition. In civilization it is scarcely ever in good condition, because it is covered by clothes. The clothes not only interfere but they make the skin feeble. Every organ of the body has to be exercised in order to be healthy. If I should put my arm in a sling the biceps muscle in a few weeks would not be able to lift any considerable weight. In order that the biceps muscle should be kept in good condition I must not keep my arm in a sling. I must exercise it every day; and that principle applies to every organ in the body, including the skin. If you do not exercise the skin it will suffer from atrophy just as the muscles do when inactive; and then it can not perform its functions. You expose yourself to cold and catch a cold. What does it mean? It means your skin can not react to cold normally. Normal skin will protect the body so that it is almost impossible to catch cold. One of the first things I learned when I had tuberculosis was that if you live outdoors you almost never catch cold. The philosophy I had had was entirely wrong. The true philosophy really is to educate your skin. It takes years to do that; and after I understood the importance of it I have been trying to do it and I can testify that it is wonderful what a change can be effected.

I will tell you of a physician who four years ago was down and out. He learned he did not know how to live and then he tried to learn how to live. Now after four years he can run six miles without stopping whereas four years ago he could not run across this room without being out of breath and having palpitation of the heart. But the most important change was in his skin. Four years ago he was clothing himself as most people do-- overprotecting when it becomes cold. Instead of having our skin act as an overcoat we put on an overcoat. Nature gave us our skin overcoat. The skin took care of us when it was cold and took care of us when it was hot. But today the skin shirks all its functions, or rather the owner of the skin causes it to shirk them and to substitute an artificial skin adjusted in summer one way and in winter another way. One result is that when it is hot in summer people say they can not stand the heat. A month ago in New York people were saying, "Isn't it hot today? How can you stand it?"

I said, "I did not know it was hot" simply because I had toughened my skin.

This physician in New York whom I was referring to had done the same with his skin. Four years ago he had two pairs of socks and yet his feet were always cold. He went to Paris to buy various things and he told me that he and his wife went to the Bon Marché to get underclothes and that he said, "Très chaud," very warm, the warmest you have got. That was his idea then, that he as to warm himself artificially. Now his idea is to wear as little clothing as the law allows, which he does. He never wears an overcoat. He wears the lightest clothes all the year around and his feet and hands are now warm instead of cold. But it took him some four years to accomplish this change and it has taken me that long, too. I would not advise anyone to plunge in too suddenly or say "Professor Fisher says the thing to do is never to wear an overcoat." Most of you would have pneumonia tomorrow, but if you learn, little by little, practicing and experimenting, you will find in the course of years that you can become proof against cold almost a hundred per cent simply by this process.

That is not the only thing that will insure you against taking cold either. There is a whole lot else in hygiene than the hygiene of the skin.

The second of the three parts of this book is called "Our Interior" just in contrast to the first part, "Our Exterior." The interior is what you are being taught about here more than anything else. In regard to our interior there are 8 rules.

1. Give preference to natural foods, especially fruits, nuts, greens, dairy products. Then select by natural choice.

The primitive diet consisted almost wholly of fruits, nuts, and green leaves. Dairy products came later. They are, in general excellent foods and they are added here, making four classes of fundamental and natural foods.

Then select from these foods by your own natural choice and learn how to select properly.

2. Avoid overeating and overweight.

3. Avoid excess of protein.

4. Avoid excessive seasoning.

5. Eat your food slowly, taste carefully, enjoy fully.

6. Exclude poisons and avoid infections.

7. Keep the teeth and gums clean and healthy.

8. Get the habit of thorough, frequent, intestinal elimination.

That, together with other parts of colon hygiene, represents perhaps the most important rule of health. If you want to learn how to live you can not overlook the colon. It is more important than the skin as an eliminating organ, and it is the colon which is universally even more than the skin out of order in civilization, and for many reasons. It is out of order because we do not defecate frequently enough. A baby about 20 minutes after each feeding will defecate. As its mother house-trains it as you house-train a dog, it loses, little by little, that obedience to what is called the "call." It is inconvenient as we wear clothes and as we are in society, to perform after each meal that natural function which is so supremely important.

Every live organism, every animal organism is a factory of poisons. The processes of life produce certain poisonous elements just as building a house makes shavings. There have got to be these waste products and they must be gotten rid of promptly; otherwise they get into the system and shorten life.

Metchnikoff, the successor of Pasteur at the Pasteur Institute in Paris, had the idea that human longevity was associated with autointoxication or intestinal toxemia more than with anything else, and I believe he was substantially right. Most people die by poisons. Those poisons may be taken in from the outside as when we drink alcohol or smoke tobacco or take tea and coffee which contain a certain amount of poison or take patent medicines and drugs, etc.; but all of these poisons, bad as they are, especially alcohol and tobacco, are as nothing in the opinion of Dr. Kellogg-- and I am inclined to think he is right-- as compared with those poisons that we absorb through the intestinal tube. And it is not only important to get rid of those poisons but it is almost equally important to reduce the amount of those poisons.

Now, you can reduce the amount of those poisons by reducing the amount of protein, which means practically reducing or eliminating meat, but it also means reducing eggs, cheese and other high protein foods. Yet there is nothing more important than taking enough protein foods. However, there is very little danger of protein starvation in civilization, especially in America, the error being almost always the other way-- in taking too much, especially of flesh foods. It is better not to take any, provided your diet is balanced in other ways as it can easily be by a moderate amount of nuts or eggs or cheese or lentils or beans or peas, but the use of meat can in general be discontinued with advantage. It has been perfectly well proved that it is not essential. It took me a long time to come around to that belief because when I had tuberculosis they told me I should eat a great deal of meat. I said, "I always have." As a matter of fact, I think it was a great error before I had tuberculosis and a still greater error while I had tuberculosis to stuff myself with meat as I did three times a day. That was the idea at that time. Only little by little have people waked up to the fact that meat is not essential. But that has been shown by Professor McCollum of John Hopkins and Professor Sherman of Columbia and other authorities. Meat is not even desirable provided you can satisfy your appetite and get sufficiently balanced rations without it, which in 99 per cent of situations is quite possible. When I say meat of course I include fish, shellfish and fowl. But besides these flesh foods there are eggs, cheese, and nuts. Almost everything has a certain amount of protein in it. Besides this the bile and mucus goes into the intestinal tube and that is also putrescible.

Beside the elimination of poisons as far as possible and the reduction of the amount of poisons by lowering the protein, there is a third way of avoiding this self poisoning and that is by neutralizing the production of poisons from putrefaction. Putrefaction goes on in the intestinal canal with all proteins.

Now, putrefaction is a bacterial process, and it is performed by certain kinds of bacteria which produce that putrefaction as distinct from the other kind of bacteria that produce fermentation. We can get the latter kind of germs to displace the former kind. When we can get the fermentative germs to displace the putrefactive germs we will accomplish a great deal toward reducing the amount of poisons in the human intestine.

That amounts to cultivating acidophilus germs. These germs can be cultivated in the intestine in two ways, first, by their introduction. That can be done at either end of the intestinal tube. It can be done by drinking acidophilus milk or soy acidophilus which is here available, and which seems to be a better product than the ordinary acidophilus milk. Or you can take these in enemas, and that is very helpful when the colon is, as Dr. Kellogg says, already crippled.

But even more important than introducing these germs is the cultivation of these germs. There is always a certain amount of germs there. It is a curious provision of Nature that as soon as a child is born, these germs to protect its colon are developed. Some of them are on the nipple of the mother. It is a curious provision of Nature by which this ingestion of the acidophilus germs is provided for early, and one source of getting good acidophilus germs is from the stools of babies. Then as the baby changes its diet and especially as it uses meat and grows up, those germs are crowded out more and more; but they never entirely disappear, and the important thing is to cultivate them. The way to cultivate them is by sugar of milk.

Even the old doctors, long before germs were known to exist, found this to be true from their own observations that when a baby had "bowel complaint" the thing to do was to give it sugar of milk and it cured it, though they did not know why. Why was it? Because it fed these essential acidophilus germs.

You can take this sugar of milk in various forms. You can take it as you buy it in the drug store. It is often used to modify cow's milk, making it more like mother's milk. But this kind of milk sugar is not very sweet nor pleasant; so adults very seldom use it. Dr. Kellogg has developed here what is called B-Lac, which, while not as sweet as cane sugar is sweeter than the ordinary sugar of milk. He also has taken ordinary lactose and mixed it with dextrin and flavored it with lemon, etc. Dextrin by itself, dextrose, is very unpleasant. Scarcely any human being can take it regularly, however faithful he may be to hygiene. Dextrose, Lacto-Dextrin, B-Lac and milk sugar in any form will cultivate these acidophilus germs and it can be added to the enema so that it will reinforce the introduction of germs at that end of the intestinal tube.

Now I probably am going into more detail than I should, but I would like to finish reading these 18 rules. The third group is "Our Behavior." There are five rules under "Behavior."

The first is to "stand, sit, and walk erect." That is, good posture.

The second is to "work, play, rest, and sleep in due proportions." That means moderation in all things.

The third is to "compensate for occupational deficiencies by special exercises and recreation." Really we are all specialists. The blacksmith overexcercises his arm, the clerk overexercises his faculty of adding-- unless he has an adding machine-- and so some one faculty is overexercised by each individual while the rest of the faculties are almost allowed to decay. So a sedentary man, for instance, should take physical exercise and a person whose business is physical should take mental exercise.

The fourth rule is to "keep serene; avoid hurry, worry, fear, anger."

The fifth is to "take periodic health (including dental) examinations."

Now I have read you the 18 rules of health. Of course in order to really understand it thoroughly you ought to know something individually about them all.

In closing I want to say a word about the Vitality Records Office. It occurred to me many years ago that in order to spread this gospel which is preached here at Battle Creek particularly, so as to make a real impression on the whole world we need more demonstrations of what hygiene will do. We have plenty of individual studies on individual diseases like tuberculosis, cancer, typhoid fever, etc., and we have individual studies on certain health problems like alcohol and tobacco-- lots of things have been written on all these individual subjects. But they do not ever show sufficient benefit to convince the average man that he had better change his habits. You say to him, "Smoking is injurious."

"I know it, but I like it. Does this cigaret do me very much harm?" You have to admit that it does not. One cigaret can not do much harm.

One day without moving the bowels can not do very much harm, but when all of those things occur every day it is like barnacles on a ship. The Queen Mary would not be affected by one barnacle, but if it were all covered with barnacles, which would happen if you neglect it, it would probably make many hours' difference in crossing the Atlantic. We are all covered with barnacles. You can not get much reaction out of the public by showing the results of one barnacle being on or off. What we want to do is to make a demonstration on the basis of doing all hygienic things correctly, compared with the average American who does almost none of them correctly. So it occurred to me to collect the experiences of people who, like myself, have shown in their own lives this tremendous contrast. It is very rare for a person of 31 badly broken down with tuberculosis to live to 72. The mortality rate of those who have had tuberculosis is very great. As I said, it was a very costly disease to me. And it is still rarer for a man to have this great transformation in his health that I referred to in that physician in New York. It is very rare for a man like Dr. Kellogg to live to 87 and do a day's work and more than a day's work every day.

But that can all be done through individual hygiene; and so I am collecting these records. I have had registered at this office already about 3,500 people, and I hope many of you will wish to register, too. There are no dues any more than anyone wishes to contribute toward the expense. I contribute financially myself and I contribute some of my time. For, ever since I had tuberculosis, I decided I ought to dedicate part of my life so as to help other people not to go through the experience I had.

If this Vitality Records Office can be amply taken care of financially and extended to the right proportions and be given a chance through a sufficient number of years to collect its records of mortality and morbidity, I am thoroughly convinced that its results will be very startling and that it will demonstrate a great difference between the health of the average American and that of those who have learned how to live. The difference is so great that life extension in years and in working power is beyond what most people imagine is possible.

I have very little doubt that the average person, whatever his age-- that the average person here tonight-- if he or she is willing to pay the price as I have and as has this doctor I referred to in New York and many others who have registered at the Vitality Records Office, could double the expectation of life.

b

A Lecture at the Sanitarium Parlor, Battle Creek, Mich., Tuesday, September 13, 1910, at 8:00 P. M.

By,

Mr. Horace Fletcher.

- -

Ladies and gentlemen: There is to be no formal introduction tonight. Dr. Kellogg is in the midst of bidding good bye to two of his children who are going off to shool, and it is very much more meet that he should have a last word with them than the he should have a first word for me.

At the present moment, all of us are familiar with the word "conservation." There probably has never been a nation so prodigal of its rich resources as the American people. And we are beginning to feel the waste. We are beginning to look to the future, and to see how we are going to replenish the wasts. We hear of the conservation of the forests, of the mineral resources, of the water privileges, but not so much of the more important departments of conservation, namely, the conservation of health and efficiency; the conservation of the child who will be the citizen of tomorrow, and the conservation of our political self-respect which never will be attained until the original purposes of the American government have been satisfied, and in the words of Lincoln, the government will be of the people, for the people, and by the people. (Applause) And, fortunately, we have here tonight representatives of these three fudamental departments of conservation. I am going to speak to you about two of them. Those of you who were here last week heard from Senator Owen about that most important of all, the people's rule, and as you will have an opportunity to hear again, I think we may felicitate ourselves upon a little season of what we may cal concentration, cooperation and consecration to the interests of the people. I am going to speak to you first tonight about the conservation of health and efficiency, because most of you are here on that account.

Under the primitive conditions under which man was created or among which he grew up, as it were, away back in the prehistoric periods, this question of health and efficiency was not one of interest, because man was naturally healthy; he was made to fit his surroundings, or his surroundings were made to fit him; he was compelled to follow the natural requirements. There were none of those diversions which lead us far astray and into temptation, and consequently when we cut out of the strata of the earth the remains of primitive man, we find that although the skeletons have the appearance of being very old, perhaps as old as that of Methuselah, they still retain the 32 teeth, well worn perchance, but without decay; and the evidence of those remains is that man was extraordinarily healthy in those days; because nowhere do you get the evidences of dietetic sinning so quickly as in the teeth. Decayed teeth, bad teeth are the best evidence in the world of disordered conditions along the line of the alimentary canal. Knowing this to be a fact on the evidence of these anthropological remains, it is easy to argue ourselves into a state of satisfaction as to the reasons for that extraordinary condition of health and efficiency which prevailed in prehistoric times. It leads us to believe, to know, in fact, that disease is not a natural heritage; it did not grow up with the primitive man, but is the result of what we call civilization, of luxury, of plethora, of temptations to excess. And following out that line of reasoning, we are able to determine the direct causes of our disabilities. There is probably not one person here in this audience who has come here who may not trace their disabilities, their diseases infact to dietetic sinning. Dr. Kellogg and Dr. Riley and others speak to you so frequently about autointoxication, and autointoxication is nothing else than the putrid decomposition of an excess of protein food within the body,--food which has been carelessly taken; and the unfortunate results of excesses of that kind are to be found in hundreds of different diseases and disabilities. We are the victims in this age of autointoxication, and by autointoxication I mean not intoxication, caused ~~xxxxxxx~~ by taking into the body from without poisons like alcoholic drinks, but the poisons which are generated within the body by the putrid decomposition of an excess of the protein or the nitrogenous element taken into the body and which can not be gotten rid of in any other way. There are many resources within the body for taking care of the abuses, many of them.

The kidneys are worked over time, the pores are worked over time, the pores of the skin are worked over time; all of the excretory organs are worked over time, and they are worn out, and some of the diseases from which mankind suffers in this age are the result of the breaking down of these agents of excretion. But there is even a resource on the part of nature beyond the natural excretory organs, and that is the putrid decomposition of the excess of food. Now, ~~xxx~~ thatis a grewsome picture, and it would not be at all kind of me to put this picture before you, especially those of you who are constantly thinking about yourselves, your troubles, your diseases, your disabilities, if I could not at the same time give you a very practical remedy. And that is my object. And I speak by the book.

When I was forty years of age, I was a sick man. I was denied life insurance. I was very obese. I could not run three times the length of a car to catch it to save my life, without having a spasm of coughing, and perhaps with great palpitation of the heart. In fact I was in a very disabled condition. In fact, I ~~xxx~~ lay what you may call my reform, my regeneration to the fact that I was denied life insurance for these disabilities, and having been denied life insurance, and at that time being able to etire from business, and having the time at my disposal, I determined to take up the study of the subject. The story of the conquest for good health, for rejuvenation has been told so many times that I am not going to repeat it here, but as the result of turning my attention to the study of the subjectx of my own ssxx sinning dietetically, and the results of it, within twenty years I not only have become an extraordinarily well man, but I have been enjoying progressive recuperation measured in terms of muscular efficiency for the past fifteen or eighteen years, and at the age of 61 I am in better condition all told than I ever was in my life. My blood-pressure was taken the other day, and all of you know something about blood-pressure and what it means; you can not escape it here; and whereas the normal for the normal person at any age is set down at from 95 to 105 of 110, I at 61 years of age and with a history of abuse behind me, due to this rejuvenation have a record I believe of 98 or something short of a hundred, showing that the blood is flowing easily, quietly through my veins without any friction, and I know that this is true because I feel within myself the energy of youth and all of the joy of such resources; and I am going to tell you how to attain it and to maintain it, and it is no matter whether you are thirty or forty or fifty or sixty years of age, it is available to you, and you can begin to cut coupons from the bonds as soon as you begin to reform your manners relative to the ingestion of food.

Dr. Kellogg from this platform has many times told the Sanitarium audiences that if they would follow the advice I am going to give you tonight it would not be necessary for you to come here for treatment, and you would come here as to a pleasure resort instead. But you have not done it; it is probable that not many of you will do it; but having given you the secret as I am going to give you here tonight, then it is up to you to avail yourselves of it or not; and if you don't want to do it, we will take it for granted that you prefer to be sick and not enjoy the recuperation which nature vouchsafes.

No

Now, what does this consist of? Mind you, if we were living in primitive conditions we would be compelled to do the right thing. Food would be found in such form that we would be compelled to bite it out of the envelopes in which it is found; if we wanted to make sugar out of the cane, it would be necessary for us to crush the cane with our teeth and treat it with the saliva instead of having it done in a mill in the South, then crystallized in the refinery. If we wanted to get sugar from the beet, we would have to take it in the same way. If we wanted to get sugar from starch, which is an entirely indigestible thing in its native form,--if we wanted to get that into glucose orxxxxx dextrose, or grape sugar, which is the assimilable form of starch, it would be necessary to do it in the refinery of the mouth, which is very effective. As I say, the natural, primitive conditions would compel us to do that; but what are our conditions at present? They are a great menace.

In the first place we have a plethora of food; in the second place, we have aggressive hospitality which nearly forces us to eat. We look upon it as a social function instead of as a sacred function which it really is. We really are gluttons at the altar when we are serving on the altar of our efficiency,--we are gluttons, and not because we want to be gluttons, but simply on account of our carelessness. We go to the table worried; we go to the table thinking of business; we go there sometimes to argue and to quarrel with each other, and all the time cultivating the conditions which are prejudicial to good digestion, to our good nutrition. This being the case, it is necessary for us to cultivate the science of right eating in order to protect us from the offenses. I have been giving now some twelve or thirteen years of unremitting attention to this subject, with the best talent in the world physiologically and otherwise assisting me in every way possible, with demonstrations going on in different parts of the world to prove the value or the fallacy of the ideas, of the hypotheses which we were working out, and as the result of that twelve or thirteen years we have reduced the formula for the human responsibility in the matter of nutrition which puts us in a position to perform right nutrition in the presence of all these luxurious, complicated foods,- and it has been reduced to perhaps 300 words.

The experiment conducted by Prof. Irving Fisher, the president of the Committee of 100, the professor of political economy at Yale, a number of years ago with a number of students,--the formula on which that experiment was conducted did not comprise more than 300 words; and as a summary of what I am going to tell you this evening, I might give you that in that tabloid form, I might say, so you might commit it to memory if you will; but instead of in 300 words, it practically can be given in about 20. I want to make some striking remarks that will set you to thinking about this thing.

Here you devote yourselves to counting your calories and to thinking about this subject and having it drilled into you that you must do this and do that, and properly enough, because you have thousands of bad habits to correct. You have got false ideas about what nutrition is, what digestion is, and in fact you know so little about it that it requires a great deal of teaching to bring you back to the primitive conditions where you approach food with the proper reverence, with the proper respect, giving its due value in order to get the best there is out of it in the form of nutrition, energy, health, and endurance.

Now, I want to make this impressive. Perhaps I shall fail, but I am going to try. If we are sick, we are sick because we have been dietetic sinners. Now, we want to learn dietetic righteousness. The human responsibility is confined to a very small area--the alimentary canal where digestion and nutrition is effected is anywhere from 25 to 30 feet long. Think of it,--coil upon coil of complications within the body. It begins at the lips. The first two or three inches are the human responsibility. The other twenty-five or thirty feet are the responsibility of nature herself and over which we have no control. We have absolute control over that portion that is within the first three inches of the alimentary canal, above the guillotine line. I want you to be impressed with that idea that all of our responsibility is above the guillotine line where all the senses are bunched. If it were not that we needed to use this to walk around with and to pitch hay with and to play golf with, we could get along just as well without this body as not. If the head had wings like the cupids of Raphael, it would not be at all necessary to have this complicated body. This is merely a machine to move the head around; so consequently the whole responsibility is above the guillotine line; and why do I say above the guillotine line? I want to make that impressive. The Hon. Henry Mills Alden, the veteran editor of Harper's publications, two or three years ago down in New Jersey where I was going to address an audience introduced me like this: He said, "It is not often given to a person to lend his name to the language. I have only known one American--there are numbers of Europeans--Mesmer, Boycott, Pasteur and others,--but only one American, and there is one Frenchman who gave his name to the language, who invented an instrument for the shortening of human life. His name was Guillotine, and ~~xxxxxx~~ they called his instrument the guillotine, and it was for the shortening of human life; whereas the speaker of the evening has loaned his name to a method for the lengthening of human life." So we call that the guillotine line, and it gives us an excuse every time for mentioning the fact; but it is a thing to remember because~~xxxxxxxxx~~ know where your responsibility is, and don't go all over the lot seeking to meddle with ~~xxxxx~~ Nature's business. She can do it so much better than you can; but you have got to do your part right. You have got to feed the food into the hopper in the right kind of way. It is necessary for you to treat it in the right kind of way, otherwise there will be trouble all along the line of the alimentary canal.

Now, I want to tell you in particular how to remember to keep within the field of our own responsibility, and how to do the work necessary to either. You know, hunger is an indefinite term meaning a body want. Hunger has a language, and we call that language appetite. Hunger is a very much misunderstood term, a sensation; in fact, it is not a sensation. Hunger is never expressed by any symptom, by any feeling, by any sensation below the guillotine line. A pain at the cardiac opening of the stomach which we call faintness, or all-goneness, has no relation to hunger at all, but to the reverse. It means the same sort of an unfortunate feeling that comes to a man the morning after he has been on a drunk. It means a protest either against a habit of appetite--that is, a habit of taking food at frequent intervals, or fermentation of some sort; but it has no relation whatever to hunger, but the reverse. Hunger is only expressed above the guillotine line and in the form of a keen desire for some simple food. When some simple food is thought of or mentioned, accompanied by what is called watering of the mouth, and when food is taken in response to an earned, to a keen appetite, it practically melts in the mouth, as we say; that is to say the body wants it, the body provides the digestive agents or the preparatory agents for it; it does practically melt in the mouth and it swallows itself; and if the fodd is taken under those favorable conditions it will be digested as quickly, assimilated very quickly, and you will hear nothing of it except in terms of energy after Nature has transformed it into nutriment, into energy. Therefore the first consideration is, never take food until you have an earned appetite, until you are genuinely hungry. Don't take it because the bell rings; don't take it because anybody invites you to take it; be sure that you have the appetite; it will do no harm to wait a while to see if it is a real appetite; skip a meal, or two meals, or three meals, or to do as I did the other day in an experiment in the study of the psychology of appetite, I went seventeen days without food at all to find out what a real appetite was, and then I didn't find out. But it will do no harm. During all that seventeen days I experienced no hunger whatever for the simple reason that the body was drawing upon its own resources. It does no harm to wait until you have the strength, the bodily want, until you have the watering of the mouth, until you are in proper condition; and then let us experiment with one little morsel of food, about the size of a communion lump,- and nearly all of your are church people, I presume, and know what the communion lump is; and that describes it very much better than if I tell you in terms of so many centimeters, or in terms of so many grams. So take an ordinary piece of bread, an ordinary small particle,--mind you, it looks as if it tasted good; you have a real, earned appetite, you put it in the mouth, you hold it there for a moment, you find simply that it has no taste at all, because starch in that condition has no taste until it is transformed into dextrose by the action of the ptyaline of the saliva; but the moment you begin to use the jaws the saliva begins to flow or mix with the morsel of bread; it begins the chemical transformation at once; that chemical transformation is indicated by taste, and that taste goes on increasing, increasing, increasing in sweetness, until finally the morsel has become a creamy mass, and has collected at the gate which shuts off the human responsibility from the responsibility of Nature; it is sucked up, it is swallowed, and the full requirements of transforming that in the refinery or laboratory of the mouth have been performed.

It is the same with regard to any food. Any food which has taste should be treated in this way in the mouth until all of the taste is extracted, until it swallows itself, which it will do. There is complete closure at the back of the mouth which shuts off the rest of the alimentary canal from the mouth every time the food is in process, and that does not happen until the food has been properly transformed; and to show you the mechanism of it, as prepared by Nature, I will give you a little outline of a method of testing it. When you have an opportunity, when you have a real, earned appetite, as you are liable to have, take a little morsel of bread into the mouth, as I say, and taste it, and hold the head down in this way while you are eating it, and for this reason,--in the first place it is the only natural way of holding the head in order to facilitate swallowing. If you hold your heads in this way, horizontally, you will find that it is difficult to swallow. Try it. Now this is a bit of physiology with which you are not familiar. Now, lift your chin a little in this way and try to swallow. You find it more difficult still; lift it a little more, and you will find you can not swallow at all, whereas if you hold your head down in this way, you will find you swallow with the utmost ease. Comparative zoology declares that this is an argument in favor of the fact that at one time we took our food on all fours; but anyhow, it is the natural way, the easy way of swallowing, and you will find if you put the bread in your mouth and begin to masticate it and it becomes creamy, if you hold your head down in this way, and with the tongue hanging perpendicular in the mouth, you will find that creamy substance will crawl up the tongue against gravity and will assemble at the closed gate at the back of the mouth. Now, that is as much of a phenomenon as if Niagara should fall up instead of falling down. It is probably the capillary attraction that causes the creamy mass to crawl up and assemble there at the gate. Well, when it is assembled there, it encounters a row of sentinels.

Now, here is something new in physiology. Right in front of that gate on the floor of the tongue are located xxxx five and sometimes seven little protrusions which are called the circumvallate papillae. In proportion to the area of the mouth, they are as important as fence posts in relation to a back yard; and not only are they prominent, but around each one of those is a little trough or mote, and in these troughs or motes there terminate an infinite number of taste buds, that is nerves with ends or buds in the troughs, and those are there, not for the purpose of tasting, because we are not conscious of taste in that region of the mouth. We taste in front, on the tip of the tongue, on the end of the tongue; but we are not conscious of taste, in fact, there at the opening of the throat. Now, the inference is, although we are not able to prove it excepting by inference,--that those taste buds are there for the purpose of recording, not taste while it exists, but the absence of taste when the taste has been extracted and the chances are that being there and nowhere else, at the gate, when the food is lifted up against gravity and collects there at the gate, those taste buds pass upon it, and they send word to the ganglia in the brain, to the nerve centers in the brain that there is food at the gate; the taste has been extracted from it; it has been properly transformed or refined in the mouth; it is ready for assimilation; open the gate and let it in; and to that ganglia comes the word, "Open the gate." The muscles are relaxed, there is what we call involuntary swallowing; food is sucked back into the swallowing area, it is picked up by peristaltic rings, it is carried on in about eight or ten seconds and dumped into the stomach.

Now, that is the mechanical necessity in the case--to extract all the taste from the food while it is in the mouth in order that it may be prepared for digestion and assimilation further on; but nature is wonderful, much more wonderful than any of us suspect. The study of natural history is the most fitting occupation that any one can enter into, for the reason that the moment you begin to study Nature at all, you become wonder struck, and in no instance more so than in connection with this treatment of the food in the mouth.

Now, mind you, taste has been utilized for two or three purposes already in what I have been telling you. It has taught you that bread taken in that way according to the requirements of Nature, is more delicately sweet than any artificial sugar you ever tasted, sweeter than any cake; it grows sweeter and sweeter and sweeter until that last moment when it is sucked up and swallowed; it has taught you that. It is an invitation to you to take this reward of merit for eating properly; it serves for all purposes alongx this line; but there is another purpose, and a purpose which is more wonderful still, and that is, Nature uses the reported taste to notify the stomach of what to expect and what to prepare for. While you are tasting the food in the mouth and getting all of that delicious compensation from it as a temptation to go on to satisfy the appetite, Nature is utilizing that report through the agency of the great vagi nerves which go down on either side of the head and neck and have an infinite number of terminals upon the walls of the stomach which give a picture to the stomach of what to expect--so much protein, so much, so much transformed starch, so much neutralized acid, so much of this or that, and the stomach knows all about it beforehand; and if you have faithfully taken all of the taste out of that food, the stomach knows all about it, prepares enough of and the right kind of a digestive agent so that finally when that food arrives in the stomach after having been transformed in the mouth, it drops into a digestive bath already prepared for it. The gastric juice and the other digestive agents, whatever they may be, are poured out from the glands and are there waiting for the food as it drops into the intestine; and that system goes on all the way through the body, from the stomach to the duodenum and so on.

Now, these are pictures of the natural requirements in the ingestion of food so as to conform to the natural requirements. But we are living in an entirely different set of conditions from those prevailing at the time man was made and food was ordered by creation. Then all man had to do was to nourish himself and reproduce himself and lie around. Not only he had no trains to catch; he had no business worries and everything was favorable to digestion and to

to

to the proper nutrition. But under the present conditions we have not only the super-abundance of food and the aggressive hospitality, but we have worries of business, we have nervous excitement, and we must protect ourselves against that. If we bolt our food and do not entirely taste it, only that portion of it which is tasted will be digested, and the rest of it will become a burden upon the body; but not only that, but we may perform all of the requirements up to te time of the swallowing of the food rightly, but we must conserve or appropriate the favorable mental states and conditions during the time that food is being digested; and let me give you an illustration which will make that a vivid picture to you. It is drawn from the experience of Prof. Cannon, of Harvard University Medical School who for the past ten or twelve years has been studying the process of digestion by the aid of the X ray. They use cats. They allow them to become good and hungry. They feed them with food, but that food has been stained with subnitrate of bismuth which is opaque to the X ray. You may see in Dr. Case's laboratory some pictures which show you the stomach by the aid of the subnitrate of bismuth which is opaque to the X ray. The body of the cat is luminous to the X ray, but the food which has been stained throws the shadow; and you see it picked up by peristaltic rings and carried to the stomach; then it drops into the stomach; then it makes those characteristic movements, depositing the particles of protein upon the walls of the stomach, and separating the carbohydrates from the other elements, and these are carried on into the duodenum through the pyloric opening; and that all goes on merrily while the car is in a contented, happy state of mind. He is lying there on the screen tied down to the screen, and he is just as comfortable as a cat who has just been fed and who is lying on a rug in front of a fire; he is purring his satisfaction, and everything is going on merrily through the proper muscular contraction; the juices are thrown out in the proper way and everything goes on merrily. But if you disturb that cat, if you disturb that cat, if you annoy him, make him spit, the whole process slows up, becomes sluggish; the muscles relax, the digestive agents, the juices cease to flow, and that food lying in the stomach at the time becomes dead food. It is alive while it is being digested, but the moment it ceases to be digested it becomes dead food, and the only xxxxxx way Nature has of getting rid of it is rotting, just in the same way that the dead flesh is acted upon by anaerobic bacteria; and it is putridly decomposed in order to turn it back into action and give it back to Nature in a gaseous form.

Exactly the same thing is done in the stomach with food which has not had the proper initiatory digestion before xx reaching the stomach. So you must not pinch yourself or get yourself angry, and you must not cease purring during the time you are digesting your food; you must conserve those states. You must not have scraps at the table, you must not discuss politics or religion except with those who agree with you. You must not think about bills or because of appetite; you must not worry in any way; for if you do you are poisoning yourselves through the stopping of digestion, and fermenting within yourselves--autointoxication.

Now, it is a most remarkable process, and I have given you a very good picture of it, and it is something to be remembered, but the whole thing can be summed up in a nutshell. If you want to be well, if you want to be efficient, if you want to be happy, if you want to conserve economy, if you want to be truly religious, if you want to be righteous at bottom, physiologically righteous, you must be dietetically righteous, and in order to be dietetically righteous you have got to approach your food with reverential feeling when you ask the blessing--you are supposed to do that; but if you don't carry out the contract with Nature and take your responsibility, it is merely lip service, as was expressed by Senator Owen the other day, and not true service. It is a sacred function because you are serving on the altar of your nutrition, on the altar of your efficiency and your morality, and consequently it is a religious function, and it need not be a tedious function.

Any one in ordinary health, given a keen, earned appetite, having waited long enough for it, can sit down and in the presence of almost any food satisfy a working man's appetite in not more than half an hour all day of actual eating. So that it is not a tedious process; and I want to disabuse you of that idea. The proper mastication, the proper transformation of food in the mouth is not a tedious process; but it is one wherein you must be deliberate. If you only have two minutes in which to satisfy a working man's appetite, if you must catch a train, it is all the more reason why you should be deliberate during those two minutes, because the food with which you are not deliberate is not digested; and if you have five minutes, if you have ten minutes or fifteen minutes, you can satisfy almost any appetite which anybody may have. So consequently it is not a tedious process. So that it is only necessary to think of these few things:--

Wait for the appetite; masticate food which is solid and sip food which is liquid or in semi-liquid state; get all the taste out of it in the mouth; swallow it when it swallows itself; don't be afraid of starving, and the appetite will persist. If you don't get it at one time, you will get it at another time. Don't bother about the constituent principles of food, because appetite will tell you just as surely and just as distinctly where to reach for this and where to reach for that,--for the butter, for the bread, for the cheese, for whatever else you need; and you need not be afraid of protein starving; but there is always the danger of having too much. Be deliberate in that way, and above all things you can not be reverential--you can not go to church and hit your neighbor and practice the requirements of religion. You must conserve these states; and if you can not take your food when you can take it quietly, and appreciatively and reverentially, you better wait if you have to wait a week. I have noticed in my own experience and in the experiments of others, that the earning and getting of a good appetite, a keen appetite, will make you forget all your other troubles, and for the time being you will cease to worry if you are only sufficiently hungry. It is only these forced appetites, this fear that if you don't get it now you won't get it by and by, that leads people to take food when they ought not to take it, and to take it in excess. It is very simple. Wait for the appetite; be deliberate. Get the taste out of everything in the mouth in order to conserve the requirements of Nature, and you will live lives of usefulness, efficiency, and great happiness. (Applause.)

I hope I have made myself clear upon this subject tonight. Under ordinary circumstances it is my custom to ask for questions relative to the subject if I have failed to make it clear, but tonight we are fortunate in having with us a gentleman who has for the past eight years been identified with a movement where fletcherizing, so-called, and that is the deliberate and careful eating of food, has been practiced for purposes of basic economy, and where the results are of the most encouraging sort. We have with us Prof. Magan who, many many years ago was the dean of the school here at the Battle Creek Sanitarium, and he associated with Mr. Sutherland. Prof. Sutherland went to the South to inaugurate a unique missionary enterprise. Taking the means which they had accumulated, they went South and purchased some land, and practically that land has grown with the great missionary project which has grown up. They have now some thirty schools scattered over different parts of the South, among the people who do not know how to read or write; and these schools comprise in the neighborhood of a thousand pupils who are being taught the basic economics first, and letters, mathematics, etc., on that basis and on that foundation. Prof. Magan has consented to give you some little account of that experiment. It is of the utmost importance; and after he has done so, I will be available for a few minutes to answer questions which may have been formulated in the meantime.

Prof. P. T. Magan. I appreciate very much tonight the kindness of Dr. Fletcher in asking me to say a few words in regard to our work. I almost feel that I am out of place in taking any of this valuable time. Not very long ago a friend of mine remarked to me that he thought it was utterly out of place for any one from Tennessee to talk in regard to food reforms. He thought that all we knew down there was in regard to whiskey. In fact, he made the remark that he understood that when we went to our tailors to kkkk be measured for a new pair of trousers, and it came to the specifications for the hip pocket, the question was always asked, "Pints or quarts, sir?" Of course we believe that that is a libel on our state and on a number of good things which we have in the state of Tennessee; but I will only take a moment or two of your time tonight to tell you in a word in regard to this aspect of our work.

I have always felt in life that I would a great deal rather be doing a thing which I loved for nothing than doing something else for pay; and that one of the great things to be sought in life was so to order one's course and conduct that when the end was reached one would feel that there were none of the great or major marks in your life which you would care to have changed. I have often felt that if I could reach the end with that satisfaction that I would feel and realize that my life had not been altogether wasted.

A few years ago I became deeply interested while I was teaching here across the road in what was then the old Battle Creek College in some of these movements of which Mr. Fletcher and Dr. Kellogg are so fond. I became quite desirous of taking up a work for the poorer classes of our white people in the southern states which would embody these principles and which would endeavor to connect with the ordinary education what we now term the rational education. It is very little use to teach to a poor person a number of things out of books when the simple, common, and economic things of life are altogether forgotten. Senator Taylor of Tennessee once remarked in a speech that ~~xxlxxx~~ once you taught a colored man to say, "hic, haec, hoc", it was always good by to "gee, whoa, haw, back." And I think that is very true. And I believe that we all need a little gee, whoa, haw, back, in our lives. There are some of those things which make men of us and give us a sturdiness which we do not get in any other way.

When we first located in Tennessee, we purchased, as Mr. Fletcher has told you, a large farm, a farm of some 400 acres. It was not the best land by any means in the world, but our problem was to help the people who dwell in the hillsides to live well off poor land. One man remarked to me that our rocks were so thick down there that the Almighty had to stand them up on end, that they could not lie down flat; and we have the problem of making a living off very poor land, and that, of course, is quite a difficult thing; and to teach these people how to live hygienically, to live well, and live in a sanitary manner when they are very poor, when all these good things that they make up here,-- Nottoss and Protose and bulldoze, nd all the rest of it are beyond our pockets. We have to meet the problem of teaching these people to live well on what they can raise; and consequently it became a very vital matter with us to train our teachers so that they would be able to promote that class of life.

As I have said, we started our school on this old, rundown plantation; and you know those who give themselves to missionary work as a rule are not very rich. They are always doing for the other members of the family, and they have never saved very much, so that those who agreed to consecrate their lives to doing good in the poorer districts of our state and the adjoining states were mostly those who were quite impecunious. Mr. Fletcher told you we took what means we had and put it into the place, and began work with very few students. The problem of self-support for those students and afterward for these new thirty schools that we have in the South, was a very vital one, and we resolved to make it a most intensely vital one.

Now, you may be surprised if I tell you that our students average in the expenses for their table board from five to six dollars per month. We serve our board on the European plan at two cents a dish. I suppose the sum looks almost ridiculous to you, but we find that by economy we can do that and serve plain but wholesome food and quite a variety of it. But even then some of our young men who had to work their entire way while they were getting their education found it was almost impossible to do it. Their expenses were light, but their appetites were very heavy, and they always had the appetite with them. We began to inaugurate just as far as we possibly could, and to make it the fashionable thing in our school to fletcherize. (Laughter and applause.) It was not so amusing to us as it may be to you. We were driven to it. Poverty was the best friend we had. I remember very well one young man, one of these tall, telegraphic pole kind, who had a very hard time to keep his appetite within his means. It was almost impossible for him to do it. He sat at my table in the boarding hall, and I began to drive it into him a little that he must chew his food more. He just bolted it, didn't taste it, and he didn't get much good out of it. At that time he was eating thirty cents' worth a day, and that was a very large amount for him. That man actually cut down his food ration to sixteen and eighteen cents a day. He weighs more today than he did then, and he has supported himself while going through school, doing heavy work in the Institute,--he has supported himself by the labor of his hands, and lived off that amount of money. Now, he is only one case out of a large number. We have endeavored to inculcate this plan into the minds of all of our students, and we have found that it has lowered the expenses of the students; they have found that themselves,--I should say on an average, one third. Some of them have cut down their expenses one half; some of them only one fourth; but I think one third would be a very fair average. These students as a rule go out into the hill districts and there start little schools where the rational things of life can be taught to these poor people. We have felt that it was more important for the women of those districts to know how to cook well and hygienically the things which they can raise themselves on their farms. We do not have access to all these high priced foods which you do in this section of the country. We have to train these people to live well and to have good nutrition off the things which they can raise. Now, I believe that that can be done anywhere and everywhere,--that the ground can be made to yield in every district the things which are necessary for the sustenance of human life, and can be made to do it well. All our men teachers are thoroughly versed in scientific agriculture and scientific agriculture to my mind should include the chemistry of all foods. We make that a most important point in our teaching.

I was very much interested the other day at a convention where the superintendent of one of our schools reported that in his district right around his school there had been sixteen orchards set out that spring, and 23 patches of berries. Now, that meant that those people were waking up to the new methods of living; and that the old days of corn pone and salt pork were being replaced by something which would be more hygienic, more sanitary, and more nutritious in every way. In all these little schools we endeavor to inculcate these principles. And we have found that they have had a wonderful effect upon the people. Of course, we know, when we can not get any other kind of whiskey down there we get moonshine whiskey. Not very long ago a man came to our hospital--he did not come, he was brought to our hospital suffering with delirium tremens. We kept him there for quite a while. We taught him as faithfully as we could in these principles. That was three years ago now and that man has not touched a drop of liquor since. I said to him the other day, "Mr. Mitchell, to what do you ascribe the fact that you have given up whiskey?" "Why," he said, "I haven

I haven't any appetite for it." "Well," I said, "why is that?" "Well," he said, "when I ate meat, and a great deal of it, I wanted whiskey, or beer, or liquor all the time, but now that I eat simple foods and chew all my food thoroughly, I have absolutely no desire for liquor at all." He said, "I have had no desire for liquor, and I have had no desire for tobacco." Now, that man is only one of a dozen or two that I might mention here tonight, but I am very sure that there is a great relation between this matter of thoroughly masticating the food and eating very simple food, eating when you have, as the Doctor tells us, an earned appetite,--I am very sure that there is a great relation between that and the whole temperance problem; and that if this manner of life is followed and followed faithfully, that it will produce results in the temperance movement which at the present time we little realize. I know that a great many people after they begin to live in this way or have been living in it only a little while feel that it is not going to work. But you know, all these good movements are like a good orange--they have all got a rind to them, and it takes a little while to get through the rind. You have got to stick to it until you are through the rind of the thing, and then you will find it will work all right and give very satisfactory results.

I don't think I need to take any more of your time, and I thank you very much. (Applause).

Now, I want to say one word. Prof. Magan and Prof. Sutherland are doing this work in the true missionary spirit, and while the work in all of its running expenses is self-sustaining, it is made self-sustaining, and that is a part of the principle on which the whole scheme is worked, they have collected from time to time funds for the extending of the work, that is, for the building of buildings,--and I know of no missionary problem or no missionary scheme so worthy of support as that conducted by Prof. Magan and Prof. Sutherland, and I simply offer that as a suggestion to the charitable--those who are assisting in missionary enterprises, that while I don't want them to send any less to Timbuctoo, it would be very delightful to divide it with Tennessee.

And now for a few minutes, if there are persons who would like to ask questions, I should be very happy to answer them.

Q. Would you advocate two meals a day to a man of sedentary habits?

A. To a man of sedentary habits, I should say that two meals a day were ample, and if he is very sedentary, one meal a day is better. Unless a person is very careful, he can not get away with three meals a day, and do anything else. The question of the periodicity of meals is one very easily arranged with nature. When I am doing my best work and need all of my energy for the work, I find that one meal a day serves the purpose better. If I happen to be going back and forth on the steamer, as I do three or four times a year, to Europe, with nothing particular to do, but to just feed, I can take two meals a day; but if I take three, then I am on the borderland of trouble.

Q. Am I right in believing that an occasional fast does the body good inasmuch as it kills off the disease cells in the body?

A. I am not sufficiently familiar with the results of inanition--that is, fasting,--to give an opinion on the subject as to what it will do in the way of removing disease cells, etc. You know, all of us are nourished not from the food which we take in, but from the food which is stored, not immediately, and there is storage for a great many days. I undertook for the very purpose of answering that question authoritatively,--I took up in the latter part of July and made a test; I started in to study the psychology of appetite, to see what affect the mental states had upon appetite. I had no idea of how long I should test it, whether it would be one day, or two days, or three days; but I went on seventeen days without taking food, and I took no water for the first 100½ hours.

There was a discussion among those who had opinions upon the subject as to the merits of it, and some thought the longer you fasted, the better it was, and the more you were benefited, and all sorts of ideas; but I found, as is usual whenever I try to investigate any of the opinions of Dr. Kellogg, on the subject, I found that xx of all the opinions expressed his was the most in accordance with my own experience. At the end of fourteen days I began to experience decided symptoms of autointoxication--heavy head, furred tongue, bad breath; and I didn't want to go on any longer, so I broke the fast. But I will tell you relative to the psychology of appetite that during those whole seventeen days I had no sense of hunger whatever, no all-goneness, no faintness; I did more work than usual; I wrote from six to eight thousand words a day; I pitched baseball; I took long walks, seven or eight mile walks; I was particularly active, losing about a pound a day, suffering no inconvenience whatever. I forgot the periodicity of meals and would not have thought of it excepting that I saw people filing out and in; and when I broke the fast, it was not because I was in any way hungry. I know something of foods and their values; I knew that I had been drawing on my protein supply; I knew that there was plenty of fat and plenty of fuel in the body to use up; the bunkers were still more than half full or two thirds full; but I was conscious of the fact that I had drawn on the protein supply; that which is floating about in the lymph and blood streams would be impoverished in that way, and that was the reason of my autointoxication,--there not being sufficient food to draw on, the body was drawing upon itself. It was a case of putrid decomposition. That is to say, that was the inference, and I believed it to be true; so I determined to break the fast; and knowing that beans are rich in protein, that whenever I desire protein I seek beans as a dog will seek a particular weed in the pasture, or a cow,--so I ordered beforehand some beans to be prepared. It took nearly twenty-four hours to prepare them properly in the Boston style, of which I am very fond; and when they were brought to me in the original pot in which they were baked, they were hot, they smelled good and looked good, and I looked at them, but no desire to eat them whatever. Finally I took a fork and dipped into them, and put a half a dozen beans into my mouth. I held them there for a moment,--no taste, no desire to eat them; but the moment I brought my teeth down on them and crushed them, and the saliva got at them, I had a burst of taste which was as brilliant as any of Paine's fireworks. It went all through my head, and I never shall forget it. I was almost lifted off my feet. The taste of those beans just pulled all through my head in a way I had never distinguished before. I walked about the room enjoying that taste until it disappeared; and then fanulfy I went back for another forkful. Those tasted just as good as the first. I had another explosion, but from that time on the taste began to wane; and with the consumption of less than an ounce of beans, a little over three quarters of an ounce of beans, the appetite of seventeen days was completely satisfied. I took no food until twenty-four hours afterwards. That is to say, it was served to me twenty-four hours afterwards, and consisted of quite a little variety of what you might call a non-meat menu; and it was very appetising; it was put before me in my room, and just at that moment an old college friend from Dartmouth called, and I stopped to greet him, and he stayed for half an hour; then Mr. Norman C. Mack, the president of the Democratic organization in this country, the president of the Democratic National Committee, and party, came there and got to talking about child conservation, and it was four o'clock before I returned to my menu. And, mind you, I had simply broken the fast once in eighteen days. So that appetite is not one of those things to be afraid of. You don't have it until you conjure it up; it serves a very good purpose in telling you what to do; but you need not be afraid of starvation if you have to go without a meal.

Q. Can your views on the subject of mastication be had in book form?

A. I have perpetrated six of them already, and Dr. Kellogg has--

I won't say "perpetrated" in his case--quite a library of them; but they can all be summed up, as I say, in 300 words.

Q. I came from down in Tennessee where this gentleman is from, and maybe that is the reason I had not heard of it before. (Applause).

A. Perhaps you came around by way of Missouri.

Q. What meal would you advise dropping in case of two meals a day?

A. That would depend upon the boarding house where I was living. In my own experience, I never take food until I have practically done my days's work. I can work better when the stomach is not working, and consequently, as is the experience of mountain climbers and all people who do very strenuous work, they do their day's work first, before they take their food; and then, having done the day's work, and having had the satisfaction of having performed something, you can sit down quietly and luxuriate, to appreciate your food. Those are the best meals.

Q. How much weight did you lose during your fast?

A. I lost almost exactly a pound a day, which I could very well afford to lose.

Q. Did you regain it as soon as you quit fasting?

A. No, I have not; but there has been no disposition to gain it. I have not restricted myself at all, but I am holding about the same weight I did at the end of the fast.

Q. Would you take any artificial methods for producing an appetite?

A. I believe not. I did not find it necessary. I took no artificial methods to have an appetite for those beans. I simply buried my teeth in them, and Nature did the rest. Any artificial stimulation is very bad. All you need is to put the food into your mouth, and if the food is there, it will develop taste naturally.

Q. What is the test for an earned appetite where one is obliged to subsist upon liquid food?

A. Why need one be obliged to subsist on liquid food?

Q. They haven't any teeth to bite into anything else.

A. Well, you know that is a very important question. Do you realize the fact that only about two per cent of the cadets who go to West Point and the Naval Academy have teeth in proper condition to take their food? An examination of the schools of Brookline, which is an aristocratic island in the midst of the ocean of Boston where they have lots of money and where they are up to date, and where the people are supposed to be slow, 40% of the children were found to be in a condition not to take their food properly and hygienically on account of bad teeth, the result of bad nutrition; but if you have no teeth whatever, it is better than to have a mouthful of bad teeth. The bad teeth are a great objection. If you have no teeth whatever, you can even take zweiback and coax it into solution simply by the action of the saliva. The gums will serve the purpose when the teeth are not present.

Q. Are you entirely vegetarian?

A. Almost practically I am. Theoretically I am not. And for the reason that I am making a study of this subject at first hands, and whatever Nature permits as a food I do not discredit in any way, for the reason that she draws her own lines; but I will tell you, as a matter of experience, that whereas I entered into the study of this subject thirteen years ago, I believed that meat was a great advantage,--it was condensed food, it was the white man's soft snap and the cause of Anglo-Saxon superiority, and all that sort of thing, still my own experience led me away from meat until now, if I never saw it, I would never regret it; and whenever I take it it is purely in an experimental way. I believe in the principles of the Battle Creek Sanitarium as far as I know them; and I will say as a word of just appreciation, after some eight or nine years of intimate acquaintance with the Battle Creek Sanitarium from the inside and from the outsidd, that we may not think Dr. Kellogg is right because he is usually from five to ten years ahead of us. But when we catch up with him we find he is right; but we never catch up with him, and consequently we never can know he is right; but I will give you a pointer. You are perfectly safe in following his suggestions and his lead; and while I am not a theoretical vegetarian, either for sentimental reasons or otherwise because as a student of the subject I can not take a ground of that kind, still you are on the safe side in following the principles of the Battle Creek Sanitarium.

Q. Do you think your system suffered any permanent depletion as the result of your fast?

A. No. I will tell youthe only effect it has had that I know of is that whereas I was inordinately fond of sweets, candies, sugar, and that sort of thing, the taste for them has sloughed off, and I find myself so satisfied with what you would call the sugars that are manufacturdd in my mouth, the sugars that come from bread, that I have no desire for sweets. I believe that sweets like alcohol are more or less cultivated taste; that is, these highly artificial sweets.

Q. How long must one fletcherize before he receives noticeable results?

A. Immediately you get noticeable results if you have been a dietetic sinner. You know most persons pretty nearly fletcherize, but not always, and the thing to do is to practice it always, because in those moments of carelessness is when you do the damage. If we did not fletcherize pretty consistently all the time, we would all be dead. It is the necessity of our existence. The only question is to be thorough at all times, and not to neglect it at any time.

Q. How many calories a day do you suppose you eat on an average?

A. I have had that tested in the calorimeter. I have been in the calorimeter on several occasions, once for three days and a half when I was locked up; and Dr. Kellogg has been in the calorimeter; and whenever I have had the calories measured, my consumption has averaged from 1500 to 1800 calories a day, and that when I have been particularly active. Dr. Kellogg's I think measured from 1200 to 1500, but he is a smaller man than I am, but very much more active. And let me say about Dr. Kellogg, I have been trying to get a gauge on his activities, and Napoleon was a lazy man as compared with Dr. Kellogg.

Q. What is the formula you mentioned that is followed at Yale?

A. Dr. Kellogg in an address at a meeting of our Health and Efficiency League at Chautauqua, gave the key to the whole situation. He said that to establish and maintain the automatic equilibrium of nutrition in the presence of any foods, whether complicated or simple, is the key to efficiency, and that is true. The formula is this: Do not eat until you are hungry. Get all the taste out of your food, solid or liquid, in the mouth, enjoy it to the full, give it full appreciation, do it with reverential appreciation, and only swallow it when it swallows itself; and that is all there is to it; but while you are digesting your food, love everybody and love everything. As I said the other evening here, to give an illustration which was familiar to all of us, if I were Mr. Jeffries or Mr. Johnson, and I had an engagement to meet Mr. Jeffries or Mr. Johnson to do him up, while I was in training to do him up, I would love him for all he was worth,--in order that I might do him up. I would not love him for his sake, but for my own sake.

Q. Do you drink water at meal times?

A. I do, and it is the only time when I ever want it, and consequently I take it. I take it in response to thirst, and only to quench thirst. And, by the way, a decision has come out at the Rockefeller Institute, in New York, in recent times, that the taking of water when you are thirsty at meal time, is a good thing and aids digestion, which I always believed to be the case, because Nature does not give the thirst unless she wants the water. Many physicians, and mature physicians, will tell you to drink a quart or two quarts of water, because it flushes out the system, just the same way as you would wash out the gutters. It is nothing of the xkaxxx sort. When you are thirsty, the body wants water, you swallow it, and even before it arrives in the stomach, it is in the blood, and you can get it back in three or four or five minutes. It has simply gone into the blood and gone through the whole body two or three times, and has got into the salivary glands, and that is where you need it. If you are thirsty it goes immediately. You know the taking of too much water is equivalent to the water cure. You remember there was a xam scandal about our officers in the Philippines practicing the water cure on the Filipinos who would not confess; that was one of the favorite resources of the Spanish inquisition,--was what was called the water cure. That is to say, they would get a man down on his back, or make him drink glass after glass of water until xxxx he could not drink any more, and they would force it on him and he became thoroughly waterlogged, and there is nothing so painful. Those persons who follow the prescriptions to drink two or three quarts a day to flush out the body are practicing upon themselves a mild form of the water cure.

Q. Do you object to taking fruits and sweets, or both or either one between meals?

A. I advocate eating anything whenever there is an appetite for it, no matter when it is, but eating it in the right way so that the appetite will have a chance to limit itself,to have a descrimination. If a person fletcherizes his food properly, that is, the ordinary, simple foods with which he comes in contact, he will find that there will be that complete satisfaction between meals, and I can tell you you won't want fruit and other things between meals; you won't want stimulants of any kind; and the probability is your smoking after while will slough off. There have been so many instances. Prof. Magan was present when my smoking sloughed off. That was six or seven years ago.

Q. Does not the appetite satisfy itself normally with a very limited number of dishes at one time if they are properly taken?

A. Yes. It is desirable to have some variety for the appetite to select from, because Nature abhors monotony as she does a vacuum, consequently a generous menu is a very good thing. But my appetite, which is a very exacting one, will satisfy itself, or does on test occasions, with a little round--and I may say I do love corn bread; I love brown bread; I love butter and beans and fruits in season, potatoes and that sort of thing. I am very fond of potatoes in different forms, and when I was doing my endurance tests in the Tyrol a number of years ago, some eight or nine years ago, when I was doing everything I could to induce fatigue, the hardest sort of work anybody could do in hot weather, when I would round up along about sundown at the hotel, my appetite almost always selected German fried potatoes and milk, and rarely anything else. Now, that was on a very long menu, and it reverts to that almost always,--that is, something similar to that.

Q. What relation does intemperance of eating have to crime?

A. I believe it is the foundation of it all. You heard Prof. Magan's evidence with regard to that moonshine whiskey drinker. Our Roman Catholic brethren, through the leading of Father Higgins, of the Germantown Seminary outside of Philadelphia, and with the consent, with the knowledge of Cardinal Gibbons, had issued xx a circular in which they state that not only is great economy effected, but they emphasize the fact, put it in capitals and underline it,--they say it, and emphasize that it is a condition which makes for poverty--that is, intemperance. And what they underline is the fact that no fletcherite can be intemperate in the use of alcohol. Now the same sort of common sense,

calm

calm satisfaction coming from right eating puts one into state of not wanting. You know, the highest felicity is not wanting anything. When you haven't got a kick coming, there is nothing you want, then you are perfectly happy; so consequently you eat your food, and you haven't any of those abnormal cravings, those bad appetites; you do not want stimulants, you simply go on generating energy and enjoying txxx yourself to the highest, and it seems to me as if a person in that condition could not commit a crime. The many intemperate habits with which we are beset in these civilized conditions slough off with the attainment and maintainment of vital nutrition.

Q. I understand you fasted seventeen days without being hungry and you ate beans. Can you eat beans with impunity whether you are hungry or not?

A. No, sir. I don't quite see the connection between your question and my experience. How could you know you are not hungry until you give it a trial? There is a very good reason in your question. But there are two sides; there is the mechanical side and the psychological side to it. You can habituate the appetite to rest and quiet; but if you give it an inch, it will axxxx then express itself. If you invite it to speak, it will speak loud.

Q. Does not one at first lose flesh when fletcherizing?

A. At first, unless they are very thin.

Q. What do you think of a milk diet?

A. For babies I think it is splendid. For grown persons it is a very well balanced food, but I might answer that as I do all questions with regard to the selection of food--the thing you like best is what the body wants. And if you have a craving for milk, the body wants milk; but you should not make a prescription of any sort. I am anti-prescription. The only proper and just prescriber is the body itself expressed in terms of appetite.

- - - - - - -

v-9-16-10.

613

A UNIVERSITY OF HEALTH AND EFFICIENCY.

A Lecture at the Sanitarium Gymnasium, Thursday, September 16, 1909, at 8 P. M.,

By

Dr. Horace Fletcher.

- -

Ladies and gentlemen: I have been requested to repeat tonight the description of the process of digestion as pictured, as it were, upon the walls of the stomach very much in the same way as the activities of the outdoor gymnasium were pictured upon the screen tonight. It is a picture of digestion that has not been understood thoroughly until within the past two or three years; but now we know that there is a system of signals set up within the body in connection with the ingestion and digestion of food which performs a very useful purpose in securing perfect digestion.

During the time that food is in the mouth and is being tasted, there is conveyed by the vagi nerves, and through hundreds of terminals upon the walls of the stomach, a perfect picture of what is going on in the mouth, a representation not only of the quantity of food that is in process of ingestion, but the kind of food and the nature of the digestive agent required for the purpose of digesting it. It is most remarkable. It is like a silhouette. That is, you can imagine it is so; for, suppose you take a piece of ordinary bread, perhaps a half inch cube, into the mouth and gradually develop taste by the aid of the saliva, transforming the starch into dextrose or grape sugar which is the assimilable form of starch,--just what is going on in the mouth is conveyed by these means to the stomach so that the digestive agents are prepared beforehand; they are exuded into the cavity of the stomach, so that when the morsel of bread or whatever else is being tasted is dropped into the stomach through the cardiac opening, it falls practically into a digestive bath. The importance of this can be realized when it is understood that if the food is only half tasted it can be only half digested. If it is not tasted at all, the morsels of food drop into the stomach and become inert, dead masses; and the same thing happens to food in that condition that happens to dead animals--dead animals in the gutter of the roadside. Therefore it will be recognized how important it is to cultivate and to develop all of the taste possible relating to a morsel of food during the time it is in the area of taste. It has been said, and said rightly, that digestion depends not upon the quantity of the food, at least nourishment depends not upon the quantity of the food, but upon the amount of the taste extracted from it; and this is true.

I want to speak to you tonight about the University of Health and Efficiency which is growing up here in Battle Creek and which we are enjoying now. These sports which have been pictured upon the screen are but a few of the pleasantries that may be engaged in in this delightful spot. It is not known to many that it is really a university of complete education. It is quite possible for a child to be born in the streets of Chicago, not knowing his parents, to be wrapped up in a bit of cloth, to have attached to him a tag of the American Express Co., and addressed to Battle Creek, to Dr. and Mrs. Kellogg, and that child is sure to come here and to fall into hands so hospitable, so kindly that you may be assured, and you may insure the fact that the child will pass through a series of education equal to that anywhere to be found in the United States, and to emerge when of age a splendid citizen of the United States, a Christian Altruist, and go out into the world as such.

There are in the United States, it is said by statisticians of the subject, in the neighborhood of 450,000 children so completely neglected that it is impossible for them to become honest boys and girls and good citizens. Think of the disgrace of such a condition of affairs in a country like this with the abundance of wealth and with every facility for being kindly and hospitable to the poor waifs, and yet to have nearly half a million falling into such conditions as these. They are children who are born into areas of neglect where they never learn to know what the good is until they have become incriminated by the bad and are really taboo in society; for to have once been marked with the stigma of crime, no matter what the age, no matter how little responsible, that stigma attaches to the child during life, and at no time is he safe from the tongue of reproach for the crime perhaps committed in childhood. Consequently, in this country of ours, blooming as it were with wealth and with every facility for hospitality, we find this large number of children born, you may say inevitably into crime. It is certainly a reproach upon this country, and I was going to give an illustration and some incidents to prove that it is purely the fault of society that this exists; but I will not do so tonight. I am going to reserve that for tomorrow night before the Business Men's Association of the City of Battle Creek; but I want to say a word about Battle Creek.

Battle Creek is to me one of the most attractive places on the Continent, in fact in the world, because of the atmosphere of sweet reasonableness, you may call it, that covers the landscape here in almost every direction. Each time I come here I feel it more and more. It is an irresistable attraction which grows upon one as one comes here year after year and sees that the conditions existing here go on persisting year after year, and that one may drop in here as into a sanctuary of heaven at any time for a few days, a few hours, a month or so, and get the recuperation which may be had here so easily and so agreeably.

I have been for many years pursuing the occupation--I will not call it an occupation,--pursuing the object of cream-skimming. That is to say, in any part of the world where there is anything going on that is especially interesting, I make it my business to go there and to participate in the enjoyment and in the festivities. There is no place on the Continent that I enjoy dropping into and remaining a few days more than here in Battle Creek, and I speak as one accustomed to what you may call the creamy parts of earth, and consequently I speak of it in high appreciation tonight in order that some of you who have not traveled so extensively over the world may feel the value of the entertainment and of the enjoyment that is put up here in this blessed burg of Battle Creek.

I want to speak also of this Middle West, the home of many of you here, and its wonderful facilities for education. Within three hours of this City, on the Grand Trunk Railroad, is the city or town of Valparaiso in Indiana. Thirty-six years ago it scarcely had a school. Now it has the largest practical university in the United States and perhaps in the world. It is the University of Valparaiso, and we have had the pleasure within the past few weeks of having with us the President and one of the originators of that wonderful institution. Last year the enrolment amounted to nearly 6,000 persons; and between 3,000 and 4,000 are in attendance upon the classes there during all of the year; and it is one of those extraordinary places where education is almost free; for it is possible for a young man to go to Valparaiso, to be taught, to be boarded, to be lodged, for only $125 a year. Think of it--not fifteen dollars a month. And right here in this narrow area--narrow only in the sense of its being concentrated, you have all the facilities of a classical university and a university of health, a great university of health; and it is something to be appreciated, I assure you. I am going to speak upon that subject at the Business Men's Association tomorrow night.

But in addition to expressing my appreciation of this as one of the creamy spots of earth, I am going to say that there has been born here a Health and Efficiency League, backed by some of the most powerful influences in America; and the object of that League is not only to study subjects relating to human health and efficiency, but also to conduct such large experiments as to test the universality of the ideas underlying the principle; and this League is forming here in Battle Creek. Many of those who are here now were here the other evening when the purpose of the League was under discussion; but if there are any here tonight who did not then send in their names for the purpose of receiving the literature of the League, I hope they will do so tonight. The number has already grown into many hundreds, and it is quite desirable that it should grow to many thousands.

One of the requests of the evening was that questions relative to the League, and also questions relative to the specialty which I particularly promote, might be answered; that those present should have the privilege of asking questions and, with Dr. Kellogg's permission, I am now at the service of those present for that purpose. If they are not too difficult I will try to answer them for you.

Dr. Kellogg: Mr. Fletcher, a question which has been asked me many times is this: How much time does Mr. Fletcher occupy in eating his meals? How can a businessman get time enough to fletcherize?

Answer: That depends somewhat upon the meal; but where there is an abundance of everything, the time required need not be more than half an hour a day for full sustenance, and that under conditions of hard work. At Yale University I never spent more than twenty-eight minutes in the consumption of food, and at the end of that test period I weighed slightly more than I did in the beginning.

Q. Twenty-eight minutes at each meal?

A. Twenty-eight minutes at both meals,--from twelve to fourteen minutes at each meal; but that meant there was no discussion of politics, no question raised as to whether Cook or Peary had found the north pole; it was a strictly business affair.

Q. What did you eat?

A. On that occasion I may say that corn flakes had not been discovered at that time, but a breakfast cereal, milk, and maple sugar,--one quart of milk served for the day; the breakfast cereal according to taste, and maple sugar according to the sweet tooth of the time.

Q. Do you think it is best to make especially a business proposition of the meal, or would you make it a social one?

A. If it can be made an attractively social affair it is a very good thing. If the compliments passed about are all favorable and nothing but good cheer passed about the board, then sociability is a good thing; but anything in the form of controversy, a scrap, a discussion of politics, or anything of that sort is prejudicial to digestion. It is not so much the amount of the communication as it is the quality.

Q. What did you eat for your noonday meal?

A. The noonday meal in my case is the first meal of the day. I have no means of judging of the quantity in ounces, or even in calories; but my rule is to have as keen an appetite as possible, and to satisfy it as completely as possible with whatever is at hand. I am very fond of baked potato; I am exceedingly fond of watermelon in season, and muskmelon at all seasons of the year; there is scarcely anything on the bill of fare of the Battle Creek Sanitarium that is not palatable to me.

Q. When do you have your second meal?

A. In the evening at six o'clock or seven o'clock, unless I am busy. If I am busy, I take nothing until the next day.

Q. What do you take for your second meal? You said you took corn flakes for your breakfast and maple sugar and milk; what do you eat for your second meal?

A. I did not say that I took corn flakes. At the time I took for breakfast a cereal, milk and maple sugar, I was taking two meals a day, and I was taking the same food at both meals, and that was for the purpose of saving trouble to the laboratory. It is a complicated matter to analyze foods, and I knew that that food would please my appetite and would serve my purposes, and consequently I chose it in order to make it easy for the men in the laboratory.

Q. Do you consider it advisable to make a point of discussing a business proposition at lunch?

A. It depends entirely upon the nature of the business, entirely, because it is the quality of the thought and not the thought itself that causes the disturbances of digestion.

Q. Do you approve of drinking fluids at meals?

A. It is my habit to take water whenever I am thirsty, and the only time I am ever thirsty is at meals. But I never take water for the purpose of washing down food.

Q. Do you fletcherize water?

A. It depends upon the water. Pure water is perfectly neutral. It is neither acid nor alkaline, and there is nothing that saliva can do to it; consequently it is in condition to be drunk; but if it have anything mixed with it, like lemon-juice, or even sugar, it is then desirable to treat it with the saliva; but if it is pure water it may be drunk in ounce quantities until the satisfaction of the thirst.

Q. What do you mean by an ounce at a time?

A. The ordinary swallow happens to be an ounce, and I merely mentioned that because it happens to be so, and you can judge of the amount of water you are taking if you ever want to measure it, by the number of swallows.

Q. You do not just drink a glass of water down?

A. Only enough to satisfy the thirst.

Q. How can you tell when you have taken enough food?

A. There is only one way of telling when there has been enough; but there are two ways of telling when there has been too much. When there has been enough, if the food has been carefully taken so that the appetite might discriminate, the appetite will be cut off short, sometimes between two morsels of food; but in that case there is no gastric distension; there is no fulness of the stomach. Whenever a fulness of the stomach is felt, it is evidence that food has been taken really in excess of the need.

Q. Did you suffer from indigestion before you took up this test?

A. Yes, many years ago I suffered enormously from indigestion.

Q. How did you discover this method?

A. The question is, how did I discover the efficacy of the careful mouth treatment of food? It was partly through accident and partly through search. And it came about very naturally. It is quite a long story, but I can tell you in a few words that I had supreme confidence in Nature, that she intended for us only well, that if we were suffering any disabilities it was our own fault and not the natural intention; that if Nature had given us any responsibility in the matter she had not hidden it away in the tortuous alimentary canal, but it was somewhere within our control, before we had lost control of the food. That led to a study of what happens within the area of our control, and there the books were defective because they told us very little of what happened there, or what should happen there; consequently I took it up in a businesslike way to thresh it out after the manner of the Japanese in treating the subject, and I very soon found that very little had been known and less taught about that important area which is our responsibility, that first three inches of the alimentary canal; and when you come to think of it, Nature has given us every incentive to pay attention to that small area of the alimentary canal, that area above the guillotine line as it has been called, because there all of the senses are bunched; all of the compensation in connection with food is there felt; and it is the most unbusinesslike proceeding imaginable to slight that area, and to pass on quantities of food to the inhospitable stomach where it not only is not wanted, but where it becomes poison. I will say in connection with this that one of the most important tendencies in reform has grown out of this careful study of the treatment of food in the mouth. Now, it may seem a very small matter to you, you may be strong, you may be young, you may have the stomach of an ostrich, and Nature has the patience of a saint; and you may go on abusing those organs, throwing work upon the involuntary part of the alimentary canal; you may do that for a number of years and it may not seem to make very much difference; but you can take it for granted that during all of that time a large part of the energy which you might have had available for work, for play, for study, has been squandered in the heroic attempt of Nature to correct the abuses of neglect. It seems a very simple matter, but it is of the utmost importance. There is no doubt that nearly all of the invalids here, those who come here for recuperation, are here simply on account of neglect of that first three inches of the alimentary canal, and they are suffering in one form or another, as Dr. Kellogg tells them many times a day and on every opportunity, from autointoxication. The booze of beef is worse than the booze of beer; and it is a veritable booze; it is a poison; it is an intoxication.

Q. You spoke of leaving off supper sometimes. Does not that irregularity interfere with your digestion?

A. I have never known anybody to suffer from leaving off supper or any one of the meals; but I have known persons to suffer very acutely for taking food when they really had no appetite for it, and simply because it was the schedule time to take it.

Q. Do you believe in a regular meal hour, then?

A. I do if the activities are regular; but if the activities are very irregular, then the appetite will accommodate itself to the activities, and food should be taken when the appetite is in readiness.

Q. Do you think a man doing very heavy mental work should fast at that time or eat very lightly, more lightly than at other times?

A. I can speak in that regard only from my own experience. I do my work best before eating food. My work is done usually between two o'clock in the morning, or three o'clock and one o'clock when I take my first food; and that is the productive time of the day; that is the time of endurance; that is the time of clarity of thought.

Q. How do you choose your breakfasts and dinners from the menu we have at Battle Creek? Isn't it too much of a variety?

A. It certainly would be if everybody took everything there was upon the menu; it is a very generous menu.

Q. I mean, how would you choose your breakfast or dinner from such a menu?

A. I have a discriminating sense. My appetite controls, and I have no difficulty whatever. If I see a thing that looks attractive, I check it off, and I go on through the list in that way, and my appetite governs entirely that selection. If you had a little dish of salted almonds on your right hand, and a radish on your left, and a bit of celery on another part of the table, and a lump of sugar, and a piece of bread and some butter, your appetite would lead you from one to the other of those just as distinctly as if the body had a language and called these things by name. There is very little trouble in that regard. The appetite is quite sure; it understands what it wants. I may give as an illustration the fact that thirst is merely the appetite of the body for water. You know when you are thirsty; you know distinctly when you are thirsty. So it is with regard to other articles of food, although water is not a food. Is water a food, Dr. Kellogg?

Dr. Kellogg: Yes.

Dr. Kellogg says it is a food.

Q. If you should take medicine would you fletcherize it?

A. I have not taken any pills or pellets for very many years, and I really do not know. Perhaps you can give us information on that subject.

Q. Have you taken a tonic?

A. Water is a beautiful tonic.

Q. I mean, some of us may have prescribed tonics for us on certain occasions.

A. I really don't know what tonics are.

Q. Say for example, some petroleum emulsion,--would you fletcherize that or drink it down?

A. As I think of it from this distance, I would eschew it. (Applause).

Q. If you were not hungry at all but only knew you ought to eat because you felt very faint, would you eat then? Or would you keep from eating until appetite came?

A. I am glad you asked me that question because it gives me a chance to say that that faintness is not a mark of hunger at all. It is a pathological symptom, and it means you have over-eaten previously, and it is the grumbling of the last meal, and the best way to quiet it is to pay no attention to it whatever but to let it work itself off. I never suffer that sense of faintness. The growth of my appetite is like the growth of a young sapling; it is beautiful; and the accumulation of it is delightful and desirable.

Q. I mean when you had indigestion many years ago?

A. I don't remember, it was so long ago. I don't remember what it was like.

Q. What does your appetite demand now, or what is most craved by a healthy appetite?

A. Perhaps I can give you the answer to that question, but I can only speak from my own experience, and as I think of the things we have commonly on the menu here. A baked potato appeals to me. The soups, in the first place, appeal to me, and then baked potato, bread and butter, and milk; those are the staples that I happen to think of at the moment.

Q. How many hours a day do you sleep?

A. My habits are to sleep four and a half or five hours on a stretch, and then sometimes in the afternoon or evening if anything is going on that is not particularly agreeable, I sleep through it.

Q. What is the cause of sleepiness after eating?

A. Stuffiness.

Q. If you do an unusual amount of work during the day, do you take more nourishment that day?

A. Not that day, but usually the next day, and the day after. It comes gradually; that is, the repletion comes gradually. I once lost two kilograms or five pounds during one day, and I think it was a little more than a week before I had regained that amount, but it is impossible to tell how much of that was moisture and how much was not. It is impossible to measure those quantities.

Q. In the case of a child who has suffered from paralysis and inability to make perfect use of the tongue, would recommend the giving of large pieces of meat, too large to swallow, to the child to chew on, so as to encourage the child to masticate?

A. Well, giving a child large pieces of meat anyhow is equivalent to giving it poison.

I think if there are no more questions, I will close, as it is now past nine o'clock. I thank you for this opportunity to address you. (Loud applause.)

- - - - - - - - - - - - - - - - -

v-9-17-9.

LECTURE

At the Sanitarium Chapel, Battle Creek, Mich., Monday, August 30, 1909, at 8 P.M.

by

Dr. Horace Fletcher.

- -

Dr. J. H. Kellogg. You do not need to be introduced to Mr. Horace Fletcher, or to have him introduced to you, for the whole world knows him. Mr. Fletcher has very kindly consented to talk to us tonight upon his favorite theme, Fletcherism. (Loud Applause).

Mr. Fletcher. I can not tell you how much pleasure it gives me to be here tonight and to find this interest in the question of health and efficiency which is so evidenced by this large audience. I have just come from the parent Chautauqua at Chautauqua Lake, New York, where, during the two months' season, we have had upwards of forty addresses, and always to large and very interested audiences. Dr. Kellogg is kind enough to say that I am a drawing card. That I deny because I assure you I could appear with any other subject that I know of and not interest people at all. It is the subject, and it is the subject in which we are all interested, because it relates to our welfare, our happiness, to the most intimate of our life interests. At Chautauqua two weeks ago, at the close of health and efficiency week, under the inspiration ~~and~~ of a glorious address by Dr. Kellogg, and one supplementing it by Mr. McClure, who has been here, a mass meeting assembled under the chairmanship of President Vincent, of Chautauqua, and we formed a health and efficiency league; that is, we established the nucleus of a health and efficiency league. A large number of persons indicated their interest in the subject, and there is no doubt in my mind ~~of~~ but what it will be the next great movement of humanity towards realizing their resources, realizing their wealth, their natural heredity which is constant good health and a very much higher efficiency than is now enjoyed by the average of mankind.

During the past ten years, we have operated and carried on a number of experiments with the purpose of dinsing possibilities of improvement through various means. We all know that during the latter part of the last century great attention was paid to the realizing of our resources in discovery, in invention, in the improvement of livestock, in the improvement of plants. Enormous progress was made until it was possible to grow twice the amount of wheat upon an acre that formerly was the case. We were also able to get twice the amount of milk and cream from dairies, from herds, that was formerly the case. And in the realm of invention and discovery, we have conquered the air, we have conquered the water, we have conquered everything in the way of the inanimate forces of nature; and now, having sought health and happiness and wealth in these extraneous directions, we are turning to see if we can not put ourselves into a condition to enjoy our luxuries better than we have been.

I have been interested in this movement from the beginning, and was fortunate enough to fall upon a discovery, a discovery of something that had been under my nose for fifty years, and being so near and so directly under my nose it had not been noticed at all. And when I made the discovery for myself, I looked about and found that it had escaped the notice practically of science, of the medical profession. It was that little three inches of the alimentary canal, the first three inches of the alimentary cana, you may say the corridor of the subject of digestive efficiency; and in seeking knowledge of the subject, science had taken a hop, skip and a jump through that important small section, and had gone into the interior of the subject; and when I came to look for what information was printed upon the subject, I found that some 2500 to 3000 pages of small print, quarto, had been devoted to speculation relative to the xkxee feet of thirty feet of alimentary canal lying beyond, and only a few pages, not more than two chapters altogether, devoted to the important part which was the human responsibility.

Dr. Van Someren, my colleague and son-in-law, has rendered great service in this study by separating the responsibility in this matter of human nutrition. He calls it the voluntary and the involuntary digestion; the voluntary portion all occurring, then, within these two or three inches of the alimentary canal, and Nature accepting the responsibility of the thirty feet lying beyond. If we do our part well, if we do it faithfully, if we do it even respectably, Nature will do the all the rest aright. But we have been neglecting our portion. I must tell you that in seeking to locate, to concentrate our own responsibility in the matter, we have been looking for all sorts of catch phrases or suggestions that would simplify the matter in the minds of the layman to induce him to stop searching about all over his body for symptoms and reasons, causes and effects, and to concentrate where Nature has intended that his responsibility should rest. And Henry Mills Alden, the veteran editor of Harper's Magazine, Harper's publications, in introducing me to an audience near New York recently, gave us a new definition or illustration which it is of value to remember, and I will tell you how he did it. He said it was not often given to a man to give his name, or to loan his name for the purpose of verb-making and noun-making in a language. He knew of no American but one who had done so, but in Europe there were many,--there were Pasteur, and Mesmer, and Boycott, and others, and one especially, a certain Monsieur Guillotine who had invented a machine for the shortening of human life; whereas the speaker of the evening had invented a method whereby we might prolong the human life--two quite different things. And consequently, it being a picturesque allusion, we say that all of the responsibility in the matter of nutrition lies above the guillotine line, and we need not think of the rest of it except as an efficient machine with which to accomplish any of the purposes of our desire if we will only faithfully perform our responsibility above the guillotine line. And that responsibility is comprised in two details, I may say,--the mental and the dental, with the dental purely subservient to the mental. I have been dignified as the "chew-chew" man because I have insisted that mastication was necessary to produce--to attain and maintain right digestion and right nutrition; and that is quite true, because that had been sadly neglected, and neglected for many reasons. But I have insisted upon dental care because it is the facile but not altogether necessary servant of the mental process which is the true guard and guide in nutrition.

If we have no teeth at all so that we are compelled to suck nutriment out of the food as babies are compelled to do, we are much better off than if we have very bad teeth which are painful to use, and which lead to the bolting of food to escape the use of them. Consequently, let us call chewing, while a very useful process in attaining and maintaining right nutrition, as not absolutely essential, but it is essential that we should get all of the good taste there is in food out of it in the mouth, and for reasons which I will explain.

In the first place, Nature has bunched above the guillotine line, not only all of our responsibility in this matter, but all of the senses which take cognizance of the process. There are taste and odor, smell, feeling; and all of the felicitations, practically, of eating are felt and enjoyed above the guillotine line; and if we become so thoroughly epicurean, whether it be from selfish motives, or whether it be in order to effect our higher, our better efficiency, we are accomplishing a purpose which Nature has given us to perform, and this is a beneficent purpose, because the more we perform our part rightly, the more Nature rewards us very faithfully in the terms of good taste, in the terms of complete satiffaction; and I may say that if we could concentrate upon this, if we could bring our reverence to bear upon it and feel that when we are aiming for dietetic righteousness, we are serving upon the alter of our nutrition, we would not violate any of the sacredness of religion or of the word righteousness.

It is a fact, and a fact that we should all bear in mind, that it is entirely possible to feed for efficiency or for inefficiency, to feed for morality, or for immorality, to feed for temperance or intemperance; to feed for irritability or for amiability. And with such objects before us to avoid or secure, is it not a sacred function that we are called upon to perform within the beautiful area of the mouth--and what a wonderful place the mouth is! It will stand more heat, it will stand more cold, it will stand more abuse, it will give more pleasure than almost any other area of the body; and we have neglected it frightfully. We have not only missed our opportunities in bolting food, but we have suffered untold misery as the result of the return of acid fumes to the mouth; as the re-
~~sult of indigestichowthrresult of ournoreglectt this important area of the mouth?~~
Thar sult of indigestion, the result of our neglect.

And now, how are we to know more about this important area of the mouth? There are many of you here who were here when I was here last, but during that time we have constructed a picture of digestion which I think is much more interesting, much more easy to remember and to understand, and to feel, really, than any other picture of digestion that has been given; and that is an account of the signalling process which Nature has installed for the purpose of taking care of progressive digestion all along the line of the alimentary canal.

Now, we use our teeth, or we use our gums, or we use the sucking process for the purpose of mixing saliva with the food in transition. The saliva performs a chemical act in its contact with the food. The physiologic chemists tell us that the ptyalin of the saliva transforms the starch of the food into dextrose or grape sugar which is the only assimilable form; it is practically the malt honey which is served to you upstairs, and which,xxsx as was discovered in Japan twenty-five years ago, acts as a great digestive assistant. It is there called "metzuami"(?). It is what the saliva does to the starch of the grain in the mouth, and it is the taste which we find so delicious when we are developing it from a morsel of simple bread. Now that taste is transferred. That is the picture, and that taste is transferred through the great vagi nerves to the stomach. There are millions, perhaps, of the terminal ends to the vagi nerves set all over the walls of the stomach, and there is a picture there of what to expect, not only of the kind of food that is being transformed, but the quantity, the amount of the digestive agent required for the purpose of digestion; so that while we are still enjoying the taste of the food in the mouth, preparations for its reception and digestion are taking place within the stomach. There is a picture as intelligent to the organs, to the functions of the stomah as are the projections of the lantern slide upon the screen to our visual senses; and while we are still enjoying the food, I say, these digestive agents are being poured out into the stomach in advance of its coming, so when finally it passes through the cardiac opening of the stomach, it practically drops into a digestive bath xlrxxdy all ready for it; and another thing to perfect this process,--if we have given full attention to the process in the mouth and derived all the taste from it, appetite has been served with a notice of what is being served to the body,--when the body has received all that it needs of that particular food, appetite will cut off short, and there will be complete satisfaction and no desire for more of that food; so consequently while this signalling process is signalling the stomach to get ready the digestive agents there, it is also giving information to the appetite so that it may shut off when just enough has been received. And the consequence is that when food is taken into the body that the body does not want; when food is taken into the body that the body can not digest and assimilate and use; and when complete satisfaction has been gained, although perhaps the stomach may not be half full, there is no gastric distention, the body has been thoroughly served and there is nothing to be harped upon by the hostile or unfriendly bacteria for putrid decomposition.

Now, the beauty of this is that if we perform our part of the signalling process perfectly well, if we up in the switch box are doing our part faithfully, Nature will take care of all the rest throughout the whole process of the alimentary canal. I will not say anything about these signals as they progress.

Dr. Cannon, of the Harvard University Medical School, in our experiment station in New York one night last spring, gave a very graphic picture,xx he told a very graphic story of the picture which is carried from the stomach xxxx to the duodenum, and so on through the rest of the alimentary canal; but that is xx xxx within the field of Nature's responsibility, and we may not pay any attention whatever to it. Let us confine ourselves to this portion.

Now, it is only necessary for us to wait until we have a thoroughly keen appetite, an earned appetite, before we take any food at all. Hunger is merely a negative expression which means want. The only evidence of hunger to us is appetite. Hunger never expresses itself, healthily, normally,--in fact, it never expresses itself below the guillotine line. In these sensations of faintness, all-goneness, the hunger that is expressed here is not hunger in the true sense of the term; it is a pathological symptom meaning that the body has already too much of something and that there is indigestion; and these are the protests of the body--indigestion, the fumes, you may say, of indiscretion; but true hunger is only expressed by a keen desire for some simple food, bread and butter, or even bread alone, accompanied by a copious watering of the mouth. And let me give you a little illustration so you may know sometime when you are hungry if you are not quite certain about it. If you have been out playing golf, or if you have been out taking a sunbath in the outdoor gymnasium, or if you have been splitting wood, or if you have been xxxxxxx xxx xxxd sewing or knitting or reading, or occupying yourself in any profitable way for a few hours and begin to think of food, or if you happen to pass by a cottage where biscuit or potatoes are being taken out of the oven, and you get a whiff of them, and if you find yourself distending the nostrils in order to take in that delicious whiff, and if you find yourself inclined to stand and whinny like a horse in order to express your appreciation of that smell, then you may know that you have got a good, keen appetite; and it is perfectly safe for you to set out to cater to it. And then you need not go further than the next food available. It may be in a great hotel; it may be in a boarding house, it may be in a miners' camp out in the woods, and comprisedxxrxxx purely of the natural foods, the nuts or the things that might beselected in Nature. But with that appetite, take the food available which appeals to the appetite, and get all the good taste out of it in the mouth, and you will find there is a natural separation at the back of the mouth, cutting off the throat from the mouth, which is automatically served by the nerves surrounding the circumvallate papillae, so that when all of the taste has been taken out from the food, and it is ready for further digestion, this will open automatically. and it results in what I might describe as involuntary swallowing. But when you pay attention to that, if we have given all the attention to getting all of the taste out of the food, then the food will practically swallow itself as soon as it is ready for that process. And, having done that, we have performed all of the mechanical requirements and all of the mental requirements, allthe psychic requirements imposed upon us by Nature; but we are living under conditions really so extraordinary that we need to be protected more; and I will give you an illustration of what that means by describing to you some of the observations of Prof. Cannon, of the Harvard University Medical School, in which he has observed cats.

My son-in-law and colleague, Dr. Van Someren, came over to this country some five or six years ago and offered to submit himself as a test subject, if it was thought well to study the human being; but they found in the case of the human being that the bone was too thick, and they could not penetrate it readily; and they found that cats served very well, and they have given us also a shadow picture, a silhouette picture of digestion which confirms the picture I have given you before.

Suppose, for instance, the cat is allowed to get good and hungry; that is the first requisite; and when so, he is given food which is palatable to him but, unbeknown to the cat, this food has been stained with subnitrate of bismuth, which is opaque to the X ray, consequently when the cat takes the food and swallows it, you see it going down through the gullet, it is picked up by the peristaltic rings,--mind you, this dark shadow of the food is picked up and carried by peristaltic rings until it reaches the stomach, and when it reaches the stomach it makes those characteristic trips about through the stomach, down along the fundus, then across the arc, depositing particles of protein upon the walls of the stomach, separating the other particles and carrying them forward, and by and by you begin to see it as it passes out the pyloric end of the stomach; then they begin to shoot through in little quantities into the duodenum; and then immediately there is set up that very interesting prosess which is going on during some ten or twelve feet of alimentary canal always,--Dr. Cannon calls it segmentation. There are thousands of little projections upon the inner wall of the small intestines called the papillae colivente, and these dip down into each other as the tongue of a dog or a cat would dip down into a dish to get milk; and they lick up nutriment, transfer it to the lymph and blood stream until it is entirely exhausted and there is nothingxxx left but the small, indigestible residue; and while that is going on, everything is going on as it should; but if you divert the attention of the cat, perhaps, for a moment, distract the attention, disturb the cat, you will find the process begins to slow up, there is less movement, there is hesitancy in the process; and then if you make the cat mad so that he begins to spit, whereas he was purring, the whole process stops; the muscles become flabby, the digestive juices all cease to flow, the food in process, although it is half digested, ceases to be further digested; and then is an opportunity again for the bacteria to heap around and to decompose it. It is as dead within the walls of the stomach as would be a dead cat or a dead rat on the roadside.

(At this point a small boy ran by the windows outside shouting "Fire!", the fire bell having rung a few moments before, and immediately those near the doors began to run out, creating a near-stampede.)

If you will all sit down again, I will give you as an illustration how a little excitement like this affects that process of digestion. Those of you who are entirely devoid of fear thought, who could not be made afraid even if the house should burn up, who could smell your own burning bodies with perfect equanimity--to such persons it would make no difference at all; but if your hearts had begun to flutter at this ominous word of fire, and if you are in any way disturbed, your process of digestion has quit for the time being, and it will take it a long time to get it in order; and really, disturbance or excitement of this kind will do more harm than all of the good that can be done by the preaching of the Sanitarium staff for weeks; and the thing one needs to take into consideration in connection with this matter is to divest yourself entirely of the possibility of fearthought.

You know the great enemy to digestion is what we call the depressing emotion. Fear in any one of its forms,--fearthought, anger, worry, controversy,--anything of that sort will stop digestion as perfectly as if you were to cut it off with a ligament; so that it is one of the things to be taken into consideration. In the first place, never eat unless you can eat under conditions of calm. Never have a scrap at the table; never discuss bills at the table; never argue politics, religion, the suffrage movement--nothing of the sort, because it is inimicable to digestion. What you should do is to prepare yourself to pass compliments across the table, for that is the best sauce for digestion. (Applause).

One of the comic papers in New York the other day in commending upon this assertion of mine, made a series of pictures in which the husband had come down all prepared to make a change in his demeanor at these times. He had been a surly, newspaper-reading husband who took to the table, bolted his meal, and was gone off upon his work, and had been a blot upon the landscape and the scenery at home; so he thought he would reform; and he came down all smiles, and as he sat at the table, he began to say, "Mother, I never saw you looking so well as you do this morning." And she looked at him. It was such a surprise she did not know what he was going to say next. Then he took some food, and he said, "How perfectly delicious; I never tasted anything quite so good in all my life." Then her wonder was excited more and more. He only made one other break in this direction when she picked up a chicken and threw it at him, and said, "I will teach you to be sarcastic in my presence." (Laughter). So those are the things you want to avoid in connection with your nutrition. I hope none of you will suffer tomorrow morning by this little fright you have had, but it is a most excellent illustration and I am very happy of the opportunity to give it.

In the forming of this Health and Efficiency League, for which Dr. Kellogg is responsible, as he is for a thousand and one other good suggestions tending towards health and efficiency, there are great forces behind it. I made the statement upon the platform at Chautauqua last week, before an audience of several thousand persons,--I gave it as a prophecy and I wanted them to take a note of it, so that I could be verified or discredited five years hence,--I told a remark by Professor Chittenden made to me three years ago, when that most conservative of all scientific men, in a burst of enthusiasm, said to me, "Fletcher, I believe that within ten years it will not be respectable to be either sick or inefficient." I predicted at Chautauqua the other day that in five years from now this subject that is in the minds of everybody, that is discussed by everybody, will within five years from now be taboo, and for the reason that we will have threshed out the subject in true American fashion so thoroughly and will have gotten hold of our resources for health and efficiency so perfectly that it will be chestnuts to mention it; it will be a matter of course; it will not be respectable tobe either sick or inefficient unless we are run over by an automobile, or something of that sort, over which we have no control; and that from that plan of the higher efficiency, with the presently submerged tenth of society lifted up from their malarial condition, and from that higher plane of health and efficiency, we will be striving for new aims and new ideals of which we now have no time to think because we are forever and eternally thinking about our health and our ~~efficiency~~ inefficiency. Now, I would like you of the audience to make a memorandum of that fact and just check up. It was only three years ago when I with Mr. Wadsworth, of Detroit, was in an exhibition of airships in New York. There was an enormous display, filling the whole of the Madison Square Garden, and overflowing into the Armory across the street, of automobiles. There were there by the thousands. There were hundreds and hundreds of different makes, and there were hundreds and thousands of persons coursing through the exhibition and looking at these wonderful machines. Mr. Ford, one of the inventors and perfectors of the automobile, came up to us and said, as we were looking about a few crude illustrations and models of the air-ships at the time,--he said, "Boys, do you see this? It doesn't amount to much now, does it?" He said, "It was less than ten years ago when I exhibited one of two automobiles at the World's Fair in Chicago." He said, "At that time there were not ten men in the United States who knew how to run a gas engine; there were not ten men who knew how to run an automobile. See what there is in all this display in the Garden opposite. You see these things here. Within ten years the automobile will be a back number, and we will be moving about by these means." That was Mr. Ford's prophecy. Now, in these days, when we feel the power of getting hold of forces, of the knowing and of organizing and directing our own forces and resources, there is nothing sort of perfection within sight that we are not going to have; and it is not going to take a great many years, now that we have got the means of accomplishing it.

We have tried the experiment of drugs; we have tried the experiment of the selection of foods; we have tried exercise;we have tried everything under the sun but the one thing that Nature required us to attend to particularly, and now we are turning ourselves to protection and prevention. The whole system of attaining the highest efficiency is--not doing the things that prevent Nature doing her best; it is a process of separation, and elimination; it is a process of finding out what prevents Nature doing her best, and stopping doing it; and when we have found them out, there is not one of them that is not something we have learned to do in defiance of the natural indications, and something that we are better off without doing.

I have not the chart here which I have prepared for that subject, but I can give you in a few words what the meaning of the separation and elimination is. We may perform all these requirments of Nature relative to dietetic righteousness, the attaining it and maintaining it; but there are certain things we have learned to think of as felicities which are really poisons. Now, let me tell you that I am not speaking from the point of view of a theorist, trying to support a theory. I entered into the study of this subject on natural lines, believing that these very things that I speak of as unprofitable indulgences were really felicities that we particularly, as I thought, those of us who had the money to buy them could enjoy, and that it was the luxury of our civilization. Now, let me tell you, in the first place, what the profitable felicities are, that we may cultivate and appreciate and enjoy to the full extent without any reaction whatever, and they are in the order of the frequency of their need,--air--notice the picture as I give it to you,--the picture of the words,--air, water,--fresh air, pure water, sleep--profound sleep, food--in the exact amount required by the body and no more, and which can only be prescribed by this means of careful eating which I am describing to you; and then we have those emotions which must be cultivated in connection with it, otherwise we do not get the best results,--health, hope, faith, optimism, charity, altruism,--all of the bubbling emotions, all of the altruistic emotions, those we cultivate; and then there is one word that we must bear in mind, I think of, and put upon the list of the felicities, and that is the word forethought. Our time is divided into three periods, the past, the present and the future. The past is gone, and except for purposes of pleasant reminiscences, let it go--let the dead bury their dead. The present does not exist, because the moment a moment has arrived, it is gone; consequently we are living in the future; we are working above the guillotine line, and we are living in the future, and the future is, as we live in it, is forethought; but we must make dead sure that forethought has had eliminated from it any element of fear thought. Forethought, not fearthought, is the perfect thing in this constructive series, and fearthought is relegated to the other side. Then, exercising all of the forethought possible, without fearthought, we may cultivate to the full extent appreciation, because appreciation is the measure of all values. Any time that we spend in the appreciation of even the smallest of blessings is profitably employed; but anything in the form of either indifference or depreciation is poisonous. So that if we spend the greater part of our time,--and let me tell you a story--I find it is not altogether new, but it was new to me and perhaps it will be new to some of you. We have down on the East side of New York, where we are operating an experiment station to learn how to teach these truths to those in the most need, there is an old Irish woman who is such a pronounced optimist that she does not require anything else. She lives entirely upon optimism; she lives optimism, eats and breathes optimism, and is living in an atmosphere of optimism. She has one or two garments to her name, yet she is full of radiating happiness, and she goes about through the community looking up people who are not so happy as she is, and she makes their acquaintance and tells them how perfectly silly it is to devote any time to thinking about troubles when there are so many blessings and she gives herself in illustration. She said, "Now, I haven't much of this world's goods, and nobody would change places with me; but I have two teeth and, thank God, they hit." Now, that is the capital in trade of that old woman, and she goes about shedding sunshine merely by clicking those two teeth together, and incidentally using them to bite her food; so that if we cultivate appreciation of the little things by which we are surrounded--and most of us are perfectly swamped with them, we have no time for depreciation.

Now comes the other side, and this will delight the heart of Dr. Kellogg as I have seen him smile all over at Chautauqua when I gave this list, and when I had the chart up there, the things that are unprofitable, because the reaction is greater than the stimulation, and because they leave a mark of what you may call stain , and they are in order, tea, coffee, tobacco, alcohol, food in any excess; and then come those unprofitable, those poisonous, those mud-staining emotions of hate, anger, worry--all of those depressing emotions, and it comes about physiologically so that we have that list, and at the bottom of that list we have, right opposite forethought, fearthought; we have relegated that to the unprofitables. And it is entirely possible to get rid of fearthought; it is entirely possible to put yourself in such harmony with the inevitable that even a cry of fire would not disturb you and make you get up and try to run out of the house and climb over somebody to do it. You would retain your orderly sense, and retain your digestion at the same time, so that one of the first things to be gotten rid of is fearthought. Then, below fearthought, comes indifference and depreciation, both of which are not respectable.

Now, I have used a large part of the time at my disposal in telling you about this, but I want to say that I am not speaking to you of theories. A living model is worth all the theories in the world,,and we are getting some living models. My own experience is the foundation of the enthusiasm which I put into this work; and then coming along side by side and neck by neck with me in this competition for the higher efficiency, you have one of the best models that the world ever knew, and that is in Dr. Kellogg. (Applause.) Those of you who are here at the Sanitarium and remain here for months, in all of that time do not get an adequate idea of the amount of good that Dr. Kellogg is doing in the world every twenty-four hours. He sleeps less than any man I know; he works more than any man I know; and he does not work along what might be called uncertain or vague lines,--one who performs with his own hands more than a thousand major surgical operations a year, which would be the work of a whole staff of ordinary surgeons, [illegible] who is the life, the soul, the spirit, the guiding star of a great institution like this and more than a hundred off shoots from it, who is the father of a family of forty children and grandchildren coming on in droves (loud applause), who supports and conducts great institutions in Chicago for the rescue of people from the disabilities by which they are surrounded, and one who never is tired. I am not an isolated example, but I receive from Dr. Kellogg in the course of our discussion of these questions every year, enough to make a very large volume in the form of letters, and scores of them will be very, very valuable as evidence of this movement in which we are all interested.

Now, Dr. Kellogg, as I say, lives upon a ration which, if the world knew it, would make it rich. There are already being saved in the United States today, on a conservative estimate, every day, more than a quarter of a million dollars as the result of the agitation we have been carrying on jointly for the past ten years, and it is increasing in tidal wave proportions, in geometric ratio. Think of the enormous saving, and when you come to a realization of the fact that that saving results in an accumulation of energy which has been estimated at anywhere from fifty to 200 per cent, as the result of thet economy, and when you come to xxxixxx think that if this knowledge is distributed throughout the land, as we intend to distribute it, that within five years it will practically transform the human race from a state of dyspeptics and invalids into a state of highly efficient altruists ready to endure,--when you come to think that you may feel that you are in the midst of things; and while you are interested daily in seeing the progressive achievements of the air ships, you will see the progressive improvement of the human race towards the goal of health and efficiency is the greater wonder still.

And then, again, we have with us very fortunately this evening, a young gentleman who is--I hope he will not blush unduly when I say it,--a prodigy of muscular perfection, with the natural accompaniment that comes to all perfection along all the line of the human interests. And this accomplishment of his, which has been performed within the past six years, has been the result of his own work, working along the same line that any of us may work. He was taken as a young man of twenty-three at the time of the Chittenden experiments xxxxx yxxxx xgo seven years ago, he was picked out from the Yale athletes; at that time he was teacher of wrestling in Yale gymnasium, and he was selected as the perfect type of the heavy weight gymnast, in the pink of condition under the old conditions of training. He served through those experiments, and he picked out of those experiments the key to the secret, and for seven years he has been taking his food in the careful way I have suggested, and has been getting the benefit of it yxxx xy yxxx that all of you may achieve. And as a result, he has increased the total of his strength and his endurance by more than 100 per cent without any ex extraordinary training to that end, and as a living model and one who can speak from experience, I am going to ask him to tell you something of his experience because it will be what all of you can take and use for your own advantage.

Now, I thank you more than I can tell you for this opportunity to preach this gospel of dietetic righteousness, and I take pleasure in introducing to you Mr. John F. Stapleton, formerly of Yale University, more recently of the St. Luke's school, at Wayne, Pa, and who is now associated in this missionary movement of spreading the gospel of dietetic righteousness. Mr. Stapleton. (Loud applause).

Mr. Stapleton: It is commonly said that no speaker can hold an audience for over forty minutes. After Mr. Fletcher has held you for forty minutes, he hands you to me, and I am not going to keep you very long. What Mr. Fletcher said, of course, I believe to be true. I became interested in diet over six years ago, when Dr. Chittenden conducted the experiments in the Yale scientific school. I was a subject then that they tried to starve to death, and they were not successful. But he wanted to prove that a man could do a maximum amount of work on a minimum amount of food, and I think that all the physiologists agree that he proved his statement. The ideas that he advanced are excellent,--a low protein diet; and all of us know, if we could all have cards, such as you have in this institution, to show how much protein, and how much carbohydrate are in the different foods, it would be easy enough to make selections of the various kinds of foods which are good for you to eat; but as it is not convenient to have those cards, there must be some other way if that form of diet is to be a success; and the way that that form of diet can be made a success is by thoroughly chewing your food. It is a very peculiar thing, and a great many people don't believe it; and lots of people say that they are so fond of particular things that we claim have too much protein in them, that are not good for them,--they say, "I could not possibly give them up." For instance, people who are very fond of meat will say, "There is nothing in the world I can think of that will take the place of meat," and I always think of a person who can not swim. They think they never can, and when they learn, they wonder why they could not always do it. It is the easiest thing in the world; and so it is with regards to things that are not good for your body. Once you get into the habit of eating the right things, you will never think of the things that are bad for you, regardless of how much you cared for them at the beginning. And as I say, the thorough mastication of food will bring this particular result. I believe that in the experiments that were conducted in New Haven to find out just the effect that the food was having,--I believe that thxxx if those experiments were conducted again with a grade of people who were fletcherizing without paying any attention to the scientific side of it, to the kind of food they were eating, I believe the results would be practically the same, because those who thoroughly fletcherize make exactly or very nearly the same selection that those make who take it from a chart; that is, that you will find if you chew meat thoroughly, I do not care how well you like it, if you chew it thoroughly, you will gradually grow to care less for it. Now, no one has a better right to say that than myself, because I was a great lover of meat; and I found that I cared absolutely nothing for meat shortly after I began to fletcherize; and I have sat for nearly seven years,--over six years, at tables in private schools where I have had charge of physical training work--have sat with boys where meat has been one of the features of the school, and have carved meat perhaps two or three times a day, and it is quite different from the average person who xxxx xxxx cuts out meat and does not have it at the table at all, from the way I had to have it there. I had to go to the table on account of discipline, and I had to carve that meat, and no matter how juicy or how delicious it may have looked in the past, there never was any temptation to eat it at school. It was very, very rarely that I ever had any desire, and if I ever did have any desire for meat, it was for meat that was very fat. And now the object of all this is of course to gain health. And as Mr. Fletcher told you, I was one of the subjects in the Chittenden experiments. At the end of the Chittenden experiment, I had gained a great deal in strength as a result of proper eating. And six years later,--I remember that at that time I was considered what is termed in the pink of condition. I did not believe myself that it would be possible to get stronger or to be in a better condition, and I found that six years later, I was able to lift nearly twice as much as I was at that time, and in feats of endurance, I was able to triple the best records I had ever made; and all that without any particular training forit; that is, without making any effort at endurance. And I can not think of anything else that is the cause of it only proper eating, and the proper eating is caused by the thorough mastication of food; that is, the proper selection of food is made. You don't need to pay any attention to what the foods contain if you will thoroughly masticate them. You will get foods that are proper, and the foods that your system needs; foods that are peculiarly suited to your own individuality. No two people can follow the same prescription. I thank you very much. (Loud Applause.)

Dr. Kellogg: It is not late yet; I am sure you will be willing to stay just a moment longer; we have an interesting announcement to make a moment later, but I want to emphasize two or three points. Mr. Fletcher has made more great discoveries than any man I know of. I certainly think it is not more than fair to say that he stands, like Saul, head and shoulders above all of his peers in this matter of diet reform. I just want to emphasize two or three points which I think are important. Mr. Fletcher made the great discovery that the mastication of food is the most important thing we can do in relation to our nutrition--thorough chewing of the food. It makes more difference, in other words, how we eat than what we eat, because if we chew properly--that is the next discovery he made, a most important one--if we chew properly it will correct our wrong eating, if we have gotten into wrong habits of eating, proper chewing will correct those wrong habits, and we will be instructed by our natural sensations, what to eat, how much to eat, and when to eat,--if we are thorough about this matter of fletcherizing or thoroughly chewing the food.

And the third great discovery that Mr. Fletcher made was the fact that there is anix instinct within us to instruct us in relation to this whole matter of nutrition which is set in operation thoroughly when we give it an opportunity to act by thorough mastication of the food. A horse has what we call horse sense. He knows what to eat, when to eat, and how to eat. He does not have to have some one come along and tell him to fletcherize, but fletcherizes without instruction, without tutoring; but human beings seem to have lost their horse sense. Most of the people I have met at any rate, were certainly very lacking in horse sense. We say that sometimes without appreciating how actually true it is; for the horse, never having departed from its natural habits still follows his natural instincts, and his sense leads him right. We sometimes fall into serious misfortunes in consequence. Some women have lost their horse sense as well as men. I was reading not long ago a story of a lady whose doctor told her she must live entirely upon animal food for a time. The doctor saw her some time afterwards, and he said, "How are you getting along?" She said, "Oh, I got along very well with the oats, Doctor, but the hay I could not eat." She had been trying to live on food entirely unadapted to her situation, but taking, as the doctor told her, animal food. Now, the animal eats foodsthat are adapted to him. Human beings, if they follow the instincts that are put into them by the Creator, will be able to find a way without any difficulty at all.

I dare say we should have nobody here tonight, should not have this audience here tonight if it were not for the fact that fact; we would have no need for sanitariums if people would only learn to fletcherize. What a splendid thing that is. I feel like taking my hat off every time I think of it. As I told Mr. Fletcher today, this great principle, this great fact that Mr. Fletcher has emphasized, brought to our notice so graphically, and has been explaining now so lucidly,--that there is an intelligence within us capable of guiding us right so that we are not turned loose so that we have to have a doctor at hand all the while to tell us what to eat, what we should eat, a mentor to direct us,--we have an intelligent mentor within us that is capable of guiding us exactly right and doing better, making better prescriptions for us than it is possible for any doctor to make.

I want to say just another word, to tell you how much we owe Mr. Fletcher. Seven years ago Mr. Fletcher made his first visit to us. We were all in a turmoil at that time, with a heap of rubbish here, just after our fire, and we had 400 people here scattered about the town, and great disorder and confusion. Mr. Fletcher came here and he said, "Why, I have discovered that you and I are working in the same line. I came up here to tell you of the discoveries I have made. I think you will find them useful here." I am ashamed to tell you that although I had appreciated the importance of fletcherizing, chewing food years before, I had gotten so busy in doing missionary work of various kinds and building up our work in many different ways, I had quite forgotten about it; and I was bolting my dinners in great haste, spending about three minutes; I didn't stop to eat more than once or twice a week if I ever stopped to eat at all; I always worked answering letters while eating breakfast and during dinner, and was filled with fearthoughts and all sorts of depressing things, with worries and anxieties. Mr. Fletcher did me a lot of good, and I want to acknowledge it right here, in holding up a new picture to me. I had really become pretty much of a pessimist. It seemed to me the whole world was going wrong, and there wasn't any hope for accomplishing anything very much. If we could just save a few people that were pretty badly maimed and crippled, but the rest of the folks were going to the bad any way, and it was really a pretty bad outlook. Mr. Fletcher explained his discovery about chewing, told me what he was going to do, and I found him the truest prophet I ever met in my life. He said, "I am going to make the scientific men recognize these discoveries." They had not done it then. He said, "And when the scientific men recognize this, get into it, they are going to vindicate the things you are doing here at Battle Creek; the decision they come to, the result of their experiments, will certainly be a vindication of this low protein diet, the non-flesh dietary; and the things you are doing here and have been doing all these years." I said, "Mr. Fletcher, it looks very good, but I can hardly believe it." So I watched with a good deal of interest and anxiety the next two or three years. By and by Prof. Chittenden's experiments with Mr. Stapleton during nine months in which he fed people on a low protein diet, lower and lower all the while, were concluded, and the results were published, and confirmed absolutely Mr. Fletcher's prophesies, although there were so many opposed to this idea. The ~~xxxxxxxx xxxx~~ butchers were all opposed to it everywhere, the meat vendors and packing companies, the great vested interests are violently opposed to this reform; and many people who were very fond of beefsteaks, and had given up their appetites, had perverted appetites--not their own natural appetites, but appetites they had borrowed from other classes of animals, don't belong to us at all,--these people were opposed to this reform; but notwithstanding all this, Mr. Fletcher succeeded in interesting scientific men after an expenditure of many years of effort and thousands of dollars, in which he traveled from one scientist to another, traveled from one physiologist to another, submitted himself for experiment, expounded his views, showed himself for investigation, finally succeeded in getting men enough interested, at any rate in getting Dr. Chittenden enough interested to make this investigation; and the results came out exactly as he prophesied. I confess no one has realized greater good and greater benefit from these discoveries than I have myself. Personally, I am certain I have greatly increased my endurance and fitness. At any rate, I have not degenerated, deteriorated as much as I would have done if I had not had the benefit of these things to which Mr. Fletcher called our attention. Then in our work here at the Sanitarium we have found our task of helping sick people get well immensely lightened by carefully following these principles and requiring our patients to do it. If we could only get them all to do it thoroughly, to fletcherize very thoroughly every morsel of food, it would be very much easier; but it is hard to break up your habits. Now, we used to say to our patients, "You must not eat this thing", or that thing, "you must not combine this thing with that thing, or any other thing with this thing; it will disagree." Now, we only have to say, "Fletcherize, fletcherise", because in the fluid state everything agrees, all combinations agree in the fluid state where everything is properly chewed; we have our bills of fare with the calories all put down for the benefit of the people whose tastes are still thoroughly perverted, who haven't gotten reformed yet; but you don't have to take the bills of fare home with you; you don't have to take a calorimeter homw with you; you don't have to take any machine for measuring your food, because if you get thoroughly trained so you get a good appetite and get rid of the old appetites entirely, then you can depend upon this mentor to take care of you, and without taking a doctor or nurse along with you. But I want to tell you here how much we are indebted to Mr. Fletcher and how anxious we are that these principles should be spread abroad throughout the world, and I am very proud that we have with us tonight, Mr. Fletcher ~~of the~~ as president of the Health and Efficiency League of America that has just been born and is beginning to do business, and tomorrow night, we are to have one of the first public meetings, the first public meeting of the Health and Efficiency League, held outside of Chautauqua, in our Gymnasium tomorrow night, at eight o'clock; We hope to see you all there, and a good many of our townsmen will be there also.

- - - - - - - - - - - - -

v-9-2-9-.

LECTURE - SOME EXPERIENCES IN WINNING HEALTH

By

Dr. Irving Fisher, March 31, 1940, The Miami-BattleCreek, Miami Springs, Fla.

Dr. Jeffrey: It is a great pleasure this afternoon to have with us a man who has done outstanding things in his field. He has not only done wonders in the economic field, but has been more versatile than that and has got into another field because it was necessary originally for his own personal good. We have with us this afternoon Professor Irving Fisher, Professor Emeritus of Yale University, Department of Economics, who will speak to us on some of his experiences in winning health. DR. IRVING FISHER:

Dr. Jeffrey, ladies and gentlemen: It is always a pleasure to speak at Battle Creek, whether it is Battle Creek in Michigan or Florida, because Battle Creek has meant so much to me. I first became acquainted with Dr. Kellogg and his Sanitarium at Battle Creek in 1904, and I got more in the short time that I then spent with him than I had before in any equal length of time through anybody else. I shall always be grateful for the help I have had from him and his institution then and since, and I am very glad always to accede to his invitations to speak. He desired that I would speak on my own personal experiences. I shall do so to some extent, but will also include the personal experiences from other people because I do not like to talk about myself and I do not think it is so convincing as it is to talk about the experiences of other people.

The proposition which I want to impress upon you through the experiences of myself and others is this: that practically each one of us can accomplish far more toward increase health, strength, endurance, working power, longevity and usefulness than most of us have any idea of. I myself, after I had had tuberculosis, never supposed that it was possible for me to get back the health that I formerly had and still less to improve upon it, which has been the actual fact.

There is in the audience a physician, a friend of mine, who dislikes particularly to have his name mentioned, who is an even more striking example of what scientific medicine can do. He, at the age of 63, which was six or seven years ago, felt down and out and was seriously considering giving up his professional work as one of the leading physicians of his large city. Now, this morning he told me he had run five miles which he usually does every day. He is trying to use every method which he could find to improve his health, strength, endurance, working power, longevity and usefulness. When he tried to run at the age of 63, he said - trying to catch a trolley-car,-that going a half a block exhausted him so and gave him such heart action he was afraid he was going to die. Contrast his condition then and his condition now and consider that the transformation has been made against a tendency of aging, and you have an extraordinary example of what can be done.

In my book, How to Live, I have given four such examples, all of physicians, because they are expert testifiers on this subject.

I, myself, think that I am a triumph of modern medicine, although I still have ambitions to proceed farther along the line of health than I ever have. Even twenty years - and I am much stronger in every way now than I was then - I remember contrasting my endurance with that of a Yale athlete. I was then trying to collect evidence as I have ever since, on the subject of which I am speaking, and I got up some very simple methods of measuring endurance. Since then they have been improved upon, but at that time they were extremely simple.

I have been told that it was impossible for anyone to hold his arms out and hold them there for longer than five minutes and I started right in with men in the Yale gymnasium, thinking that I would get persons dropping their arms in one or two or three or four minutes, never dreaming what I was letting those students in for.

I found that among the flesh-eaters, those who fed largely on beefsteak and roast beef, that endurance was comparatively small; that very few of them could hold their arms out over fifteen minutes, although almost any one who is in good condition and tries, can hold his arms out over five minutes. There was only one, I think, as I remember it - you will find a record of it in the appendix to this book - who was able to hold his arms out fifteen minutes, among the flesh-eaters, and that man was the pitcher of the Yale baseball team, whose deltoid muscle had been made strong by his pitching and therefore he had more endurance than he otherwise would.

One day I went in the Yale gymnasium and spoke to Dr.Anderson, the head, who was having some tests, and a young fellow went through his room stark naked. He was the most beautiful physical specimen I ever saw. His name was Dole. He was from the Hawaiian Islands, where the Dole family comes from, as you know. He was the champion featherweight wrestler, small but well proportioned. I said, "Would you like to take some tests?" He said, "Yes. What are they?" "Put out your arms and see how long you can hold them." Dole did. He was a beautiful sight to any one who loves physique. He stood so long I decided I would let him stay there as long as Dr. Anderson would be the witness and I would go home to have something to eat. I did that and afterwards inquired of Dr.Anderson. He said, "After he stood there one hour and fifty minutes he looked at me rather appealingly and he was shivering, and I said, 'I think you have broken the record and that you had better go home.' " So what he would have done I do not know, but I do know his diet. I asked him because I was making these tests largely to compare the endurance of those who ate meat, by which I mean muscle cuts - there is a vast difference between muscle cuts and the glandular product like liver - and those who did not. I did not know which class this man belonged to. Of course I supposed he was a meat-eater because practically every Yale student was, but while ~~still~~ he was standing there I asked him questions as to what he ate and I said, among other things, "Do you eat much meat?" He said, "No, I do not eat any." I said, "Are you a vegetarian?" He said, "Oh, no, not on principle, but I am trying to work my way through college, and at the Yale Commons they let me have all the milk, vegetables and bread and butter I want for a dollar and a half a week, but meat is extra, and you have to use your meal ticket for that and coupons, and I have tried to see how much I could save by going without it."

So there he had been inadvertantly, you might say, giving up meat purely for economic reasons, but as a by-product he was getting this enormous endurance.

Another Yale student who was a vegetarian on principle likewise broke the record as compared with any of the meat-eaters.

When I came out to Battle Creek, Michigan, I brought with me one of the leading physicians of New Haven, not particularly on this matter, but merely in order that he might see what was being done at Battle Creek. He had been a former football player and was a man of unusually good physique. He pitted himself against one of the physicians then at the Sanitarium, who had come there as an invalid and who had a very poor physique and who was himself, like me, a monument to scientific medicine, to be in the world at all. Since I had already discovered which way this comparison would go, in order that I should give the New Haven physician the full benefit of the doubt, I did not have them start holding out their arms at the same time, but I had the Battle Creek vegetarian physician have his arms out first and then this doctor after a minute put his arms out, so he knew that if he dropped his arms first he would be beaten, so he was evidently wishing that the other man would be exhausted first, and he did his level best. The time came, however, when his arms sagged and sagged and he could not get them back again, and he was very badly beaten.

I started, however, to tell you my own experience. There was a runner named Hale at Yale. He was a long distance runner and a man supposedly of great endurance, and I tried the same thing with him, giving him the benefit so that if he dropped his arms before I did he would know he was beaten and he tried his level best and in the same manner his arms began to sag. He tried to bring them up but he could not, and at the end of eight minutes and fifty-four seconds it was impossible for him to get them horizontal again. I had scarcely begun to feel it. It is not a pleasant sensation when you do feel this aching in the deltoid muscle. You want to drop your arms right away. Some people thought the test was not a good one on that account, but in this case and in other cases where it was perfectly evident that the man could not bring his arms back again it was a perfect test. I went on until I had got it to nineteen minutes and then I stopped, although I could have gone further. Think of it, a man who had been an invalid, who was considerably older than the athlete, simply because of his change of diet, apparently, than this man who was a professed athlete.

One of the best tests of one's condition and a much better test than most people appreciate is the condition of the teeth. The teeth are among the first things to give way, when there is insufficient nutrition, especially mineral salts and vitamins. I have here a book called Nutrition and Physical Degeneration, written by a dentist Weston A. Price, with a forewood by Professor Hooton of Harvard, of whom many of you have doubtless heard.

I knew Weston Price many years ago. When he visited New Haven I had quite a talk with him in regard to the subject, and I remember, I think, saying that we needed more information as to the condition of the teeth of races other than our own.

It was probably before that time that a Negro visited New Haven, the son of a Zulu chief, and when I heard that he was there I went down to the railroad station to meet him and asked him to open his mouth and let me see his teeth. I had quite a little talk with him.

At that time we did not know what caries, dental decay, in any way compared with what we know now. At that time I was under the impression, and I think a great many others were, that bad teeth were very largely due to our soft foods, and I still think there may be something in that theory, but the evidence shows that it is nutrition more than anything else.

And when I talked with Dr. Price, back in those days his theories were quite different from what they are now as expressed in this wonderful book. You know, if every physician in the United States could read that book over this week-end, it would do two things: It would start such a movement toward rational nutrition to replace the irrational nutrition that we now have in America, that the health, strength, endurance, working power, longevity and usefulness of the American people would be unrecognizable, so great and rapid would be the improvement. That I am sure of. The other is that it would put half, perhaps ninety percent of our dentists out of business. Dentists register bad teeth. In America we have the best dentists in the world because we have the worst teeth in the world.

Dr. Price conceived the idea of visiting those groups of primitive people left still in this world who do not live on the kind of food that we are accustomed to think is right. So he visited a number of peoples, the Eskimos, the Indians of Alaska, who are quite different from the Eskimos, the Swiss in the high Alps, who are isolated and have no railroad connections and therefore are forced to live on the products of their own fertile valleys and the milk from the cattle that they rear there, with almost nothing from civilization, the Gaelic in the New Hebrides, and off the northwest coast of Scotland, the aborigines of Australia, the Maoris of New Zealand, the Belanesians in the in the Pacific, the Polynesians in the Pacific, the Peruvians of the Coast, the Peruvians in the Andes, the Africans who raise cattle in the interior and the Africans who are agriculturists in the center of Africa. He and his wife visited all of these places as explorers. They took with them photographing apparatus and collected samples of the dietary of these people, and they compared the diet of each of these primitive people, as long as they are primitive, and the diet of those among them who had contacted civilization and who had adopted a so-called civilized diet, so that in each of these cases he has two groups. He has Eskimos in Alaska who are so far from civilization that they cannot get so-called civilized foods and Eskimos who are sufficiently in contact with trading posts to get civilized foods and use them. In like manner the Indians of Alaska and northern Canada, he found certain groups who had almost never seen white men. He describes one of these groups who had never seen a white woman before they saw Mrs. Price. Then he had plenty of Indians who were at the trading posts and were living on American foods or Canadian foods.

I spoke of the Swiss living in the high Alps, who were isolated because they were inaccessible, and they have neighbors living under similar conditions and of the same race who were accessible because railroad had been brought there. He compared those two groups. He found the Gaelics in the same way. Certain of them were using English foods and so were the Australian aborigines, the Maoris, the Polynesians, the Peruvians on the Coast, the Peruvians in the Andes, the Africans who raise cattle in the interior and the Africans who are agriculturists in the center of Africa. In each case he had two groups to compare and in each case he got the same results. He found that caries - sometimes thirty, forty or fifty times - as frequent where they had used civilized foods than when they used the primitive foods.

And when he compared their diets by ~~testing~~ subjecting their food products to the laboratory tests, what did he find? He found that the mineral salts and the fat soluble vitamins which are so lacking in the American diet - they are found in cod liver oil, for instance - he found that these important requisites of a complete and proper diet were many times more frequent and abundant in the primitive diet than in the civilized diet. Among Eskimos he found that calcium was over five times as abundant in their food as in the food that was replacing theirs among the the Eskimos who had adopted American food. Phosphorous also five times, iron one and a half times, magnesium eight times, copper twice, iron forty-nine times, and he found that the fat soluble vitamins were at least ten times as abundant. He found in all of these cases that I have mentioned to you that the fat soluble vitamins were ten times more as abundant.

You might be interested in my rapidly going over what may seem like dry statistics, but they are important ones for you to remember. You just take calcium and run through this list in the order that I read them. Eskimos, the far North Indians, the Swiss, the Gaelics, the Australian aborigines, the New Zealand Maoris, the Belanesians, the Polynesians, the Coastal Peruvians, the Andes Peruvians, the cattle Africans, the agricultural Africans. In comparing the two groups he found that the primitive group had, in the case of the Eskimos 5.4 times as much calcium. Calcium is very important for the teeth and bones. In the case of the group of Indians of the Far North 6 times. The Swiss 4 times. The Gaelic twice. The Australian aborigines five times, the Maoris six times. The Belanesians 6 times. The Polynesians 5 times. The Coastal Peruvians 6 times. The Andes Peruvians 5 times. The internal African cattle raisers 7 times, and the agricultural central Africans 4 times.

In other words, calcium, out of which teeth are made, was from two to seven times as abundant in these primitives diets as in the other groups where they used the civilized diet.

In regard to phosphorus in the same way, for the same group we find the following figures: 5 times, 58 times, 2 times, 2 times, 6 times, 7 times, 6 times, 7 times, 5 times, 5 times, 8 times and 4 times.

For iron: 1½ times, 3 times, 3 times, 1 (that is the only case where there is no excess) that is, for the Gaelics in regard to iron - 50 times, 58 times, 22 times, 19 times, 5 times, 29 times, 17 times, 17 times.

The Eskimos had eight times the magnesium when they lived on the primitive diet as when they lived on the American diet, and the others were as follows: 4 times, 2½ times, 1, 17 times, 23 times, 26 times, 28 times, 14 times, 13 times, 19 times, and 5 times.

Those are to me extremely significant figures and the photographs in this book show the tremendous contrast between the teeth of these different groups. There are photographs of magnificent sets of teeth, with magnificant - what he calls dental arches - and no crowded teeth. The wisdom teeth have plenty of room to come out, whereas in the other group there are missing teeth, bad teeth, crowded teeth and a contraction of the jaw which changed the character of the expression.

Many people have thought that the children and grand-children of foreigners who come from Europe or from places where they have a better diet from a scientific point of view than we do here, that the reason why they changed the character of the physiogominy is racial. They mix their blood with ours and they get lantern jaws, etc., whereas if you will read this book you will be convinced that it is not racial, it is dietetic, and we are degenerating fast, and the teeth represent the best index, probably, that we have of this process of degeneration.

Now the foods that enter into these primitive dietaries which I have described in these figures in terms of iron, magnesium and the other mineral salts and various vitamins, vary very greatly in regard to the names of the foods. The Eskimos live on animal food, not flesh but fat to a large extent, whereas in the Swiss Alps they live, as I said, largely on dairy products and vegetables; but the contents in terms of minerals is very much the same among all these various diets as I have indicated to you here.

On the other hand, the so-called civilized diets are even more the same. They are not only the same in the deficiency in mineral contents and in vitamins, but in consisting very largely of the same foods. You will find very much the same foods in America, England, France, Germany and Italy, and much more nearly similar than you find among the Eskimos and the Gaelics and Polynesians, etc. Superficially there are great differences in primitive diets; fundamentally there is great similarity.

What is the matter with our diet? It lacks lime and these other things. Dr. Price specifies particularly sugar, white flour and polished rice. Of course the same is also true of flesh foods, ordinary muscle cuts, what we call,ordinarily, meat, has no lime or very little, and the animals that live on meat, the carnivorous animal that lives on other animals, eats the bones as well as the flesh. We are not adapted to that. So we may add that flesh foods, at any rate muscle cuts, are deficient in lime and a good many other of the other elements that I have just described.

Now it is really very simple. The most wonderful thing is the uniformity of the reports that he makes on all these score of different comparisons throughout the world. Professor Hooton says in his introduction here that "I have been kicking myself that I did not think of doing that thing. It is something that ought to have been done long ago." As I remember it, I said that same thing to the author of this book before he made this trip, that we needed a study of the primitive diets to find out what was more or less the normal diet for men.

Now only does he find that these people have better teeth, but he finds that they are freer from disease, particularly tuberculosis. Both of these facts struck me because at the age of thirteen my father took me to a dentist and was horrified to find how many teeth I had that either had to be extracted or filled, and I have never had good teeth, and now I only have a few left, except those that I bought, and Professor Hooton says, "What makes store teeth is store food." In his introduction to this book because what you buy at the store is sugar and white flour instead of eating the fruits, the vegetables, the leaves, lettuce and other salads, and milk, that our teeth are bad.

Americans are starved to death because they have so much food. They have such a variety of food that in choosing that food they starve themselves by leaving out some of the most essential elements.

The simple way to solve this problem is not a prescribed diet nor is that the best way for those who have not altogether lost their natural instinct. The proper method is first to exclude from your diet the unnatural foods, those refined foods like white flour, sugar and polished rice and muscle cuts of meat, and restrict yourself to foods that you know are good. You have an enormous variety, far more than you need even then. Even if you take those four classes that I stressed a moment ago or that I meant to have stressed, the fruits, the nuts, the leaves and dairy products, - milk. Even if you confine yourself to those four foods you have an enormous variety, and you can add to those the whole wheat grain in the wheat flour. You can add ordinary vegetables, especially potatoes. You can add almost any other food except those I have mentioned, but rule out those foods that lack the lime and phosphorus and other things and then use what you want and you will choose more wisely than any physician can choose for you provided that you have not lost your natural food instinct too much. For a long time I distrusted my own, but I have it now. Babies have it until it is spoiled, and in the appendix to this book How to Live, which I wrote, practically - the pro-author is Haven Emerson, formerly health commissioner of New York City, you will find in the appendix to this book some statements in regard to this matter, partly written by me, regarding some experiments I tried with Yale students, having them choose their diet in the manner I have just suggested. They improved greatly in endurance. In five months they doubled their endurance.

There is also an appendix by Dr. Clara Davis of Chicago, a child specialist who had the advantage of using the children in one of the great hospitals there and testing them with respect to their natural instinct. She found that even newborn babies could choose between different types of baby food, with considerable precision, while older children after they had been weaned could choose between thirty-one different types of food that she provided them with, always the same, meal after meal, three times a day. The children were constantly violating their diet and they frightened the nurse at first enormously when they would have what they called an egg jag for instance. They seemed to eat nothing but eggs day after day, and yet not getting sick but getting well, and then when they had gotten all the iron or whatever it was out of the egg yolk that they particularly needed, and got literally fed up on that particular kind of food they would turn to something else and at the of a period of time those dietaries would balance up beautifully with respect to protein, fat carbohydrates, mineral salt, vitamins and everything else that Clara Davis was able to keep track of. When one of the physicians came to that institution and said, I want to get some specimens of the best bones of children for x-ray, she selected the x-ray plates from that hospital which were the best for the purpose, without knowing which children had these x-rays until they were looked up and were found, if I remember right, that everyone of them were those who had been in this experiment of Clara Davis, and the head of the dental school in Northwestern University took a group of these children who had for several years continued this experiment of Clara Davis, and found this "The best teeth in a group that size he had ever found in his whole experience."

So you do not need to go to Belanesia or to become an Eskimo or to go up in the high Alps where there is no railroad in order to get good teeth or in order to keep good teeth if you have them. You cannot improve your teeth but you can prevent their getting worse. All you need to do is to choose your own food and to choose it from a list of natural foods, putting yourself in the place of your anthropoid ape ancestors who had nothing but natural foods.

You do not find ordinary white cane sugar in Nature. When you supply that artificial food its sweetness is so appealing that you are tempted to eat it and then you do not get enough lime because so much of your calories are in sugar and in white bread and meat, without any lime to speak of, so that in your other foods you cannot get enough.

The author discovered a great deal of tuberculosis as well as caries. I did not know until I read this book that those two go together, but it struck me right between the eyes because not only have I almost as bad teeth as any one in America who has any left at my age, but I had tuberculosis. It never occurred to me, but when I mentioned this to Dr. Kellogg he said, "Why yes, they would be related. Don't you know what stops tuberculosis is the deposit of lime?"

The only way we cure tuberculosis today, if you can say that we cure it, is by encapsulating the lungs with a deposit of lime, or at least that is one of two ways, and so if people who start in with a little tuberculosis if they get plenty of lime will cure it without knowing they had it. In the big cities ninety-nine percent of the autopsies show tubercular lesions. If you have lived in a big city I venture to say you have had tuberculosis and probably have gotten over it and did not know it. It did not get as far as it did with me. It became a serious thing with me. I doubted whether I would live or not. People who lack lime in their foods and lack these other minerals are very much more likely to have tuberculosis.

So these people are freer from tuberculosis and cancer. Among these people they do not find cancer at all and no tuberculosis and very little disease of any kind. They are magnificent physical specimens and have the joy of life that goes with it.

At lunch someone came up to me and said, "A friend said it must have been a misprint that you were going to talk about health. It should have been a W instead of H."

Well, that is because I am supposed to be an economist. That is my vocation, but health is my avocation, and I will say what Emerson said, that health is the best wealth. I have seen many so-called rich men who were in poor health and they were the poorest people I know, and I have seen many poor people in the best of health and they are the richest people I know. I imagine the richest people in the world in this sense, of Ralph Waldo Emerson, are the Polynesians. They are magnificent specimens. They cultivate their health. They are proud of their health. Like the Ancient Greeks whose ideals of health have been transmitted to us in the imperishable marble. Those people have a good opinion also of their own health. Some of them are helpless when they come in contact with civilization because if they are put on reservations they have to live on the food the white man gives them. If they could live on their ancestral foods they would never have tooth decay and with them in the absence of dentists a toothache is something terrible. We think nothing of it because within a few hours we can get rid of that through a dentist, but these people do not know how to get rid of it and it leads many of them to suicide. The chief cause of suicide in these primitive people is toothache, what we think of as of no consequence. It would perhaps be better for us if we did not have our dentists because we might be forced to adopt dietary reforms.

A Polynesian said that according to their traditions, and they are quite serious about it, "God made the Polynesians first and therefore they are the best. They are the chosen people. He made the pigs next and the white man third." So while we are so snippy about these primitive people because they do not have automobiles and they do not have wealth they reciprocate the feeling and, as a matter of fact, they are happier than we because they are healthier.

A RECEPTION TO DR. J. H. KELLOGG

BY

PATIENTS OF THE SANITARIUM AT THE SANITARIUM PARLOR

Saturday, June 27, 1914, at 7:30 P.M.

-/-/-/-

Professor Irving Fisher:

When I first visited The Battle Creek Sanitarium nine years ago, the fact that impressed me most was its isolation. Both the Sanitarium and its head, Dr. Kellogg, seemed not to be appreciated outside of a limited circle. Dr. Kellogg seems to me now as he did then one of the great men of the United States and of the world. I have always hoped to see his work connected up with the currents of University life, and himself recognized for his achievements in medicine, in education, in character building. I am not the man really to explain the insignia which Dr. Kellogg has recently received because I am not an authority on academic costume. I hope that Dr. Kellogg himself will tell you a little and I hope he will say a few words as to the contrast between the treatment which Battle Creek originally received and the recognition which the institution and he are now receiving. I found nine years ago that there were still strong traces of the old prejudices against Battle Creek prevalent a generation ago and due to the fact that this is a pioneer institution. This is not a conventional sanatorium or hospital. It is a leader in the scientific world of medicine and the processes which have been inaugurated here have been so far in advance of the usages elsewhere as oftentimes to have resulted not in praise but in blame. Now at last the world is beginning to appreciate the great work which has been done at Battle Creek by Dr. Kellogg and his loyal assistants. Dr. Kellogg has been increasingly recognized in recent years by his professional colleagues all over the world. He is an honorary member of the Royal Academy of Medicine and last week he was elected into the newly formed and honorary body, The American College of Surgeons. He has a gown and cap which the members of this Society wear at their initiation ceremonies. I am sorry that Dr. Kellogg has not brought that particular gown and cap with him. He has come, however, with the cap and gown of "Doctor of Laws," a degree which was given to him last year by Olivet College in this state. It is sometimes said that a prophet is not without honor except in his own country, but that is not true in this case and we all take pleasure in the fact that Dr. Kellogg has received recognition in his own state. Dr. Kellogg is the recipient of many other honors and I hope that in the future we shall see him be recognized for the high place in medicine which in actual fact he holds and deserves.

Dr. J.H.Kellogg:

Ladies and Gentlemen: I assure you I do not feel at all at home in these emblems of academic honors and really have been so long accustomed to live without any such sort of recognition that I feel almost as though they did not belong to me and I am not sure that they do. I certainly am very much obliged to Professor Fisher for the kind words which he has been saying here for me and for the institution tonight, and still more for the many thousands of kind words which he has been saying for this institution and the work we are trying to carry on here during the last eight or ten years since we first had the honor to become acquainted with him.

What Professor Fisher has said to you, however, you must take with some grains of allowance. I think he is a very indulgent friend and that he takes a very generous view of the work which I have personally been able to do; and I ought certainly to tell you that whatever work has been accomplished here in this institution has been the result of team work. It has not been the result of my own personal work alone by any means, but I have a large number of very able and very earnest and very loyal and enthusiastic colleagues who have worked along with me for many years, and whatever has been done we have done by our combined efforts.

It is certainly gratifying, however, as I look back to see the change which has occurred in the attitude of the public and especially of the medical public toward this institution. At its beginning the Sanitarium was in a sense a work of protest and a very earnest and a very practical protest against the prevailing methods of living and the prevailing methods of treating the sick which were in use fifty years ago. The institution from the very beginning was not properly a medical institution. In the first charter that was received from the state and the articles of incorporation, it was announced very clearly and distinctly that one of its chief objects was the education of the public in right methods of living, the promulgation of the principles of the simple life and right living. It was not its sole object or really its chief object to deal with sick people, to heal the sick, but its most important purpose, as announced at that time, was the teaching of those who were well how to keep well and those who were sick how to get well and how not to get sick again-how to remain well.

At that time nearly every idea which was promoted by this institution was most unpopular. I cannot think of a single one of the main ideas which we now call the Battle Creek Idea, or the main principles which were promulgated at that time,--I can not think of a single one which was not in great disfavor with the public and also with the medical profession at large.

One of the first principles of the institution was the absolute disuse of alcohol, not only as a beverage but as a medicine. At that time alcohol was not only considered a very good food but was regarded also as a very excellent medicine indeed. The medical profession, I am sorry to say, in my opinion, are more responsible for the intemperance which prevails today than any other portion of the community because up until very recent times the great lights of the profession, the physiologists, the professors of dietetics and the leading men in the profession, the so-called scientific men, (they were really scientific men,) these men very firmly maintained and very persistently and constantly argued that alcohol was a food, that it was a most excellent food, a concentrated food, a most important food for use under certain circumstances; that if all other food was not available, or for any other reason could not be taken or received by the patient, alcohol was always at hand, a concentrated and easily assimilable and highly valuable food and it has been a very easy thing indeed for the average man to argue that if alcohol was a good thing for him when he was sick then it must be a good thing for him when he was well; that if it was a good thing to heal him, it was a good thing to keep him well. That was a very reasonable conclusion and I am satisfied that the great confidence the public has had in alcohol has rested upon the opinions supposed to be sound and scientific which were promulgated by the medical profession, that alcohol was an extremely valuable and useful food.

This idea in recent years has been absolutely abandoned. There are still a few scientists who maintain that alcohol in small quantities may be assimilated by the body, may be utilized in the body as a source of heat; but even these men no longer dare to recommend alcohol as a food, but while they maintain it may be used in some respects as a food by the human body, it is nevertheless a dangerous food, an impractical food and a food which is quite different from ordinary food,--that it is a food only in a special and a technical sense.

Then on the other hand, as a remedy, alcohol was regarded as a most wonderful and a most useful, almost indispensable stimulent. When a man fainted, when a man collapsed in shock after a surgical operation or after a severe accident, it was at once thought that alcohol was the one indispensable thing to rally him and this idea was carried to such an extent that when a man collapsed under the shock of a surgical operation or under the influence of an anesthetic composed of ether or consisting of ether or chloroform, which was simply a modified form of alcohol, being produced from alcohol, simply a combination of alcohol,-that when a man under the influence of a large dose of alcohol in the form of ether collapsed and his heart was failing, the one remedy that was thought to be better than any other was alcohol. He must have alcohol injected into his system in order to rally him. But now we have learned by actual, careful laboratory experiments that alcohol is not a stimulant at all; that it is the very reverse, in fact; that it is a depressing agent; that it is a narcotic; that it is the very opposite of a stimulant, and consequently it is the very last thing to be used when we want to rally a patient whose vital forces are debilitated.

So at the present time, when the up-to-date surgeon finds a man who is in a state of collapse, who has fainted away, he does not pour alcohol down his throat and he does not inject alcohol in some form into his tissues; but he does something very different, does something the very opposite.

So alcohol has lost its prestige as a remedy, and the Battle Creek Sanitarium which forty years ago was regarded as very fanatical because it announced to the world that it used no alcohol and did not believe in alcohol as a food and made no use of alcohol as a remedy,--the institution was looked upon as very fanatical and it was almost considered that the physicians here were guilty of mal-practice because they did not under some circumstances permit their patients the use of alcohol, did not prescribe it. In fact, more than once when compelled to deal with a necessarily fatal case, a case that came here under conditions that could not be helped and a case that was simply within a few hours of death, when compelled to deal sometimes with such a case, I felt myself very much shaken up. More than once I expected to have to face a suit for mal-practice because I refused to give alcohol under conditions in which I knew it would do more hard than good and so refused to use it. So at the present time the Battle Creek Sanitarium has come to be in fashion as regards the use of alcohol.

As regards tobacco, tobacco seems to be going out of fashion with the best people, with those who are looking about to find how they can increase their efficiency. Not very long ago I was invited to dine with a very prominent surgeon, one of the most eminent surgeons in the United States, and a number of other medical men were present at the dinner. After dinner we were invited into the general parlor for a little chat, and greatly to my surprise the host said, "Gentlemen, it is customary to pass around cigars at this stage of the game, but I have no cigars in my house. I have fully determined that I shall not present cigars to my medical brethren any more; for I have observed that among the best physicians, among medical men in general who compose our best society, tobacco using as well as alcohol is going out of fashion."

And so, as I said, whereas forty years ago we were out of fashion, we are now beginning to come into fashion. We are quite in line with the latest fashion as regards alcohol and as regards tobacco;and what is true of these things is also true of other things.

Forty years ago the institution was regarded as a fanatical institution because it did not serve meat, did not recommend meat. Now it is a very common thing to hear physicians saying to their patients, "Leave out meat, discontinue the use of beefsteaks," etc. So with reference to every means employed here.

I remember one incident in my career, which is not a very long one, nor one that has been accompanied by any very remarkable incidents,- I remember one which I think I shall never forget,-one occasion in which I sat before the Bar of a medical society which had gathered for the purpose of turning me out. Charges were preferred against me as being guilty of mal-practice. The accuser thought he was able to prove that I had imperiled the life of a man suffering from pneumonia and the evidence was this when it was sifted down: that the patient's wife had heard through a neighbor that at the Battle

Creek Sanitarium Dr. Kellogg recommended the application of cold compresses to the chest when a patient was suffering from pneumonia. Her husband had pneumonia and was not getting better under the treatment which he was receiving from his doctor and his wife suggested, in fact took the liberty to apply to the patient's chest, cloths wrung out of cold water. "Why", said the doctor, "You might just as well have put a bullet through his head with a rifle as to apply cold water to the chest of a man suffering from pneumonia."

Now at that time that was the general opinion. The doctor was not an ignoramus by any means but that was the general, current opinion among physicians,-that cold water was a dangerous thing in pneumonia. But the labors of the eminent Professor Virchow of Berlin, and of Winternitz of Vienna, and of numerous other eminent European physicians, finally convinced the world that water is the sovereign remedy in fevers of all sorts, not only in pneumonia, but in typhoid fever and every other sort of fever. So water, which was regarded at that time as positively dangerous and was rarely used in any kind of fever, is, at the present time, the one reliance. So we areno longer out of fashion as regards the use of water in pneumonia or fever.

Up-to-date physicians at the present time rely upon these remedies altogether instead of upon medicinal remedies of any sort. And in many other ways the remedies employed here, which were regarded at that time as quackish and irregular, are at the present time standard remedies in the medical profession.

But just a word further of the occasion mentioned a moment ago. When I was brought before the Bar of the Medical Society to be tried for malpractice the accusation was that I was trying to found a new school of medicine known as "rational medicine." I was talking a great deal about rational medicine and rational remedies and this to my then colleagues was regarded as a very piratical thing to do.

The question finally came to vote whether I should be turned out of the society or not. I counted heads and I found there were just six heads for me and six heads against me. Fortunately I myself was a member of the court, a member of the jury, for the whole Society had a right to vote. I found by consulting with my attorney that I had just as good a right to vote as anyone else, although I was, on this occasion, the prisoner before the Bar, the culprit. I was a member of the jury at the same time; so when I found there were six for me and six against me I said, "I will not go back on myself." So the votes were counted and there were seven for me and six against me. (Applause) So my own vote saved me from being turned out of the Medical Society.

The trial of my case extended over a year, more than a year and a half, almost two years, in fact, and every three months, at the meeting, my case was discussed and I had an opportunity to present the principles of the institution more thoroughly, I think, than on any other occasion ever afforded me; and the result was that two years after an attempt had been made to turn me out, the Society unanimously elected me president of the Society. So you see there was some change of opinion.

Medical men unquestionably are as honest as any other class of men in the world and the most self-sacrificing. There is no class of men in my opinion who are such earnest seekers after truth, or, at any rate, no class of men more honest seekers after truth than the medical profession. There have been many wars in the profession, as you know. Up to recent times, the wars of the pathies were very much exploited in the papers and in the medical colleges, and in every large city there were homeopathic colleges, allopathic colleges, and there was a bitter war between the students of the so-called different systems of medicine. But at the present time this war is disappearing. I dare say not a person has seen a word in any public print in the last five years about a war of the pathies. There is no such thing any more. The medical profession, as

I said, have been always seekers after truth; and as the facts have been made known, as the laboratory discoveries of facts have been made known to the profession, and the truth has been diffused more and more through the ranks of the profession, these differences which formerly existed have disappeared. And one very interesting discovery has been made by the doctors themselves, and that is that this war among medical men, the so-called war of the pathies, was a war about drugs. It was altogether a war about drugs.

I remember some twenty years ago a doctor came here and brought a patient and he said to me,

"Now doctor, I have brought this patient for treatment in this institution and I am going to turn her over to you to take charge of her, but with one condition, and that is that you shall treat her homeopathically."

"Well," I said, "Doctor, just what do you mean?"

"Well," he said, "I am a homeopath and she has always had homeopathic treatment. I am here for the purpose of saying to you that you shall not treat her at all unless you agree to treat her homeopathically."

I said, "Doctor, won't you explain to me about that? We are going to give this lady baths of various sorts. Now how do you give baths homeopathically?"

"Oh," he said, "Of course, you understand all about baths. Of course that's all right. That's all right. Give her baths just as you ordinarily do."

"Well," I said, "We are going to use electricity also, Doctor. How do you apply it homeopathically? We are not informed about that."

"Oh," he said, "That's all right. You know all about that. Apply it as you usually do, of course."

Then I said, "We are going to give her massage. Do you give massage homeopathically? How do you do that?"

"Why," he said, "I see Doctor, it's all right. It's all right. You apply massage just as you always do."

Then I said, "We are going to give her food of various kinds. Diet is one of the important remedies here, but how do you feed people homeopathically?"

Well when I got to that point, the doctor said, "Well doctor, I see you understand about it, I will leave the case to you. I meant that when you give her medicine I want you to give her the medicine homeopathically."

" All right," I said. "We will give her homeopathic doses if we give her any." So she stayed and got well.

Now medical men discovered some years ago that this war between the different classes of physicians related to the most insignificant and the most unimportant things in the entire practice of medicine. It does not relate at all to the so-called physical remedies or to surgery, to the use of water, electricity or things of that kind; that the important things of medicine were entirely above and beyond all this war, and they discovered that a man who was educated homeopathically, when he came to use surgery used it exactly as advocated in a regular school; and really all that could be rightfully asked of a man was that he should have a scientific foundation in surgery, anatomy, in physiology, in the minute anatomy of pathology and these other large things. It has really come to be the science of medicine while the mere use of drugs was no longer a matter of sufficient importance so that there needed to be any discussion over it. And as the result, at one of the annual meetings of the American Medical Association, the bars which has been up so long between the different classes of medical men were broken down. The fence was actually swept away. The homeopathic physicians and physicians of other schools were invited to be members of the great American Medical Association and no questions were asked at all as to whether they used big pills or little pills or high potencies or low potencies. All that was asked was that they should be scientific, and the matter of applying the remedies was left to their own individual discretion.

Now this general plan of medical ideas and of broadening the feelings and opinions of medical men which has destroyed the war between the homeopaths and the allopaths so that there is no longer any quarrel among medical men, and questions of that sort, this same great progress which has been made has broken down the prejudice against this institution and the therapeutic means employed here. I thought it right that I should tell you this because I did not want anybody to think that I or the Battle Creek Sanitarium have converted the American Medical profession of any error there might have been; but it has been a general movement in the world, throughout the whole world, in Europe as well as in this country, a movement of progress which has resulted from the scientific work which has been done in laboratories and the scientific tests and checks which have been applied to remedies so that at the present time the practice of medicine has come to be a real science; and this progress has made it possible for this institution to receive a recognition at the present time which it did not receive forty years ago.

So I am very glad to be with you, to stand here tonight, feeling that the institution through myself and in many other ways is recognized as a legitimate force, a legitimate institution, a legitimate medical institution which can be recognized and patronized by the medical profession, by men in good standing.

Forty years ago no physician sent a patient to this institution. No physician ever visited this institution. There was some reason for that because the institution was started as a water cure and the people who started it were so violently opposed to the drastic measures which were encouraged at that time that they denounced the whole medical profession as being murderers and cut throats. Consequently there was very good reason for bitter feelings toward the institution.

When I took charge of the institution nearly forty years ago, or became connected with it, I should say, forty years ago, even a little longer than that, and took charge of it thirty-eight years ago, I stated to the Board of Directors, "I am a member of the medical profession and I do not propose to make war upon the medical profession. I believe the medical profession are going to make progress in the next twenty-five years. I propose to work in the profession instead of out of it, and I am not going to battle against the profession because I am a member of it and I believe the medical profession are just as honest as any other men, and that in time there will be a different opinion about these matters and there will be a different attitude toward the institution; so I shall endeavor to work in a conciliatory way." And I am very thankful that I have lived long enough to see the day come when things that were once unpopular have become popular, and the things that were denounced as irrational, almost wicked, are recognized as of true value.

I thank you, friends, for coming here tonight, and I thank Professor Fisher for his kind words, and I am especially thankful to my medical brethren for the kind attitude which is growing for the institution and which brings a great many medical men here. We have had at least, in the last twenty years, more than two thousand medical men come as patients, and we have had more than ten thousand members of the families of medical men here as patients. And at the present time quite a large proportion of all our patients are sent to us by members of the medical profession. So I think we have no reason to complain of lack of recognition.

Abstract of Work on CHRONIC RHEUMATISM by R. Fortescue Fox and J. Van Breemen, President and Secretary of the International League against Rheumatism

SOME CHARACTERISTICS OF RHEUMATIC AFFECTIONS

1. They do not end in suppuration.
2. All forms of rheumatism are progressive.
3. All show anatomical changes in (a) the joints, (b) cartilage, (c) synovial membrane, and (d) the bones. (Nothnagel)

Non-purulent arthritis may result from the tubercle bacillus, gonococcus, diplococcus, and "probably autointoxication."

The joint is a place of low resistance.

A predisposition to rheumatism when very pronounced is called arthritic diathesis.

Another cause is catching cold. Cold and dampness cause the disease and encourage its development. These factors are aggravated in special climates, especially windy, chilly, rainy, foggy climates.

Rheumatism is very frequent in cold, damp climates and comparatively rare in warm, dry climates.

PROVEN CAUSES OF RHEUMATISM

1. Focal infection.
2. Constitutional predisposition.
3. Disturbances in the circulation of the skin.
4. Weather or climatic conditions, especially cold and dampness and weather changes.

The skin factor seldom causes rheumatism without the first two, focal infection and rheumatic predisposition.

The derivation of the word rheumatism refers to cold and taking cold.

RESULTS OF RECENT RESEARCHES

Discovery of scars or nodules in the heart muscle typically characteristic of rheumatism. Found in both acute and chronic rheumatism.

Close connection between acute and chronic rheumatism, not formerly recognized.

The primary seat of rheumatism is the connective tissue (Gräff).

Rheumatism produces typical tissue changes.

In miositis changes begin with swelling of the connective tissue between the bundles which progresses to waxy necrosis of of the muscle fibers. Later fibrositis develops and Aschoff nodules form (Klinge).

The connection between acute and chronic rheumatism has been proven. The same morbid processes are shown not only in the joints but in the bloodvessels (phlebitis) and the connective tissue.

The joint disease is a local expression of a systemic condition of the body.

These new conceptions form a sound basis for physiotherapy which is the most efficient means of improving the general conditions in rheumatism.

Osler said that there was no disease entity to which the term rheumatism could be applied. This is now known to be an error. Rheumatism has been shown to be a distinct disease, the seat of which is the connective tissues.

Recent investigations have shown a connection between acute rheumatic fever and rheumatoid arthritis.

The old view connecting phlebitis and other vascular changes with rheumatism has been confirmed by late researches.

Arthritis deformans is no longer regarded as a local disease but as a systemis disorder.

Physical treatment is eminently adapted to influence the general rheumatic condition.

There may be such a thing as rheumatic allergy. But this is not proved.

Swift of the Rockefeller Foundation regards rheumatism as a hyperegic phase of bacterial infection, probably streptococcic.

Hemolytic streptococci cause hypersensitiveness or allergy when injected into rabbits.

Others think the hyperegic symptoms due to toxic antigens.

Physical treatment both cures and prevents rheumatism.

The symptoms of the disease are due to the reaction of the body against its cause.

Modern medical practice has discarded efforts to combat each morbid symptom and developed a systematic use of natural curative bodily processes.

Recent progress has developed a rational foundation for treatment of disease on a biologic basis.

Examples: vaccines and physical remedies, that is, exercise of function by physical agents and treatment by means of vaccines. Bio-chemical treatment by vaccines and bio-mechanics by physical agents, such as electricity, mechanical therapy, massage, gymnastics, orthopedics, heat and light, act as stimuli of natural functions.

The nature of the stimulus is less important than the dosage which determines the reaction.

The body makes contact with the outside world in two ways, by the senses and by the skin.

The skin absorbs, transforms and gives off energy.

Special senses originate in the skin.

The eye absorbs energy at the rate of 600 ergs per second (50,000,000 in 24 hours.) The ears admit 100,000 ergs in 24 hours.

REST OR STIMULATION

Irritability—Definitions

1. Capacity to react to external stimuli.
2. Power to react to stimuli by increased metabolism.
3. Ability to react to external stimuli for its own benefit.

Application of stimuli may produce energy a hundred times as great as the stimulus.

THE EXERCISE OF FUNCTION

Exercise stimulates function.

"Hardening" consists in training of the skin muscles by exercise. (Vasomotor gymnastics)

Exercise is a factor in almost all kinds of physical treatment.

A stimulus is like trauma, something against which the body defends itself.

Said Lagrange, "Exercise is formally indicated whenever it can not do harm."

COUNTER INDICATIONS

1. Violent exercise may cause disease of the posterior columns of the spinal cord.

2. A predisposition may cause light exertion to give rise to injury (Edinger).

Nerve paths are destroyed when they are overworked.

Exercise is contraindicated when there is exhaustion or a tendency to exhaustion.

In physiotherapy there is a wide field for exercise, but care must be taken to avoid doing harm by adapting the dose to the conditions present.

THE SKIN AS AN ORGAN

The skin is an organ which regulates the circulation.

The skin is an organ for defense and for utilizing stimuli.

The skin is the most important organ in relation to involuntary life processes.

THE SKIN REGULATES CIRCULATION

The vessels respond to stimuli after the division of the spinal cord and sciatic nerve.

The deeply seated vessels are controlled by vasomotor centers.

The arterioles of the skin have their own vessel mechanism.

Example: Cold water causes constriction which is followed quickly by relaxation or hyperemia. Warm water of proper temperature (not hot) causes immediate dilatation without constriction.

In a general application of cold to the surface as a rubbing sheet or pack, the blood driven out of the skin goes chiefly to the splanchnic vessels. This is known as the Dastre-Morat law.

Exceptions. Cold to the feet causes vascular contraction in the kidneys. Cold to the inner sides of the thighs causes contraction of the uterine vessels.

The Skin Acts as a Unit -- when cold is applied to a small area of the skin, the vessels of the entire skin contract.

The whole skin contracts under cold applications through the vasomotor nerves.

Local hyperemia caused by inflammation is accompanied by dilatation of the blood vessels in distant areas of the skin with rise of temperature. Local hot applications produce the same effects.

Vascular reactions due to changes in temperature differ greatly in different individuals. The difference is especially great in men and women. Mosso observed decrease in volume in men at 43.6°F. and increase at 91° F. in men. The decrease in women began at 54° F. and increase at 88° F.

Peripheral circulation was proved by Hasebroek to be independent.

Woods Hutchinson spoke of the skin heart.

Kylin called the capillary vessels of the skin the peripheral heart.

Tiberstedt called the capillaries the nodal point of the vascular system.

Krogh demonstrated that the capillaries act independent of the rest of the circulation.

The capillaries have both dilators and constrictors.

Adrenalin causes spastic capillaries — contraction.

The small arteries of the skin, veins and sub-capillary plexus, contract and relax under the influence of the central nervous system.

The epidermal cells next to the horny layer excrete histamin which acts in defense of the organism.

The capillaries act the same as the arterioles. This action is independent of the nerve supply of other blood vessels and enables them to propel blood into the veins. This was shown by Bier.

MUSCULAR REACTIONS OF THE SKIN

The tonus of the skin is due to muscle fibers and the yellow elastic tissue.

The skin tonus is highly sensitive to changes in temperature.

The deep layers of the skin are highly vascular. (Hold two-thirds of all the blood in the body.)

THE SKIN AS AN ORGAN OF SENSATION

The sensory nerves of the skin are continually reacting on the nerves and muscles of the vasomotor, circulatory and respiratory centers and on the whole body. When these activities are lessened, the whole body suffers and the equilibrium of the body is disturbed.

HEAT AND COLD SPOTS OF SKIN

Heat and cold spots were discovered by Goldscheider.

In some areas cold spots predominate, in others, heat spots.

Stimulation of heat and cold spots ceases when the skin is cooled to 61°F.

Danger of scalding if hand is plunged into hot water after having been for some time in a room at 41° F. to 68° F.

IMPORTANCE OF CUTANEOUS STIMULI

Weak stimuli increase normal tension; strong stimuli decrease it.

General cutaneous stimuli (tepid CO_2 bath) slow the heart and increase force of contraction.

Blood pressure influenced by stimulation of the skin.

Skin stimuli lessen the size of the spleen.

Skin stimuli affect gastric secretions, kidneys, and movements of intestines.

Cold skin increases muscular tension.

Applications to the skin influence the entire organism.
The time factor essential. The stimulus must be continued for a few seconds to produce an effect.

METABOLISM

The skin excretes 1 per cent as much CO_2 as do the lungs.
Exposure to cold causes increase of CO_2 excretion by the lungs, but excretion by the skin is diminished due to capillary contraction.

PERSPIRATION

Perspiration is much more important than gas excretion.
Two kinds of perspiration: insensible, due to diffusion of water vapor through the epidermis; sweat, due to the action of the sweat glands. Seven hundred to 2,000 gm. of sweat produced in 24 hours.
Perspiration is less in damp air than in dry.
At 91° F. insensible perspiration gives place to sweat. At 101° F. water excretion equals 3,811 gm. Increase of air temperature from 90° F. to 176° F. causes sweat secretion. Beyond that point it diminishes.
Heating, long continued, may cause complete exhaustion of the sweat glands, the skin becoming as dry as cork.
The sebaceous or fat glands of the skin contain much calcium.
The sweat is rich in potassium.
Potassium predominates in the epidermis and calcium in the true skin.
The axillary glands have the structure of sweat glands, but produce fat.
Sweat is normally acid, pH 5.5, due to fatty acids. Increased under clothing.
Salt content of skin 0.3 per cent. With increased sweat rises to 0.5 per cent.
The N ionic concentration of sweat is greater in sweat caused by exercise than sweat due to heating.
Sweat caused by heating or drugs is alkaline; sweat from exercise, acid.
Sweat from work shows increase of chlorides. Sometimes much lactic acid. In football players, when sweat begins, the lactic acid content is ten times that of the blood. This shows the skin to be a true organ of excretion.
Sweat from muscular exertion is more toxic than sweat from heat.
Variable amounts of sweat result from different procedures. Radiant heat bath or wet sheet pack may cause the elimination of a kg. of sweat. A hot sand bath may cause 3 kg. in half an hour. A long hot air bath may cause a kg. of sweat.
Water drinking helps sweat secretion.
The optimal temperature for producing sweat is 140° F. Should avoid overheating which may paralyze the sweat glands. (I myself sweat profusely in a Turkish bath at 300° F.--J. H. K.)
The skin is influenced by the internal secretions of the thyroid, adrenals, and sex glands.
There is evidence that the skin itslef may produce a hormone.

HEAT REGULATION BY THE SKIN

The colder the skin the more anemic; the warmer, the more blood it contains.

Cooling of the skin or heat radiation depends upon

1. Ratio of skin surface to weight.
2. External temperature.
3. The surrounding medium -- water, vapor or air.
4. The state of the skin.

Increase of blood circulation increases cooling.

Four-fifths of the heat lost by the body is eliminated by the skin.

The skin temperature varies from 32.4° C. (90° F.) to 36.4° C. (97.5° F.) in different parts of the body. The coolest part is the forehead; the warmest the armpit.

The temperature of the uncovered skin in a room at a temperature of 71.6° to 75° F. is from 32.4° C. (90.5° F.) to 36.4° C. (97.5° F.).

The temperature of the uncovered skin in a room at a temperature of 50° F. to 58° F. is 84.2, and covered 89.6° F.

There are variations from the normal. Some persons have always cold feet and a warm back, others the opposite conditions.

When the skin is cooled, the rectal temperature rises.

If 15 per cent of the body surface is exposed to the air of a cool room, the heat loss is one-third greater than if fully clothed.

CONDUCTION AND RADIATION OF HEAT FROM THE BODY

The conduction of heat depends on the difference in temperature between the body and its surroundings.

The skin is a bad conductor of heat, especially the epidermis.

The loss from 1 square cm. of skin 2 cm. thick is .00248 calories per minute.

The skin transmits heat about twice as fast as adipose tissue of the same thickness.

The loss of heat is greatly increased by motion.

The loss in damp air is increased by conduction. The skin becomes moist and is a better conductor.

The greater the skin surface in proportion to the body weight the greater the loss.

The heat loss by radiation when at rest is 300 to 1,000 calories per square meter in 24 hours.

The temperature of the skin has little effect on radiation.

The character of the skin surface influences heat radiation.
A smooth, shiny skin radiates heat much less rapidly than a wrinkled skin.

Rubbing increases heat radiation greatly.

In a room at ordinary temperature the loss of heat is five-tenths by radiation, three-tenths by conduction and two-tenths through perspiration.

In a room with a temperature of 68° F., with light clothing, the loss was by radiation 1,181 calories, conduction 833 calories, evaporation 588 calories, respiration 35; total 2,637 calories.

The average loss of heat per hour is 100 calories.

The possible range of increase or diminution is 3-1/3 times the average rate.

THE SKIN A REGULATOR OF LIGHT

Finsen failed to kill bacteria under the skin by light. The light rays are filtered out by the skin, The more light the more complete failure; for light heats the skin and expands the blood vessels and lessens its permeability.

The blood absorbs all rays with wave lengths shorter than 3,000 A.U.

Red rays penetrate the ear and thicker layers of the tissue, but fail to penetrate forearm after half hour exposure.

Strong applications of light produce two effects on the skin, erythema and pigmentation. Pigmentation is sometimes absent in blonds.

Erythema appears after 6 or 8 hours. The skin peels 4 days after a strong exposure.

In erythema, the cells of the deeper layers of epithelium swell, especially the nuclei; the capillaries are much distended, the blood stream is slowed down and the leucocytes are very numerous and active. After 24 hours red cells appear outside the vessels and edema.

Blistering occurs if the rays penetrate to the lower layers of the skin.

Peeling is due to destruction of the superficial epithelium.

There is strong influence of light on the sympathetic through the skin.

The leucocytes deposit pigment in the papillae between the layers of the skin, that which is peeling off and that which is being regenerated.

The calcium content of the blood immediately after erythema occurs, is increased (this is doubtless due to the production of vitamin D).

Pigmentation usually occurs only after definite erythema.

Light waves shorter than 2,900 A. U. produce erythema without pigmentation.

Strong pigmentation occurs after a dose twice that required to cause erythema.

Finsen laid great stress on pigmentation.

Rollier considers pigmentation and therapeutic action synonymous.

Pigmented areas are warmer than the unpigmented (Through absorption of heat rays.)

Some substances like eosin increase the sensitivity of skin to light. This also occurs in pellagra.

The skin is regarded as an organ of immunization.

In eruptive fevers the course is more favorable when skin eruption is pronounced.

The skin not only withdraws toxins from the circulation but makes antibodies. The various skin tests are based on these facts.

The skin acts as a filter for many toxins, organic and inorganic.

The skin protects the body against disease germs (Bloch). This fact has led to the use of intracutaneous injections.

In phthisical patients not only the lungs but the skin is affected.

The action of hydrotherapy and of heliotherapy is perhaps due to this function of the skin, increasing its efficiency in combating toxins and forming antibodies.

The skin is a filter for other substances as well as infection viruses. The effect of insulin injected into the skin differs from insulin injected under the skin. When injected <u>into</u> the skin the effect is twice as great as when injected <u>under</u> the skin. The same is true of the injection of poisons. Injections of methylene blue into the muscles was found in the urine after an hour, when injected into the skin, after 5 hours.

It is thought that a hormone similar to adrenalin is produced in the skin. This hormone is supposed to regulate blood pressure and to stimulate the sympathetic nerves.

THE SKIN AN ORGAN OF PHYSICAL DEFENSE

The horny layer of the skin offers strong resistance to electrical currents. The two layers of different polarity.

The secretion of the sebaceous glands increases the resistance of the skin to chemical agents and to bacteria.

The skin is ordinarily impervious to water and water-soluble substances. Lipoid substances may be absorbed. Gases are also absorbed in small quantities and likewise aniline dyes and carbon monoxide gas.

Chemical substances may be carried in by kataphoresis and substances may be forced in by rubbing. The amount that can be introduced in this way, however, is very small.

THE SUBCUTANEOUS TISSUE

Stiffness and pain on movement may be due to disorders of the subcutaneous tissue.

Pain produced by lifting a fold of the skin and making traction indicates a morbid condition due to lack of exercise or constitutional disturbance. It may be an organic tendency.

Fat and subcutaneous tissue are poor conductors and afford excellent protection against loss of heat.

The skin has more than 10,000 square feet of blood vessels which may contain one-third of the blood.

In the treatment of rheumatism four factors must be considered: (1) Focal or other infections; (2) inherited or constitutional tendencies; (3) disturbances of the skin and circulation; (4) external factors or weather, climate, etc.

Focal infection not an exclusive causal factor. Must be associated with some other cause as disturbance of the skin.

Joints closest to the focus are first and most severely affected.

Focal infections may be found not only in the teeth and tonsils and sinuses <u>but also in the colon.</u>

CONSTITUTION

The existence of a rheumatic constitution or so-called arthritic diathesis is well established.

Rheumatism runs in families characteristic of the arthritic diathesis.

In persons with an arthritic constitution mild local measures are often more efficient than general measures.

In cases of arthritic diathesis the history shows slight rheumatic affections during many years, frequently recurring.

Depressing influences are especially active in cases of arthritic diathesis.

There is a pronounced tendency for acute rheumatic attacks to become chronic, with great susceptibility to changes in weather, taking cold, etc. The family history indicates rheumatic tendencies in some form or another.

Cases with arthritic tendencies give family histories of asthmas, diabetes, calculi, gout, arteriosclerosis and mental and nervous disorders.

Arthritic diathesis has been defined as "a predisposition of the connective tissue, which, as the result of some alimentary derangement, becomes a place of diminished resistance, where inflammations, morbid growths and scleroses frequently find their origin."

Huchard defined arthritic diathesis as "a tendency to congestive attacks and arteriosclerosis."

In arthritic cases the muscles are very susceptible to injury or unpleasant symptoms following exercise.

Arthritic persons are much subject to secondary fatigue. The muscles are sore, stiff and painful. Several days are required to recover from a moderate amount of fatigue. Lactic acid is present in the urine in considerable quantity, 4 to 6 grains per liter. In such cases inactivity of a joint because of fracture or other cause is likely to cause onset of rheumatism in the inactive joints.

In arthritics the skin symptoms present in rheumatism are usually present, especially the following:

1. The skin is easily chilled in cool, damp air.
2. The skin does not react well to hot and cold applications.
3. The pressure of a band as a garter will cause swellings and pressure marks which indicate pronounced arthritic diathesis.

The children of rheumatic stock are liable to asthma, colitis and cyclical vomiting.

Atrophic arthritis and infectious arthritis does not begin with the appearance of joint symptoms but many years before, often in childhood.

Mayer considers 25 per cent of cases of rheumatic fever hereditary or familial.

A high blood sugar without urinary sugar is a feature of arthritic diathesis (Spiro).

Under ordinary circumstances the skin in a bath is impermeable to water and to substances soluble in water.

<u>ABNORMAL SKIN CONDITIONS</u>

A glossy pigmented skin is usually seen in advanced rheumatic conditions.

Condition of skin to be studied:

1. Fluctuations of the circulation as shown by the plethysmograph.
2. Observations of the skin temperature.
3. Appearance with capillary microscope.
4. Reaction to moist applications at different temperatures.
5. Reaction to mechanical stimulation, rubbing and compressed air massage.
6. The color of skin after application of cupping glass.
7. Inability of the skin to defend itself against cold. Easy Chilling.
8. Llewellyn wrote, "rheumatism is a disorder of heat or temperature regulation." Arthritic subjects have lost their

resistance to changes of temperature. They have disordered ability to regulate heat and to withstand temperature changes.

9. A tendency to vagatonia.

LOW TEMPERATURES

Circulatory disturbances of the skin observed in rheumatics are change of color of skin due to capillary spasm. Usually pale at room temperatures. Rheumatics complain of the room being cold when others are warm.

Rheumatics are somewhat like cold blooded animals in their inability to resist the influence of surrounding temperatures.

Rheumatics are sensitive to the influence of a cold wall, window or a draft.

In most cases of rheumatoid arthritis patients are feeble and chilly and have slow reaction. The same condition occurs after rheumatic fever.

In some cases of climacteric arthritis there is increased reaction.

THE SKIN REACTION

Technic of skin reaction to cold:

A rough mitt or towel dipped in cold salt water. One arm is rubbed vigorously for one-half minute and then the limb is well wrapped up. At the end of three minutes the wrapping is removed and the appearance of the skin noted.

1. If the reaction is strong and normal, the skin will be bright red.
2. If the color is only a reddish tinge, the reaction is feeble.
3. If there is no change in color there is no reaction.
4. If the parts are cold and bluish, there is a bad reaction (spasm of the small vessels).

STUDY OF THE CAPILLARIES

Microscopic examination shows characteristic changes. Diminished blood in the field, narrowing or closure of many capillaries, irregularity, slowing down of blood flow and a diminished amount of blood in the venous limb of the capillary.

In normal conditions only about one-third of the capillary vessels are in use at one time.

The total capacity of the blood vessels is three times that of the circulating blood.

The blood flow is sluggish in rheumatoid arthritis.

More heat is required to dilate blood vessels in arthritis in order to overcome spasm of small vessels.

In advanced rheumatism the contracted capillaries become permanently closed, losing their ability to react to heat. There is spasm in the arterioles as well as in the capillaries and many arterial and venous anastomoses, sometimes widespread.

Prolonged exposure to cold increases liability to spread of the infection.

Hyperemic conditions of the skin are highly sensitive, especially when hot water is applied.

When the blood vessels are in a spastic condition through cold, reaction to heat is slow. Danger of blistering on this account.

Certain areas assume the appearance of Raynaud's disease or thrombophlebitis, Burger's disease.

DISTURBANCES OF SENSIBILITY

Pruritus a frequent symptom in the initial stages. It is an allergic reaction and appears before characteristic rheumatic symptoms.

Sensory stimulus is a factor in inflammatory reactions.

Division of a nerve prevents inflammatory reaction in the distal parts. The vessels have lost power of active dilatation.

ACRO-PARESTHESIAS

Tingling, numbness and spasm of the blood vessels producing bloodless areas resembling Raynaud's disease. Sometimes cyanosis, occuring most often in women at the menopause.

PAIN

Pain in hands and feet may be so great as to render joints immovable when X-ray shows no ankylosis.

In general, pain indicates rest and little active treatment, at least locally.

Sometimes treatment **which** produces pain is necessary as in sciatica. When such treatment is beneficial, the pain lessens with treatment instead of increasing.

Perspiration is generally reduced. It may be increased, especially in climacteric arthritis.

In rheumatism the perspiration is acid.

Sensitiveness to cold is greatly increased. Gooseflesh appears easily.

Cold greatly increases pain when applied to the affected joints.

Certain parts are especially sensitive to cold because of the great number of cold spots, as in the case of the front of the wrist.

SKIN THERMOMETERS

Thermocouples are best for taking local temperature. (Get an assortment. See page 82).

The skin temperature in advanced cases of rheumatism even rheumatics, when warm in bed before rising, is 2 to 3 degrees F. below the normal.

Certain areas feel cold before an attack of neuralgia in cases of sciatica. An attack may be prevented by application of heat when a cold sensation appears before the attack. Use hot pack, hot half bath or hot foot bath.

Patients who recover from rheumatism sometimes continue to feel cold in spots when exposed to draft.

SUBCUTANEOUS CONNECTIVE TISSUE

Normal skin can be lifted in a fold and rubbed without pain. In rheumatic conditions this causes pain.

RHEUMATIC ERUPTIONS

In rheumatic cases skin eruptions of many sorts are frequent. Eczema and psoriasis most common; sometimes rheumatic purpura.

EFFECT OF EXTERNAL CAUSES

CLIMATE AND WATER

Man is better able to maintain an even level of temperature under varied conditions of heat and cold than any other warm-blooded animal.

A warm skin encourages cooling of the body.

In warm, damp climates, cooling is less efficient, evaporation is hindered and hence exercise causes overheating.

Heat formation is diminished by resting the muscles and lessened carbohydrate intake. (It is important to lessen the protein intake, especially meats). These remarks apply especially to tropical countries. In cold countries the temperature of the air is 40 to 60° F. below that of the body and the skin is cooled instead of warmed as in the tropics.

Heat production may be increased four or five fold after sea bathing or exposure to wind with no variation in body temperature.

In so-called cold-blooded animals, the temperature is only a little above that of the surrounding medium, air or water.

Some warm-blooded animals have poor heat regulation. The porcupine ant eater of Australia can not sweat. The body temperature is 82° F. It has no heat regulating function. It can not endure exposure to unusual heat or cold and has to stay in its hole at night.

Man fights a lifelong battle against cold. The battle is more severe in temperate regions than in the arctics because in the arctics better provision is made for protection from cold.

In the arctics man by the aid of clothing and protection endures temperatures 160° F. below the temperature of the blood.

Men endure tropical temperatures of 130° F.

Fordyce entered an oven at 250° F. (121° C.). Steaks were being cooked.

The writer (J. H. K.) once remained 1 or 2 minutes in a Turkish bath at a temperature of 300° F.

Man can adjust himself to a temperature range of 300° F.

Rheumatics require an increased supply of external warmth.

The importance of cold and dampness as a cause of rheumatism is shown by its infrequency in tropical regions and its frequent occurrence in temperate climates.

The compensating regulation of temperature requires good digestion to supply fuel food, and muscular exercise to increase oxidation and heat production.

The weakness of these factors in infancy and advanced age renders necessary special protection of the aged and infants. The same is true in persons with impaired ability to exercise. In such cases special protection is required.

CLIMATIC COMPLEX

The climatic complex consists of light, heat, movement and moisture. These are all active agents in affecting the human body.

The resistance of the body to climate is not like that of meteorological instruments, each of which registers one element of climate alone. The body reacts to the combination.

Peary reported that a temperature of -12° F. with wind was much colder and harder to bear than a temperature of -40° F. on a calm day.

Moisture changes the effect of the cold air or cold wind, greatly increasing the heat loss.

Heat loss is increased by mists because cool vapor readily absorbs heat.

Temperature fluctuations are great in climates much subject to mists and east winds.

Young healthy persons are benefited by weather changes and temperature fluctuations. Reactions caused by changes in light and air experienced in out-of-door exposures awaken nervous and circulatory reactions in the body which are highly important as health factors.

The reactions induced by temperature changes between the skin and the muscles maintain the muscle tone and make the muscles grow even without exercise (Rollier).

Cold is most stimulating and beneficial when applied immediately after heat. It is also most easily tolerated.

Northern people practice cold bathing after heating with vapor baths and switching with birch twigs.

REACTION TO HEAT

The effects of fatigue, cold and even chilling are almost immediately counteracted by a brief application of water at high temperature.

"Nothing compares with heat in its efficacy for the relief of pain, of muscular rigidity and vascular immobility which are the later effects of exposure and traumatism. Heat can be made to undo the effects of cold, of injury and even of septic invasion and inflammatory reaction."

THE CONSENSUAL REACTION

Hot applications to one arm increase its volume by expanding the blood vessels and causes a similar change in the opposite limb.

The general effects of a hot foot or leg bath counteract general chill and lessen hypertension and bronchial spasm.

(Very hot applications relieve urticaria. J. H. K.)

According to Huntingdon, 64° F. and 80° F. humidity with free air movement are the best conditions for physical work and for mental work the best temperature is 35° F.

Temperature changes are highly stimulating.

The uniformity of temperature of the tropics is regarded as more deadly than extreme heat.

In energizing climates the rainfall is high, which induces changes of temperature.

Climates affect the mind as well as the body. Said Buckle, "Hot countries induce despotisms and cold countries freedom and independence."

The effects of weather on rheumatic pains is an unsettled question.

Rentschler of the Mayo Clinic in studying 367 cases observed increase of pain accompanying storms in 90 per cent of cases.

Observations on humidity, temperature and atmospheric electricity were inconclusive.

It is believed by Stockman that approach of rain, sudden changes of weather and wind cause aching and pain and are felt even when the patient is in bed and not exposed.

Rheumatic fever is rare in the tropics and the arctics, the Eskimo being immune. It is frequent in temperate and subtropical zones and also along rivers and water courses, but not common in Holland. Greater in industrial and urban areas than in the country. More common in northern Europe and eastern countries than in France and Germany.

Cold and damp unfavorable for fibrositis (Buckley).

Sunshine is more beneficial in fibrositis than in arthritis.

Among peasants in central Russia there are much pyorrhea and dental caries, but little arthritis.

OCCUPATION

In trades which require excessive use or strain of joints or muscles, the injured parts are frequently subject to rheumatism.

In brain workers the injury is shown by headache and migraine. In such cases examination of the forehead and occipital region shows infiltration and often painful periosteum. This is particularly true of persons who have arthritic diathesis.

Miners, carpenters, bricklayers and blacksmiths suffer from myalgia and rheumatism of the muscles and joints which are most used.

Glass blowers and stokers are not great sufferers from rheumatism because of the beneficial effects of the great heat to which they are exposed.

Workers in ice houses, breweries and butchers are liable to rheumatism because of exposure to cold in refrigerators.

Damp houses and damp soil when houses are built without cellars cause rheumatism.

Injuries to joints prepare the way for rheumatism, especially in persons with rheumatic constitution. The rheumatism may appear months after the injury has disappeared.

The great effect of cold and damp causing rheumatism was demonstrated during the World War. In one division 25 per cent out of 8,000 healthy hardened men exposed in the trenches suffered from chill after exposure for three days to damp and cold. The disorders noted were chiefly catarrh of the upper passages, rheumatism of the joints, muscles and nerves, and bladder affections.

Chill lowers resistance and opens the door for virulent bacteria which may be present and ready for development. Chill also apparently lessens immunity.

Hans Much said "Chill is perhaps the cause of most infections."

BIOLOGIC AND CLINICAL DATA

The tissues at freezing temperature, 0° C. (32° F.) are in a state of suspended animation. At -6° C. there is physical destruction of cells. Frost bite occurs at the same temperature.

Anabolism, tissue building, stops at +15° C. (59° F.).

Katabolism stops at 0° C. (32° F.).

The tissues can be kept at the freezing point in suspended animation for weeks. Degrees of cold above freezing cause vasomotor paralysis by chill and secondary effects. Degrees below the freezing point cause frost bite by which tissues are destroyed.

Progressive chilling or frigorism (Delepine) was known during the war as "trench foot."

The arterioles are contracted by cold and the veins and capillaries are almost obliterated.

With rise of temperature vessels dilate enormously. Exudation occurs and fibrous deposits form.

People take cold by going out after a lukewarm bath. A short cold exposure, plunging into cold water after thorough heating with a vapor bath, is harmless.

Lode chilled animals and then inoculated them with the tubercle, pneumococcus or staphylococcus; 85 per cent of the chilled animals died and only 12 per cent of those which were not chilled.

Chilled animals often die of pneumonia without being infected.

Lowering resistance by chill was demonstrated by Trommsdorf who found "that the leucocytes showed lessened mobility . . . . regeneration of alexins was diminished and lessened formation of antibodies."

Long continued exposure to chill caused diminution of phagocytosis (Fukahara).

Friedberger found that animals which had been continually exposed to cold for sometime by living in an unheated stable were not subject to anaphylactic shock while animals kept in warm rooms were.

An observation often made clinically is "the more rapid recovery from infectious diseases of persons in cold surroundings or under open air treatment than those in hot hospital wards."

Veterinary doctors appreciated the importance of the chill factor long before general practitioners.

Cats get sick after falling in water. Sheep get inflammation of the lungs after shearing if the weather gets cold and damp. Horses have colic after getting chilled.

Chill favors the activity of latent germs by lowering resistance.

The skin makes antibodies which prevent the harmful action of bacteria. This action is prevented by chill which gives the bacteria an opportunity to get started.

Prolonged, almost imperceptible cooling by drafts or cold walls, is the most common cause of colds which cause vascular contraction.

(Short intense cold applications give rise to a strong reaction which quickens the circulation and is not followed by cold, but prolonged chilling, moderate in degree, causes prolonged contraction of the blood vessels and failure of reaction, perhaps from exhaustion of the vasomotor centers.)

Nursing mothers frequently suffer from mastitis, perhaps from exposure of the skin.

Anemia of the skin is accompanied by anemia of the mucous membrane of the upper respiratory passages.

A person may take cold by taking a cold bath when the skin is not properly warmed. This often occurs in sea bathers. It may be caused by giving treatment if care is not taken to warm the skin.

Cold applications followed by a good reaction increase phagocytosis and improve the opsonic index.

After poor reaction there is a lessening of "all the powers of resistance."

Liability to chill is very common in the tropics. In the tropics a temperature of 70° F. is felt severely by the natives.

Said General Wolseley, "Not to take cold is to avoid almost certainly all the causes of disease."

Wild animals seldom suffer from chill.

Tendency to chill gets worse in domestic animals by inheritance. Greenhouse plants are highly subject to cold.

The process of taking cold is not well understood. The following hypotheses are current:

1. Disappearance of thermal regulation by exposure of a large area to "damp cold."
2. Reflex action.
3. Interference with the regular circulation of blood in the skin or throughout the body.
4. Lowering the temperature of the blood and action on the nerve centers.

Chilling of the feet or other remote parts of the skin causes sneezing, perhaps due to interference with the production of hormones by the skin or some action similar to that produced by adrenalin.

CHILL IN RHEUMATISM

It is not the intensity of cold but the kind that causes chill. Damp cold is most active.

Rheumatic manifestations are most likely to appear near the point chilled as a stiff neck.

Rheumatic disease is certainly associated with chronic inefficiency of the skin in regulating the circulation.

SCHADE'S HYPOTHESIS

There is a definite connection between frost bite and rheumatism. In frost bite there is a change in the colloid condition of the protoplasm with gel formation, a change which is irreversible.

All layers of the skin down to adipose tissue can recover from effects of extreme cold.

When the muscle tissue is affected, the fibers lose their striae, the bundles disintegrate, the muscle loses elasticity, the blood vessels show hyaline degeneration and the bony tissues decalcify.

Frost bite may be followed by osteoarthritis.

An incubation period follows exposure to cold, rheumatism developing later.

Resistance to cold often breaks suddenly through exhaustion of the body resources; then rheumatism or other disorders appearing.

NODULES

Muscular rheumatism caused by myogelosis, may give rise to nodules, noticed in the muscles; rheumatic subjects.

So-called Aschoff's nodules, round, oval and longitudinal masses of avascular scar tissue, is a characteristic lesion of fibrositis.

Much exposed superficial muscles are most often the seat of rheumatism. A frequent cause is prolonged contact with a cold object, as a stone seat or a cold wall.

Muscular rheumatism may be prevented and cured by proper exercise.

SCHULHOF'S HYPOTHESIS

Schulhof regards Schade's theory of myogelosis as untenable on account of the rapid disappearance of pain following applications of heat or manipulations. He regards this as proof that the lesion is not inflammatory.

The capillary microscope shows diminished calibre of the capillary loops when parts are chilled during the cold months of September to January. The capillaries of the skin, muscles and ligaments of the extremities have the same sort of reaction to cold while the internal capillaries react in an opposite manner.

Schulhof regards rheumatism as a local disturbance of the capillary circulation resulting from chill and spastic contraction followed by a local stasis, producing in its turn serous transudations and small cell exudation.

The muscles and skin react in an identical manner. There can not be anemia of the skin and congestion of the muscle.

Chilling of the skin may provoke harmful endocrine reactions.

CHRONIC CHILL PRECURSOR

OF ACUTE AND CHRONIC ILLNESS, SO-CALLED CHILL DISEASES

Rheumatism, like other diseases, is not produced by a single cause, but by a combination of causes.

In all cases of disease there is a combination of internal and external causes.

Bacteria alone are not the cause of disease.

Susceptible people are not ill but are candidates for illness. They are like loaded guns with hair triggers which by a trivial touch may cause an explosion.

General lowering of the body temperature or chill may cause albuminuria, hemoglobinuria or catarrh.

Persons in poor health usually have subnormal temperature at some time of the day or all the time. They can not bear cold. Such persons are very subject to chill.

The condition may be remedied by active exercise and proper diet and by artificial warmth. (An abundance of vitamins and food minerals are especially needed.)

If this condition is not remedied, a state of chronic chill is set up.

Protection against external cold fails when the internal temperature is below normal.

The muscles and joints are especially susceptible to chilling.

AMERICAN CLASSIFICATION OF RHEUMATISM

The Bellevue Classification of Rheumatic Diseases (New York Hospitals)

(1) Rheumatic fever
(2) Rheumatoid arthritis (atrophic proliferative).
(3) Osteo-arthritis (hypertrophic degenerative).
(4) Gout.
(5) Specific bacteria arthritis (named after the organism causing it, such as tubercle bacillis, gonococcus, syphilis, etc.).
(6) Intermittent hydrarthrosis.
(7) Still's disease.
(8) Acute traumatic arthritis.
(9) Spondylitis (usually included in rheumatoid or osteo-arthritis).
(10) The fibrositis group (lumbago, neuritis, myositis).

RHEUMATOID ARTHRITIS

Rheumatoid arthritis has 21 different names.

DIAGNOSIS AND EXAMINATION

Most important is early recognition.

The books usually give descriptions of most advanced cases.

It is important to discover the disease early because "a rheumatic state in the muscles, nerves and joints may easily develop because of unfavorable circumstances into severe and intractable arthritis" though a cure might have been easily accomplished if proper measures had been applied earlier.

EARLY SYMPTOMS

In most cases of rheumatoid arthritis, rheumatism follows a prolonged period of ill health, disturbed skin circulation, coldness and clamminess, skin temperature lowered, rectal temperature increased.

These cases often develop after influenza and in children after scarlet fever.

A characteristic significant symptom is soreness and stiffness in the morning before rising.

STAGES OF RHEUMATISM

(1) Prodromal stage, (2) short incipient stage, (3) a long middle stage, (4) and final stage.

END OF THE RHEUMATIC PROCESS

Ultimately all forms of rheumatism come to rest.

It is often noticeable that the disease terminates first in the joint which was first attacked.

The fact that the disease ultimately ends is of great importance in relation to care and treatment because if the joints can be properly cared for and deformities noted when the disease ends, the patient's condition may be such as to be consistent with comfort and use even though more or less injury has been done. Simple physical treatment is helpful "even in the last stages of the disease."

COURSE OF RHEUMATISM

The course of rheumatism, especially rheumatoid arthritis, is very uncertain.

Complete invalidism is sometimes caused within six months. In other cases the course covers 4 or 5 years.

The disease may terminate in any stage.

Some cases seem to be little influenced by treatment (probably because they do not have the benefit of all possible measures, especially diet regulation). Other cases respond readily to treatment. Cases which have long been mild may suddenly become very active.

Cases of sciatica and lumbago in patients with rheumatic constitutions generally respond to treatment.

Mild cases of arthritis, muscular rheumatism and neuralgia are often very tedious; respond slowly to treatment. (This also may be due to lack of the necessary combination of curative measures.)

EXAMINATION

Examination must be complete so as to discover every possible cause, exciting or predisposing.

Special attention should be given to the skin circulation as well as to the joints.

EXAMINATION OF THE JOINTS

Arthritis is always a symptom and the joint affections not the whole disease, but a local expression of a general condition.

The use of many joints is lost through bad management.

It is important to remember that all the tissues of a joint have a common embryonic origin, the mesoderm, and they may all return, bone, cartilage and synovial membrane, through degeneration, into a fibrous mass if unsuitable treatment is applied.

To prevent cartilage from undergoing degeneration into fibrous tissue it is necessary "to keep it in function," that is, to expose it to pressure by bodily movements.

SYNOVIAL FLUID

"A key to the problem of arthritis lies in the physiology of joints."

The primary change in arthritis is "a modification in the synovial fluid."

The synovial fluid has two functions, to lubricate the joint and to nourish the central and superficial portions of the articular cartilage.

The normal synovial fluid dissolves loose pieces of bone and so removes troubles caused by loose bodies.

The synovial membrane may be regarded as modified cartilage and develops cartilage when subjected to pressure. The morbid process begins in the synovial membrane. Some authorities think that the first change is in the synovial fluid, its alkalinity being diminished.

ARTICULAR CARTILAGE AND BONE

Cartilaginous tissue when once destroyed can not be regenerated. It may be replaced by dense fibrous tissue.

Some authorities claim to have demonstrated the regeneration of cartilage.

Cartilage is believed to be nourished by the synovial membrane.

Bone regenerates to a high degree; this, in fact, is the cause of some of the troublesome developments in arthritis.

The shape of the articular surfaces is subject to change as the result of modifications in the use of the joint.

In examination of joints attention should be given to:

1. Changes in the shape, noting especially extension of the diseased process to the tendon sheaths.
2. Abnormal functioning. The joints are moved actively and passively in all directions.
3. Crepitation, noted by both palpation and auscultation by the method of Garrod.
4. Presence or absence of bursitis.
5. Condition of the capsular ligaments and muscles attached to the joints.

PAIN

The condition of the non-articulated surfaces may cripple the joint by causing muscular and fibrous contractions and pain which gives rise to spasm. Removal of pain may restore almost complete function.

A second examination should be made after pain has been removed. It is sometimes necessary to examine the patient under an anesthetic or local injections of novocaine.

Pain is likely a cause of atrophy of the muscles.

A sedative full bath encourages activity of the joint by relieving spasm.

MOVEMENT OR REST

Must the joints be immobilized?

During rest the circulation of synovial fluid is very slow. Movements of the joint encourage the circulation of lymph in the extremities by emptying the vessels, sending the lymph toward the heart. These suggestions apply to both acute and chronic rheumatism.

Harm always results from complete fixation of rheumatic joints.

In acute cases allow only movements which the patient himself can make. Later passive movements and later resistive movements.

Movements of the joint must be adapted to the nature of the case. Joint movements must be much more careful and conservative in character in rheumatoid arthritis than in osteoarthritis. More vigorous exercises may be applied in the later stage.

In osteoarthritis bony ankylosis may occur.

In artificial arthritis, deformities developed when the animals were allowed free movement.

Allergy develops in cases of arhtritis. (It may be that excessive exercise of joints might give rise to anaphylaxis by forcing toxins into the circulation.)

In normal conditions the limits of equilibrium and all the functions of the body are at their widest. In rheumatism the normal equilibrium of the organism is lost.

In rheumatism the heat regulating functions are crippled so that a condition somewhat similar to that of the cold blooded animals is developed.

Joints in which the equilibrium is disturbed, so-called weak joints such as weak or sagging knees, joints which have been subjected to sprain or strain, to exposure or long rest in bed after operations subjecting the spine to strain may cause injuries which may cause rheumatism.

Many joints show limitation of movement before obstinate rheumatism develops. Months may intervene before characteristic rheumatic symptoms appear.

WHAT IS ARTHRITIS?

A joint may be rheumatic when only the connective tissues about the joint are infiltrated and X-ray shows nothing. Such a joint may be the cause of much trouble.

EXAMINATION OF FASCIAE, MUSCLES AND SUBCUTANEOUS TISSUE

Palpation is important in examination of articular capsules, muscles, fatty tissues, panniculitis, adiposalgia, and cellulitis. Put patient and diseased part in perfect relaxation. Lubrication of skin facilitates palpation.

The nodules are soft at first and later become hard, feeling like scars in the muscle.

Rheumatic persons often get painful patches or nodules after exertion.

These hard spots are not the same as Aschoff's nodules.

EXAMINATION OF THE SKIN

Important in all cases, especially in panniculitis and adiposalgia. Most marked in outer side of muscles of the upper arm and thigh.

Tissues infiltrated and sensitive to touch.

The skin does not react well to cold.

Condition different from indurations of tendons, joint capsules and periosteum. The latter often seen in rheumatism following influenza.

EXAMINATION OF BACK AND LOWER LIMBS

Examine the whole leg and pelvis.

Fallen arch causes lumbago by stretching the sacro-iliac articulation and surrounding ligaments and capsules.

Slight displacement of head of femur may cause arthritis of knee.

So-called rheumatic arthritis often relieved by posture treatment.

Supposed arthritis in knee in women due to overweight of body.

Periarthritis without lesion of joint due to same cause.

In many cases not the joint only but rather ligaments, muscles or connective tissue are the seat of disease.

LABORATORY METHODS

Examination of blood:

1. Sedimentation test.
2. Leucocyte formula.
3. Percentage of uric acid.
4. Sometimes study of lime and phosphate blood content.

Sedimentation test highly important. Westergren's method employed at Amsterdam.

Burger's method employs but one drop of blood.

Sedimentation test is especially useful,

1. To make sure that the cure is complete when other symptoms have disappeared.

2. In cases of infective arthritis sedimentation is greatly accelerated. It is never accelerated in osteoarthritis of hip and knee. Sedimentation is thus a means of excluding infection and inflammation. Some authorities call cases due to wear and tear of cartilage arthrosis instead of arthritis. The French distinguish between infective and inflammatory conditions.

3. Disappearance of a high sedimentation rate is an indication of a return to normal. This test is not always dependable but when positive is a good indicator.

NORMAL SEDIMENTATION READINGS

	1st hour	2nd hour	After 24 hours. Minimum
Men	3-6	6-12	40
Women	8-8	8-16	55

Sedimentation test often rapid. When sedimentation test is found accelerated, even in mild cases of neuralgia or myositis, the cases will prove stubborn.

WHITE BLOOD CELLS

White blood cells seldom give any direct indications. Useful to distinguish between septic and rheumatic conditions.

The infective forms increase lymphocytosis.

Five to 8 per cent eosinophils occurs in pronounced arthritic diathesis.

Blood examination important in malarial regions to distinguish malaria from rheumatism.

Increase of uric acid is an important indication for treatment. Cases showing much increase of uric acid may be chronic gout.

DETERMINATION OF METABOLISM

No definite connection between rheumatism and disturbances of metabolism is observed.

EXAMINATION OF SYNOVIAL FLUID

The sugar content is often very high, 145 mg. per 100 cm. Rises rapidly after ingestion of sugar.

Sugar content of synovial fluid of 60 or below suggests infectious arthritis as probable. Below 45 probably pyogenic. pH value of 7 also suggests infection and below 7 pyogenic infection.

Traumatic rheumatism gives an icteric index higher than 5.5.

Blood rarely found in synovial fluid in rheumatism. When present suggests trauma.

High leucocyte content (11,000 or more) with high proportion of granulocytes (60 per cent) suggests specific disease.

Positive Wasserman in synovial fluid with negative reaction in the blood almost positive indication of syphilitic arthritis.

RADIOGRAPHIC APPEARANCES

X-ray may check a wrong diagnosis by showing changes wholly or mainly in the soft tissues instead of the joints or due to tumors.

X-ray examination alone may be misleading. Great danger of wrong interpretation of X-ray pictures of joints. Expert opinion needed.

In a roentgenogram the appearance of loss of cartilage, osteophytes, ankylosis or subluxation may depend as much on occupation as on disease; hence other evidence than X-ray should be considered.

It is hoped that bone density, a new criterion, may prove very valuable.

Atrophied bone, like atrophied muscle, not due to disuse alone. Pain is a more decisive factor.

RHEUMATOID ARTHRITIS

First stage: Atrophy (osteoporosis), rarefaction, chiefly of cancellous tissue adjacent to affected joint.

Second stage: Atrophy increased; loss of cartilage; no destruction of bone.

Third stage: Atrophy; loss of cartilage; erosion; loss of articular surfaces of bone; subluxation; sometimes bony ankylosis; absence of lipping of articular margins; bony surface smooth; well defined margins; rarely loose bodies or cysts.

Bony structures diminished. Occasionally slight proliferations and loss of lime.

SYMMETRICAL POLYARTHRITIS

First phase: Decalcification; rarefaction. The interarticular line is narrowed and effaced. Destruction of cartilages.

Second phase: Contact of bony surfaces. Condensing arthritis; condensation of bone. No osteophytes.

Third phase: Rarefaction of osseous tissue.

PRIMARY PROGRESSIVE POLYARTHRITIS

Later stage strongly atrophic.
(See plates I and II opposite pages 172 and 174.)

OSTEOARTHRITIS

First stage: Sometimes slight atrophy of cancellous tissue adjacent to joint surfaces; osteophytes and lipping along articular edges; periarticular ossicles; opaque bodies in substance of the capsule.

Later stage: Bone density increased; dentate surface of finger joints, not affecting large joints; narrowing of joint interval; erosion; area of articulating surfaces changed; periarticular lipping; loose bodies; new bone from ossifying periostitis; bone increase; eburnation.

ARTHRITIS DEFORMANS

Articular hemisphere often united at an angle; osteophytes first isolated and then jointed in the form of a crown; interarticular line very irregular.

SPONDYLITIS

Rarefaction of vertebral bodies; joint space diminished; degeneration of cartilage; ossification of ligaments and intervertebral discs.

SPONDYLITIS DEFORMANS

Cartilages discs affected first; vertebral bodies malformed; osteophytes; in the young caused by trauma.

GOUT

In gout the bones show punched out areas and transparent spots under cartilages; bone increase; disorganization of joints; irregularity; erosion; subluxation; bone destruction.

TUBERCULOUS RHEUMATOID

Tuberculin tests useful for diagnosis. History shows glandular tuberculosis in youth. X-ray picture of lung hilus.

Opsonic index useful in diagnosis. In using the opsonic index make the test before and after an hour's massage of a joint.

It has been noted by some authors that lung tuberculosis is often a cause of death in rheumatoid arthritis.

Treatment of tuberculous rheumatoid different from the ordinary form. Drastic treatment avoided. Light therapy, dry heat, sun baths, rest, and treatment to improve nutrition.

Massage in these cases of the surface is a sort of vaccine therapy.

Opsonic index findings in a case before massage .75. One hour after ten minutes' massage .87. Seven hours later 1.08.

INFLUENZAL POLYARTHRITIS

Occurs in people previously infected by rheumatism. Main characteristic great sensitiveness of the periosteal margins of the joints. Most persistent in knees and shoulders. Strong doses of ultra-violet rays beneficial. Combined with colon lavage.

CLIMACTERIC ARTHRITIS

Different from other forms of rheumatism in that treatment is remarkably successful, especially if begun early. Sometimes mistaken for rheumatoid arthritis.

GOUT IN WOMEN

History in these cases shows (1) special liability to specific fevers in youth; (2) rheumatic fever; (3) chill; (4) catarrhal affections; (5) disorders of skin circulation; (6) neuralgia and nervous affections.

Rheumatism common in sufferers from exophthalmic goiter.

OSTEOARTHRITIS

Usually no fever. A gradual development. Usually begins with one or more large joints. Grating, lipping, eburnation, osteophytes. The lesion is often not symmetrical.

Post mortem shows most knee joints more or less affected after 65 years.

Senile changes do not cause arthritis.

Chill, strain or immovility important exciting causes.

Prolonged rest in bed frequent cause.

Changes in the small joints differ from those of the large joints.
Sedimentation rate nearly always normal.

THUMB BASE ARTHRITIS

Thumb flexed toward the palm. Cupped palm characteristic.
Osteoarthritis rare in first half of life. Most generally appears after the climacteric and old age.

HEBERDEN'S NODES

Not connected with gout. Never occurs in gouty patients.
Usually two nodes on terminal phalanx. Begins with heat and pain. Each node contains jelly-like substance, the removal of which may arrest the disease. If not removed, the nodes become hard and painless.
The diseased process is periostitis and osteitis rather than arthritis. The joint itself is seldom affected. Regarded as a form of gout by some authors and by others as osteoarthritis.

SPONDYLITIS

Total ossification of the ligaments of the spine may develop.
Hip and shoulder joints may be affected with the spinal disease.
The disease may be grouped under either rheumatoid arthritis or osteoarthritis.
It affects the patient first in the erect posture and then in the sitting posture.

LUMBAGO AND SCIATICA

Lumbago a disease of the muscles or fibrous tissue in the lumbar region. In women often due to sacro-iliac arthritis.
Contributory causes incorrect pelvic slope, that is, diminished obliquity of the pelvis.
Irregularities of the fifth lumbar vertebra or spondylitis of some vertebrae.
Roentgenogram necessary for definite diagnosis.
Sciatica when rheumatic in character usually begins with lumbago.
Sciatica often cured by treating myositis of the median gluteal muscle.
Sciatica sometimes indicative of disease in the hip joint in elderly persons. In younger persons diagnosis of sciatica confirmed by Lasegue's sign, -- pain produced on flexion of the hip joint of the extended leg.
Treatment of a diseased nerve very different from that of a diseased joint.
Dupuytren's contracture "and trigger finger" due to what is termed intractable contraction of the palmar fascial aponeurosis. Regarded by excellent authorities as undoubtedly hereditary.

ADIPOSALGIA

Most frequent among well-to-do. The patient complains of skin drawn tight. Pains in limbs. Worse in cold weather.

Walking and bending the knees in climbing stairs painful.
Patients often resort to aspirin.
Skin of legs pale and cold.
When exposed to air, skin often becomes purplish red.
Lower part of legs somewhat swollen and sensitive to pressure.
No pitting.
Picking up skin fold painful.
Buttocks and upper arm painful to pressure. Fatty layer hard and inelastic.
Applications of cold very disagreeable.
Skin reaction to cold very poor.
Pain relieved by a hot bath.
Adipose tissue, skin and muscles less sensitive in bath.

INFLUENCE OF SEX AND AGE

In women tendency to obesity and nervous depression are frequent manifestations of rheumatic tendency.

In advanced age so-called senile rheumatism. Premature senility. Joints enlarged. Muscles soft, tender and wasted.

TREATMENT

Rheumatics should be treated as individuals.

The physician must be thoroughly acquainted with theoretical physiotherapy in order to properly direct the physical treatment of rheumatic patients (Fox and Van Breeman).

Prescriptions for rheumatics must properly combine physical stimulation of various sorts calculated to produce a curative hyperemia to be followed by massage and exercise. Also sedative applications.

INFLUENCE OF TEMPERATURE

Both animal and vegetable forms are dependent on the maintenance of suitable temperatures.

THERAPEUTIC PROGRAM

Besides physical remedies of all sorts, colon lavage, diet, support by splints and orthopedic treatment of joints are all required in chronic rheumatism.

PLAN OF PROCEDURE

1. Thorough examination for focal infection.
2. Removal of active effects of infection.
(a) Treatment of general condition by general measures.
(b) Functional treatment of affected joints.
3. (a) Institution treatment; or
(b) The use of vaccines.
(c) Protein injections.
(d) Thyroid, iron and other drugs if indicated.
4. In intractable cases splints and orthopedic treatment under an anesthetic if necessary.
5. In rheumatoid tuberculous cases light treatment, salt baths, etc.

INFECTION

Rheumatism not always due to focal infection. When present it should certainly be removed. Connection between diseased teeth and rheumatism not always traceable.

In Arizona where there is much sunshine and very little rain and very low humidity there is little arthritis although there is much dental disease.

REACTIONS IN PHYSICAL TREATMENT

Treatment is badly prescribed and badly carried out unless the reactions are considered. A cold friction bath is a good example. The reaction is a complicated function. Not only the circulation, nerves and glands, but the whole system is involved. The reaction may be defined as a series of readjusting processes following a disturbance caused by stimulus. Either the nervous or circulatory element of a reaction may be excessive or deficient.

The skin should be gradually educated to improved reaction.

Reaction is shown by opaque or reddish color which may at first be faint, but after each successive application the skin should show an increasing amount of color.

The pulse should become slower and a sense of warmth and increased general well being should follow each treatment.

Incomplete reaction and excessive reaction must both be avoided. Only a normal and correct reaction is of value.

ARTIFICIAL CLIMATE

After a good reaction the improvement of the circulation may continue for hours and also the increased metabolism.

It is from the reaction that the chief benefit is secured in the treatment of chronic disorders.

The beneficial reaction resulting from a prolonged course of treatment may continue for months. This is one of the great benefits of institutional treatment.

The effects produced by hydriatic reactions and other applications of physiotherapy are similar to those which are induced by climate and are sometimes referred to as artificial climate.

The good effects do not follow a single application but only result from persevering treatment, which, if continued long, produces a cumulative effect.

The first applications often show no effect, whereas after several applications distinct effects may be observed which become more and more evident as the treatment is continued. Long treatment is necessary to afford opportunity for structural as well as functional changes.

Army records sometimes show diminished chest expansion after four or five weeks of drill, but after six months show a marked increase in chest measurements. Similar observations are made in noting the effects of physiotherapy.

Chilliness or a feeling of exhaustion after a cold application indicates a lack of vital reserve. Repetition of such experiences will do the patient harm and discourage him from further efforts. Body functions are all aroused to increased activity by general cold applications followed by normal reaction.

Intensive treatment should follow a carefully graduated scale, beginning with an application to which the patient is amply able to react.

Applications of this sort encourage bodily function whereas applications followed by a poor or excessive reaction exhaust the central nervous system through excessive strain upon the vasomotor centers.

The greater the difference between the temperature of the application and the temperature of the skin heat is, the colder the water, the more pronounced will be the thermal reaction.

Thermal impressions are usually accompanied by mechanical impressions.

Two kinds of impressions produced by water:

1. Sensory stimulus through which an immediate reflex effect is produced.

2. Communication to or abstraction of heat from the body; that is, a warming and cooling action of the parts to which application is made and of the body as a whole. Cool baths increase the dissipation of heat and lower the blood temperature; hot baths produce the opposite effect.

Air, hot or cold, produces similar effects but less pronounced than water as the latter is a better conductor.

THE POINT OF THERMAL INDIFFERENCE

The temperature of the skin is the zero of the skin temperature scale. Temperatures above that of the skin feel warm; temperatures below the skin temperature feel cold.

An experiment may be easily planned by which water of a given temperature may be hot to one hand and cold to the other. Place one hand in water at 60° F., the other in water at 104° F. Place the two hands in water at a temperature of 86° F. and one will report the water to be hot and the other cold.

Cooling baths produce one set of reactions and heating baths quite a different series.

Very hot baths too prolonged and too frequently repeated may produce depressing effects in the treatment of rheumatoid arthritis as well as other chronic maladies and give rise to a sensation of faintness which may occur after a single bath or only at the end of a prolonged course. This occurs especially in persons whose hearts have been weakened by exhaustion, malnutrition or other cause.

These undesirable effects may be prevented by careful study of the patient's circulation in each case which should be made at the first examination before beginning treatment.

A most valuable precaution is the use of heart cooling, (so-called hydriatic digitalis.) Leiter's tubes are commonly used.

The baths at health resorts are often harmful because of heart injury resulting from neglect to make use of the cooling coil. Prejudice against the use of hot baths in rheumatism has been produced in this way.

THE CRISIS

A temporary aggravation of symptoms frequently occurs. It is usually of short duration. It is often a favorable sign, showing increased tissue activity in the affected parts, the ultimate result of which will be improvement.

In rheumatoid arthritis great care is necessary to avoid excessive intensity of applications, especially excessive exercise.

Hot applications should never be undertaken when the febrile activity is present in the joint. Such inflammatory foci may be located by careful observation of the temperature. One degree of elevation of temperature above the general skin temperature is a contraindication for active treatment.

Such sedative measures as tepid baths, low temperature vapor baths, prolonged immersion in water at an agreeable temperature close to the neutral point (90° F.) with such disposition of the body that the weight of the limbs is supported by the water proves highly beneficial.

In the condition of tissue inactivity circulatory stimulation is required.

It has been said that rheumatic disorders do not shorten life but spread over it like a blight, especially the working portion of life.

Cold and damp are by many believed to be the dominant factors in the production of rheumatic disease.

In the young, exposure to cold produces reactions whereby harmful effects are prevented, but in subjects of disease and in advanced life the defensive reactions are too feeble to afford adequate protection. Rheumatic persons, through inability to exercise are especially liable to suffer from this cause.

Legrange said very aptly, "Rheumatics and elderly people need exercise more than any others and suffer greatly because of inability to use their muscles freely." (Automatic exercise overcomes this difficulty.)

EFFECTS OF EXPOSURE TO COLD

Lowering of the temperature of the skin lessens activity of the sweat glands and diminishes oxidation and metabolism.

When one undresses in a cool room, the loss of heat by radiation and conduction from the skin is increased at least one-third, and under such conditions the body loses heat the same as any inanimate object.

Lowering the temperature of the blood diminishes resistance to infection and the results of injury.

EFFECTS OF HEAT

1. Hot baths raise the temperature of the skin and make it the hottest part of the body,
2. Such baths increase circulation by opening up the capillaries.
3. Repeated hot baths greatly increase the activity of the skin and sweat glands,
4. The temperature of the blood is temporarily raised by hot baths and repeated hot baths restore the blood to normal temperature when it is subnormal.
5. Hot baths increase resistance to cold and injury and probably also to infection.

See Hyd. reaction to heat.

FUNCTIONAL DISTURBANCES IN EARLY STAGES OF RHEUMATISM

These disturbances closely resemble those resulting from exposure to cold. This fact supports the idea that cold through disturbing the skin circulation is an active cause of rheumatism

A warm climate is beneficial in cases of rheumatism because of protection of the skin. The effect of hot baths is similar to that of climate. By prolonged and systematic use, associated with proper protection, they may produce similar results.

(By means of hot baths and air conditioned rooms advantages in some respects superior to those of the best known climates may be secured.)

In cold climates hot baths are in much use to counteract the effect of cold upon the skin.

A HELPFUL HYPOTHESIS

Morbid conditions of the skin circulation are now known to be associated not only with rheumatism but with other chronic diseases.

According to Schulhof, true rheumatism is a disease in which chronic spasm and stasis in exposed capillary areas give rise to structural changes in the fibrous and connective tissues as the result of repeated or continuous exposure of the skin to cold.

In addition to this prime factor many predisposing and accidental factors contribute to the peripheral circulatory disturbances such as irritants introduced in foods (condiments), infective organisms, toxins,(nicotine, alcohol, caffeine, drugs and colon twirous) fatigue products, imbalance of the endocrine function, added to consitutional or inherited tendencies, the chief of which is an abnormal response to external cold. (failure to react or bad reaction).

This hypothesis explains the benefits derived from increased elimination, hyperemia of the skin, endocrine products and other measures which restore normal reaction to cold.

HARDENING

Hardening of the skin is accomplished by "arousing and re-educating the physiological response or reaction to cold by graduated cooling of the body exposed to the air or water, aided by frictions, exercises and suitable food."

The most effective means of protection against catching cold "is some form of hardening."

Germ killing applications are inefficient. If they destroy obnoxious germs in a microscope test, it is not clear what their action may be in the mouth. May they not also destroy valuable secretions or useful flora?

Hardening is the only active defense against chills.

Physiologic reaction not confined to the circulatory system.

Dubois Reymond defined hardening as "a gymnastic training of the cutaneous musculature"; but this is only part of the story. The whole organism takes part in this reaction, especially metabolism through the action of the nerve centers.

Rheumatics should be warned that "whilst hardening treatment is correct in principle, its application requires great discrimination, especially in the colder months. Cold is literally a two-edged weapon: it is both bane and antidote and may easily aggravate existing disease. It is impossible to counteract chronic deficiencies of body heat and circulation if after thermal treatment a rheumatic subject is allowed to pass into a cold dressing room or the open air."

The bath must be supplemented by a thermal environment in which the patient spends several hours every day. All danger of chilling must be carefully avoided.

In many conditions of chronic disease man reverts to a cold blooded condition. This can be best counteracted by long, gentle, continuous heat.

Deep breathing and other exercises protect against chill in the air bath. (Cold air exercises)

Combined air and sun baths give the best results. Friction is often needed to maintain good skin circulation.

Hardening of the skin for rheumatics is a matter of degree and fine adjustment.

A monotonous unvarying climate is least favorable to health. Life and health depend upon moderate oscillations of thermal, mechanical and other stimuli.

TREATMENT

REST

When is it needed?

"1. If there is any acute pain on movement, as in sciatica, lumbago, torticollis, brachial neuritis, arthritis of the shoulder or knee. To tender joints a bandage should be applied; in brachial neuritis the forearm, including elbow and hand, should be supported in a sling and hot compresses applied to the upper arm; hot compresses are also helpful at the onset of lumbago or sciatica. In cases of severe sciatica complete rest in bed (with very hot applications 3.⁄.d.) for some weeks will often cut short an attack.

"2. In the absence of acute pain in the joints or soft tissues, if there is any marked tenderness, or even slight pyrexia persisting for more than two or three days.

"3. If there is any sensible heat over the affected part, such as knee, wrist or other joint, which can be detected by the hand or a sensitive thermometer. This is especially important with painful knees in middle life, and may denote the early sub-inflammatory stage of arthritis. Or it may be a traumatic synovitis, perhaps connected with slight displacement of the inter-articular cartilage, which is often the beginning of a serious arthritis. In any case pain is relieved, and the joint placed in the best position for recovery, by rest in bed and a warm sedative compress of weak carbolic or lead lotion, (heating compress) under impermeable wrappings, with bandage and splint."

FASTING

Rheumatic attacks often aborted by a few days on liquid food (rich in vitimins A 100,000 - B&D&G 1000-2000 and change of flora) even if there is no rise of temperature.

"Meats and sweets should be forbidden or reduced."

ELIMINATION

Vigorous elimination is nearly (?) always needed. (& ch. of fl - cof.)

Colon lavage amply sufficient without laxatives, especially when combined with suitable laxative food. (twice daily)

WARMTH AND PERSPIRATION OF EXTREMITIES

If the extremities are cold, warm leg or foot baths, 15 minutes twice a day. Induce perspiration. Encourage it by hot drinks.

MASSAGE AND MANIPULATIONS

Should be avoided as long as there is any acute pain on movement or any joint shows a local rise of temperature.

SUB-CHRONIC STAGE

In this stage the acute symptoms have disappeared.

If there is no local or general rise of temperature and no acute pain, two prime remedies for rheumatism, heat and manipulations, may be applied,

Heat, especially radiant heat, should be applied to painful parts and whole body.

Always apply heat before manipulations.

In sciatica a hot pack followed by a salt bath at 104°F., rest in bed and diathermy.

The warm bath often gives the patient a sense of exhaustion. (Cool frictions and cool air baths help to remove this.)

MOVEMENT AND MANIPULATION

Applied especially to joints.

All arthritic joints should be moved to their full extent once in 24 hours and twice daily if this can be done without pain.

In all forms of arthritis apply heat before the joint movements. The muscles must be perfectly relaxed. (Stroking useful)

SUN AND AIR BATHS IN RHEUMATOID ARTHRITIS

Exposure to air and light stimulate metabolism and increase body heat. Especially recommended in rheumatoid arthritis.

Friction with flannel or hair glove a powerful stimulant and prevents cooling of the body,

Very hot and very short baths produce a highly stimulating effect.

EXERCISES FOR RHEUMATIC PATIENTS

When the acute stage is past, exercises are always necessary.

Active movements better than passive movements as less likely to strain a sensitive point and set up an inflammatory reaction.

The morning toilet should include movement of all the joints, preferably voluntary.

The knee joint should be exercised lying down to remove the weight of the body, first lying on the back and then lying on the face. The latter especially important. Lying on the back, cross the heel over the instep of the other foot and then pass the heel over the outer surface of the limb as far as possible.

Exercise the hand with a wool or rubber ball and so counteract the tendency to subluxation and contraction of the finger joints.

Malformations gradually disappear after several months of regular drill; hence the value of these simple movements.

To exercise the wrists, elbows and shoulders, place the hands above the head with the fingers crossed.

Avoid excessive fatigue from exercise which may overtax the nervous system.

Deformities may be prevented by proper use of orthopedic splints. Extensive splints often needed for the knees.

RADIANT HEAT BATH

Precautions:

1. Expose all sides of the body.
2. Drink water before and at intervals during treatment.
3. Cool head by wet towel if face is flushed or headache.
4. Avoid chill after bath. Wise to put patient in a warm bath after the radiant heat bath. (100° F. to 90° F.)
5. After the bath the patient should lie well wrapped to allow decrease of elevated body temperature. (The temperature should be noted with a thermometer either by mouth or rectum or both, until it returns to 98.6)

CLIMATE

Rheumatics sensitive to climatic or weather changes. Avoid cold and damp climates.

In Scotland middle aged peasant women living in cottages with earthen floors suffer much from rheumatism.

Air and light baths 15 minutes twice a day very beneficial. (Much longer exposures necessary for substantial benefit.)

Very hot baths especially valuable in cases of arthritis which are declining toward the final stage.

SCHEME FOR THE APPLICATION OF HEAT

(a) Preventive treatment. Very hot sweating bath with stimulation of the skin followed by friction bath of Winternitz. (Patient reclines in a tub partially filled with water at 90° F.)

(b) Acute and painful conditions require sedative heat and moisture. Complete rest. Useful in all rheumatic troubles of the soft parts and in many cases of arthritis.

(c) Sedative warm baths with manipulation in douches, baths or pools. Especially adapted to rheumatism of middle age.

(d) In more advanced cases hotter baths and careful movements.

(e) In old cases of rheumatoid arthritis and cases of osteoarthritis, climacteric and senile arthritis, temperature raising baths are needed. The range of temperature should be from 90 to 130° F. Combine treatment with elimination, especially colon treatment (colon lavage and cof.) Avoid drugs and vaccines. Great care must be taken to avoid exposure to cold.

MANIPULATION BATHS

Three methods of manipulating under water:

1. Winternitz bath. Vigorous friction in water a few degrees below blood heat and highly stimulating and tonic.
2. Manipulation douches introduced at Aix-les-Bains. Combine four features.

(a) Gentle underwater manipulation.
(b) Slow rhythm.
(c) Sub body temperature.
(d) Water flowing without pressure. Much used in orthopedic cases and infantile paralysis.

3. A third form of manipulation bath, a hyperthermal whirlpool. Manipulation factors are the friction of the moving water and rubbing with the hand. Produces intense hyperemia. May be used in most sensitive cases and makes possible manipulation and exercise.

Three forms of manipulation under water are associated with three different degrees of temperature.
1. Cool water several degrees below body temperature.
2. Tepid water slightly below body temperature.
3. Hot water above body temperature.

THREE RULES OF THERMAL TREATMENT

First rule: All baths for sedative effects, pools, douches or vapor, must be combined with rest both during treatment and after. The patient should lie and may desirably sleep in a warm atmosphere.

Second rule: The body temperature of chilly patients with subnormal temperature should be raised to normal and kept there by hot baths and warm surroundings. The temperature should not be allowed to drop to a subnormal level. Overheating must be avoided, but the patient should never be allowed to become chilled. Chilling may entirely counteract the beneficial effects of treatment. The process of hardening must be delicately managed.

(In cold countries air conditioned rooms are absolutely necessary.)

<u>A patient with cold skin (peno-thermal) does not bear well heat or cold. Easily injured by overheating as well as chilling.</u>

Patients with active skins and normal body temperatures (pleno-thermal) react well to both heat and cold.

COLD WEATHER TREATMENT OF RHEUMATISM

Heat treatment of rheumatism equally successful in winter and summer if proper precautions are taken for protection against chilling. Hot treatment counteracts the effects of winter cold.

TREATMENT OF DIFFERENT TYPES OF ARTHRITIS

PROGRESSIVE RHEUMATOID POLYARTHRITIS IN YOUNG SUBJECTS

Most serious and intractable form of arthritis.

Use external applications of heat carefully. Never when fever is present.

Hot baths should be short, 2 or 3 minutes. Start with 105° F. Increase 1 degree every two days to 120° F. Apply sweating pack after the bath. Keep head cool. May also apply friction douches with alternating temperatures.

In arthritic cases with amenorrhea in young women, diathermy to ovaries and cervix uteri proves beneficial (Cumberbatch). (Hot or alternating vaginal irrigation might be equally valuable. Temperatures 80 and 115° F.)

Change of climate has proved successful.

SENILE RHEUMATISM AND OSTEOARTHRITIS

Generally relieved by warm baths. Sulphur baths seem specially beneficial.

Cases of osteoarthritis and poor nutrition and much pain are good subjects for warm sedative baths prolonged for an hour or more and taken twice daily.

Improved circulation restores body heat.

Systematic local applications applied twice daily improve circulation.

SPONDYLITIS

Especially benefited by hot baths with manipulation.

Sun baths, diathermy and ultraviolet light afford relief in these cases.

THE SHOULDER JOINT

Pain and stiffness in the shoulder may be due to injury or reflex pain from heart, gallbladder or spinal arthritis.

The arthritic affection may be in either one of four points:

1. The shoulder joint.
2. The bursae and tendons connected with the joint.
3. Muscles of shoulder and upper arm.
4. Peripheral nerves about the shoulder.

Contractures and ankylosis may occur.

Put arm at rest in abduction with triangular splint. The patient should put hand behind the neck to maintain abduction and rotation once or twice daily.

The French apply Pacquelin cautery in these cases with great success. Deep X-ray therapy also successful.

Humero-scapular peri-arthritis not real arthritis. Needs different treatment. X-ray shows no affection of joints.

Fibrous adhesions and contraction of capsule and soft parts result of trauma. Limitation of movement. Little pain or tenderness.

Bursitis and tendinitis of shoulder very common, the result too much use or trauma. X-ray may show lime deposits in bursae or on tendons. Active movement lost through pain in deltoid and biceps.

The best remedy (Kahlmeter) is deep X-ray irradiation which is almost uniformly successful.

In climacteric arthritis swelling and pain of tendons of knee joints common.

PANNICULITIS

Caused by continued pressure or constriction. Most common where fat accumulates from lack of exercise.

So-called cellulitis and adiposalgia and other forms of panniculitis believed to be associated with hepatic and biliary disorder. Treatment to remedy this condition indicated (colon treatment and change of flora).

Epicondylitis of the humerus in tennis elbow. Occurs also in blacksmiths and laundrymen. Due to changes in the tendons.

A similar condition and calcareous spur at insertion of Achilles tendon.

All benefited by rest, heat and massage. Deep X-ray most effective.

INACTIVITY A CAUSE OF RHEUMATISM

Rest in bed after a surgical operation may cause rheumatism in persons predisposed to the disease.

Rheumatism of the tempero-maxillary joint recovers, apparently as a result of the necessity for exercise in chewing food.

Daily joint movements are essential in all rheumatic cases.

Absolute rest is quite wrong in all but very few cases.

Sensitive joints must be protected from body weight.

Climbing stairs usually injurious. This is especially true in climacteric and obese cases.

Weight must be reduced 20 or 30 pounds.

Going down stairs especially injurious for rheumatic knees.

Said a charwoman, "That rheumatism again--it is the kneeling and the stairs."

PSYCHIC TREATMENT

Rheumatic patients are usually depressed. Optimism must be encouraged.

FUNCTIONAL BENEFIT

Treatment may secure functional benefit even without anatomical improvement.

Rheumatism comes to rest before the patient does.

Treatment may greatly hasten the end of the disease process.

Exp. Absorption of white of egg injected into a joint is greatly increased by movements of the joint and by massage of the muscles.

Effusion into a joint encourages abnormal growth because of the nutrient material which the synovial fluid contains.

Movements of manipulation encourage the absorption and removal of fluid and so combat abnormal deposits and tissue changes.

INJURIES RESULTING FROM BAD POSTURE OR STATIC DISTURBANCE

Bad posture causes strain, especially of the knee and ankles and is a cause of lumbago. These causes produce the same results as injuries by accidents and are, in fact, a kind of trauma.

INFLUENCE OF DIGESTIVE SYSTEM

The French give much attention to the function of the liver in cases of rheumatism.

Irregular practitioners sometimes succeed in chronic cases where regular practitioners fail because of their use of measures which influence the liver. Lay practitioners succeed with dietetic treatment for the same reason.

Patients with pronounced rheumatic diathesis are especially successful cases. These cases are good subjects for "nature doctors."

THE SKIN

Science has proved that the skin is a unit organ and "autonomous" a fact which must receive constant attention in the treatment of rheumatism.

JHKb

REPRINTED FROM "GOOD HEALTH" MAGAZINE, AUGUST, 1926.

BUILD OR BRUSH—WHICH?

New Facts On An Old Subject Teeth

IN TWO PARTS

PART I

By ELEANOR B. GALLINGER, S.B., D.H.
Assistant in Dental Hygiene, Mass. State Dept. of Public Health

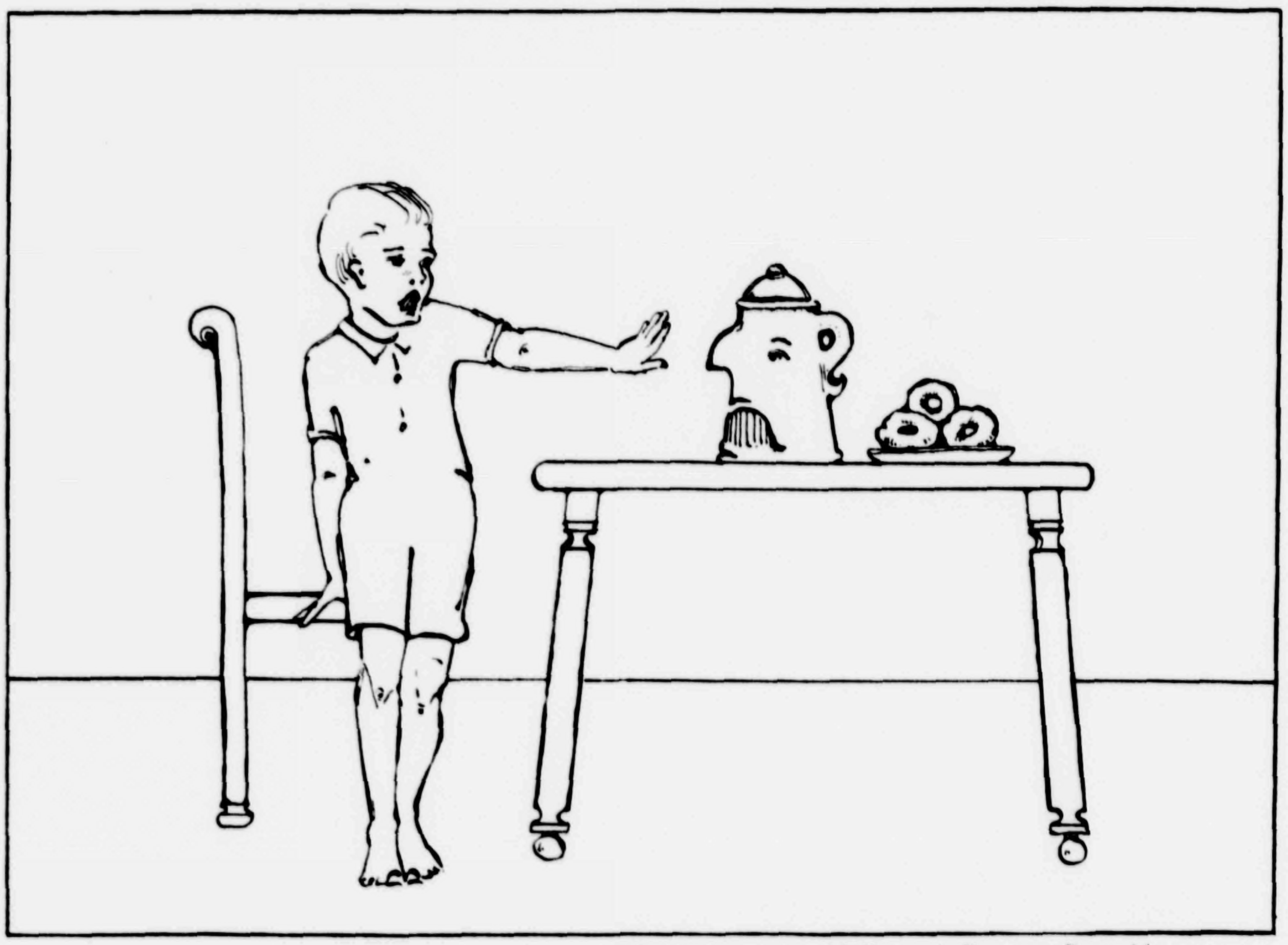
The Old Way

AT the very impressionable age of six I was given the one and only lesson on "Teeth" that I remember. A large white tooth was shown our class in school in the form of a little booklet. Inside was the red pulp and the gray dentine. Here was the telltale cavity, a little black spot just going through the enamel, the big hole reaching to the pulp (I remember thinking it large enough to fall into) and finally the abscess, found at the base of the tooth. These pictures were explained and we were warned to brush our teeth faithfully or all of these terrible things would happen to them. I never forgot it—and brushed my teeth frantically for a week! Mother was pleased, and my sister amused—she had seen me do things frantically before.

Soon the time came for my visit to the dentist, as my family made arrangements every six months regardless of my personal opinon in the matter. He found three holes. I was puzzled, but, yes—I did remember that there had been at least three days when I had forgotten to brush my teeth. And so it has been: I have continued to have cavities and have forgotten to brush my teeth now and then.

The New Way

So much for old methods. That time has gone forever, though most of us are as yet unaware of the change. We must tell our children the truth about teeth. It may be too late to save *their* teeth, but they are the parents of the future. *Good teeth are built, not made by brushing.* Good teeth mean beauty and better health. Sign posts by the side of the road, advertisements in every magazine, pictures in every street car remind us of our teeth—but *what* do they say? Brush, brush, brush, with somebody-or-other's paste or powder. Well intentioned, but how misleading! We cannot make our teeth strong by brushing or scouring them any more than we can make a house brick by painting it red.



Away with Coffee and Doughnuts! Bring on the Milk and Brown Bread!

When have we thought of our teeth? When they first appeared—to brush them; or only after they had developed holes—to fill them. No wonder we are so swamped with tooth decay; no wonder the dentists are so busy. We must about-face; we must get at the root, not of our teeth but of our tooth troubles. *Stop them before they have started.*

Health education as a whole is advancing rapidly. Our boys and girls are joining "vegetable teams" and "sleeping with the windows open" for gold stars. Yes, and they are brushing their teeth. All well and good—teeth must be clean for a healthy mouth. But they must be more than clean. The new dental health education must go back to the beginning and teach the building of strong teeth if it is to amount to a row of molars. Why must health authorities spend their efforts and time convincing mothers and children merely that teeth are *important* and should be cared for? By the time the person is thoroughly convinced, his or her children's teeth may be badly decayed. Most mothers and fathers have had sufficient experience themselves with decayed teeth, toothaches, the discomfort of false teeth, not to mention the hole in the family budget from dentists' bills, to want something better for their children.

Health Education Begins with the Parent.

It may be taken for granted that he realizes the importance of teeth. Experience with his own, or the prolific advertising of the toothpaste companies, should have convinced him long ago. Most parents are anxious to know how to care for their children in the best possible way. Of the two parents the mother is the more important. A father should be enlisted for general co-operation, especially along the line of discipline, but it is the mother who prepares the meals, who feeds the baby and who decides what she will eat before the baby is born. To be sure, she may be advised by the doctor or dentist or at a clinic and we may hope that she follows such advice. However, in the last analysis, *she is the important person to educate.*

After the Parent the Child

If carefully guided through the important years of infancy up to school age by an intelligent parent, the child in the first grade is ready to learn about teeth—what they are for, and all the preventive reasons for his mother's having taken him to the dentist when he was quite a little chap. Dental health can be taught, a little at a time, from the first through the eighth grade. By the time the child reaches high school he should have good teeth and should know from personal experience as well as from his teacher's talks on teeth what is necessary.

What Is Necessary?

1. Let building be emphasized first and brushing afterward. Good teeth must be well built. They must fit together and they must be kept clean, like any other hard worked machine.
2. A baby's first teeth are all formed when he is born. If they are to be sound and strong, the mother's diet must include one quart of milk, some dark bread or cereal, some fruit, some green vegetable each day.
3. To build strong second teeth a baby should be breast-fed first of all.

   At three months—add one or two teaspoonfuls of strained and diluted orange or tomato juice to his daily nursings. Gradually increase the amount.

   At six months—add a cooked strained cereal with the ten o'clock feeding.

   At seven months—add a cooked, strained green vegetable with butter or milk to the two o'clock feeding.

   From two years to one hundred and two years of age, the child's diet should include fruit, green vegetables, dark bread and milk.
4. Thumb-sucking or "pacifiers" may cause crooked teeth, spoiling the child's appearance and threatening the health of the child's teeth.
5. Baby's first teeth should be examined by the dentist when they have all appeared. They are very important and must not decay.
6. The child should be taken to the dentist whenever a second tooth appears. Don't wait a day. It may have tiny cracks in the surface. These are called fissures and are the cause of decay. If these are filled and the teeth watched regularly by a dentist, the child *will never* have a cavity.
7. The teeth should be cleaned morning and night to keep the mouth healthy and the food that is being chewed clean.

These are the fundamentals. If the mother understands *why* she should eat the right food and why her son should, and *why* she should take him to the dentist when a tooth appears instead of regularly every six months, as my family did, the battle is practically won.

> Are We Telling Our Children the Truth about Teeth in School—Or at Home?
>
> Good Teeth Are BUILT—NOT BRUSHED.
>
> A "Clean Tooth" *May* "Decay"!
>
> Poor Diet Weakens Even a "Clean Tooth."
>
> Are We All Aware That a Baby Is Born with His "Milk" Teeth Already Formed—Sound or Weak, According to the Mother's Diet?
>
> Do We Realize That a Child's Second Set of (Permanent) Teeth Is *Being Formed* at the Time the "Milk" Teeth Appear?
>
> The Food a Mother Gives Her Child During His First Six Years Largely Determines the Soundness of His Teeth for Life.
>
> Do Mothers Know that the Time to Take All Children to the Dentist Is When the Molars Appear, In Order that Tiny Cracks, or Fissures, May Be Found and Filled, Thus Preventing Decay?
>
> To Build Well Is Better than to Repair.
>
> Preventive Dentistry Is the Only Kind Our Children Should Know.
>
> Money Spent for Milk, Fruit, Leafy Vegetables, and Whole Grain Breads (Bran or Graham) Saves Dental Bills.
>
> *SEE TO FOOD AND FISSURES OR THE FIGHT IS LOST.*

Dental Health Teaching in the Schools

For the schools, devices such as charts, teams, gold star rewards, posters and exibits are available, and are good ways of interesting children. You can't begin too soon. Teach the children in the first grade the idea of building. It is logical and the child will see that the way to build a good brick house is to use plenty of sound bricks rather than to paint the house to look like bricks after it is built. Tell him that there are little factories running day and night in his jaws, and that he must supply his main body factory with the right material if it is to make good teeth. Make it a story, draw pictures with bright colors, make the subject as vivid as possible but all the time keep it *positive*. Positive is a word we hear so often in connection with all health work, but it is perhaps most needed in the case of teeth. I saw the tragic picture of decay and it fastened itself on my childish mind. Why shouldn't children learn to prevent disease by vivid, constructive means, instead of being shown pictures of the disease itself? Teach the value of the toothbrush and give toothbrush drills, but not first. That is secondary.

Tell him the first things first and let him see the logic of it. Call fissures "cracks." All children know what happens to a door or a ceiling that has a crack in it, if it isn't filled. This new knowledge is just as vivid, just as easy to teach and infinitely more important than the fact of how many teeth we have, or how many times a day we should brush them. In the higher grades teach with a machine in mind. The average child of today thinks in terms of machines.

He understands very quickly why parts should be well built, should fit together and should be cleaned often if one is to have a smooth running mill to grind food the rest of one's life. These new methods appeal to a child's understanding and pride in having good teeth and good health, rather than to his fear. Make him take care of his teeth for these reasons rather than the horror of a toothache or a dentist's chair.

Dental health education must teach prevention first to the mother and then to the child, using all available ways of making the information at hand interesting and all available channels for spreading such information. Away with charts of decaying teeth and the fear of the dentist! We have a new and better story to tell.

A Real Health Circus

A New Type of Child Health Teaching

(PART II, NEW FACTS ON AN OLD SUBJECT—TEETH)

By ELEANOR B. GALLINGER, S.B., D.H.

Assistant in Dental Hygiene, Massachusetts State Department of Public Health

WHAT made you yell the loudest, jump the highest, tease the hardest, turn suddenly into a thief or play hookey from school when you were a child? The Circus, of course! When you heard it was coming there was no managing you. There is nothing quite like a circus, where you will find strange sights and figures, animals, bright colors and above all, lots of action. A child never forgets the things he sees at a circus. He may listen to a talk or a story, but more likely not. If that talk or story is illustrated with pictures or if the lesson is acted out, it is more apt to hold his attention as it becomes more real to him. Vivid impressions, that is what we are trying to create in all health teaching.

How, for example, can we teach a child that good teeth are built, not brushed? Why, by making the subject graphic, imaginative and full of color and action. Here is a scheme that makes the building of teeth nothing short of a circus. It is a new type of health exhibit sent by the Health Department of an eastern state to schools or "centers," built on the idea that all boys are interested in factories and all girls in big doll houses. It arrives in big boxes labeled "*Fragile, This Side Up.*" Smaller packages with odd shapes follow. There is hammering, screwing, lifting and unpacking to be done. Two large boxes appear, then toy carts and little trucks, electric light bulbs, tin kettles, milk bottles and colored cardboard figures doing all sorts of strange things. Everything is unpacked, the children are sent home and the next day the "show" is ready.

On big tables stand the two factories; the electric signs are lighted, little carts full of supplies and drawn by horses are at one side while trucks taking away boxes of teeth are at the other. One side of the buildings has been taken away, showing the workers in their respective departments. Come nearer and see how good teeth are made!

A Tour in the Land of Jawville

You are now in the land of Jawville, the children are told. Before you stand the town's two factories going at full speed. We will take you through them both and show you what wonderful things are happening. (An older boy or girl should pretend to "guide" the class through the factories, explaining each step as they go along.)

"Well Built"—the Sign of Good Teeth

Here is the place where good teeth are made. Look at the lovely green lawn surrounded by milk bottles. Down the road comes a cart bringing supplies, milk, fresh fruit and vegetables, dark bread and cereals from the country. These are the things that make good teeth.

We will go in here at the *Mouth Entrance* and go right up through all the departments to the top of the factory.

Supply Department—First Floor

This is the Supply Department. The workers here wear big black shoes, white trousers, blue coats and white caps with red feathers. See how they store away the bottles of milk in neat rows and make great piles of lettuce, oranges and tomatoes. Look 'way over in the corner. There are loaves of dark bread, prunes, celery and bright orange carrots.

Digestive Department—Second Floor

Here is the great shining kettle. The workers downstairs have cut the brown bread, cereals, fruits and vegetables into small pieces. These are added to the milk and a certain amount is poured each day into this big kettle. The worker stirs all this around and around. It is mixed with certain fluids that "break" it up even smaller or "digest" it. As the food is digested little particles called minerals come out and run down those silver tubes into blue boxes. These boxes are piled full of the white crystals of lime and other salts and there is a little bottle of red blood. These are the things that teeth are made of. These boxes must be very full as it takes a great deal of lime to make even one tooth.

Construction Department—Third Floor

There are two rooms on this floor and here the teeth are actually constructed. In this first room they have the red pulp all made and they are putting the grey dentine over it. These are the inside parts of the tooth. The next room is the most important of all. Here the white shining enamel is going on as a cover over the whole tooth.

Polishing and Packing—Top Floor

After the scaffolding is taken down the teeth are carried upstairs to be polished. How hard the little worker rubs. He makes them shine like pearls. When they are polished they are examined with a big glass. If they have even a tiny, tiny crack they are sent back to be made all over, for this factory puts out perfect teeth.

Shipping Department

Here we are at the very last room on the top floor of the factory. Hundreds of white shining teeth are waiting to be packed into boxes. These boxes hold a set of twenty baby teeth or a set of thirty-two for older people. Down the boxes go through chutes into trucks waiting below. These trucks will deliver them to the people in Jawville that sent in the milk, fruit and vegetables.

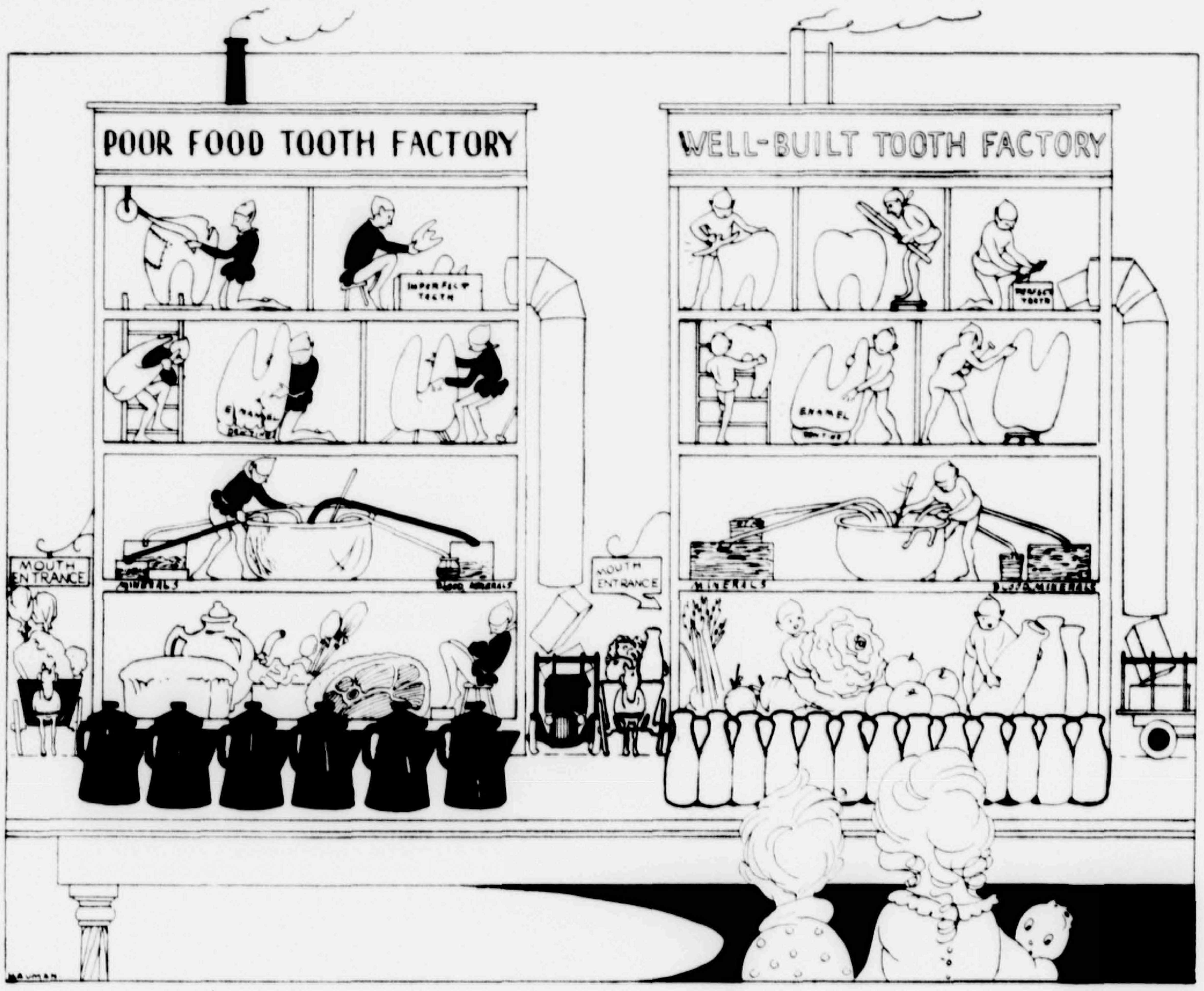
The Other Side of the Story

Right across the street is the "Poor Food Tooth Factory." It is just the same size as the other but how different it looks. It is brown instead of a shining black and the yard is dirt instead of grass. The fence of brown coffee pots is broken and ill kept. A cart of supplies stands in the yard but this time it is full of coffee, white bread, candy and meat. Such supplies are bound to make poor teeth.

Here the workmen look cross and lazy. Their coats are of a greenish yellow and the Supply Department is in such a mess. Meat, potatoes and candy are all mixed together.

What a Difference!

The second floor has a big kettle with little tubes just like the other factory, but see how hard the little worker has to stir to get anything into the boxes. These boxes are only half full of lime and other minerals. That was all that he could get from these foods. Come quickly to the next floor and see what is happening here. The pulp and dentine is all finished and looks almost as well as that in the other factory but when the enamel is put on there are little cracks in the top. This is because there wasn't enough lime to make it all smooth and hard. They are very tiny cracks, to be sure, but a tooth with even a tiny crack is never strong. These cracks will get larger and larger and they will make all sorts of trouble for the poor people that these teeth are being sent to.



The cracks will turn into holes and most of the teeth will end up at the dentist's, all because they weren't strong and perfect when they left the factory.

They don't polish the teeth in this factory, but here on the top floor is the patching room where they try to cover up the worst of the cracks. Then they toss them into boxes, some good and some poor. Sometimes there are several missing in a set. The people that send in just white bread and potatoes and candy will get these poor teeth. The poor little workers can't help it for they do the best they can with the material that is sent them. It is like trying to build a big strong house out of odds and ends of old wood.

Taking a tour through toy factories is ever so much more interesting than being told that good food makes good teeth. Health teaching that is graphic and vivid and that appeals to the imagination of the child is the kind that he will remember.

The CRACK in the DAM

By ELEANOR B. GALLINGER

Assistant in Dental Hygiene
Massachusetts State Department of Health

> Teeth are like dams—they have cracks which spell trouble.
>
> Green vegetables, milk, fruit, whole grain cereals and bread, build strong teeth.
>
> Teeth are like dams—they have cracks which *first appear*. Every day counts with a crack or fissure.
>
> For good teeth we must have the right building materials and preventive dentistry to repair tiny defects in their construction.
>
> A neglected fissure is the beginning of the end.

THE secrets of science are slow in reaching us. Its deep mysteries and thrilling dramas are revealed to the public one by one. It takes years of research to discover the "why" of things, but it should not take the years which it does take, for this information to penetrate the world at large. We do not ask for all of the details for we have not always the knowledge of anatomy and physiology necessary to understand them, but the "story", whatever is thrilling, real and with "news value" back of these discoveries, that we ought to have. And comparatively few of us have it.

For instance, who knows how a tooth is made? The dentist, perhaps, and a few others, but the average person thinks of the tooth as a tooth, something to chew on, something that usually makes a fuss when it is appearing, or disappearing, as the case may be. We realize that teeth improve our general appearance considerably, that they should be kept clean for various reasons and that the sooner we get to the dentist the smaller will be the bill. We are vaguely aware of the fact that teeth which are diseased or dead are the cause of numerous ailments and that (according to all the street car signs) we have very little chance of escaping a certain dreadful disease called Pyorrhea. But we know little about the really important facts concerning teeth: those that enable us to bring up healthier children, that teach us how to build strong teeth in the first place, and how to *prevent* decay and all its train of troubles. These are "secrets" of science that are slow in reaching us.

A tooth is one of Nature's most interesting structures. It is a rare example of good masonry and fine architectural balance and form. It must be able to stand terrific strains and stresses. It must fit in with all the other teeth that go to make up our grinding machine, and it must be smooth, white and shining like a pearl. Think of it as an instrument that tears, cuts and grinds, that must be strong enough to resist the invading forces present in the mouth all the time. We hear how food decays within three hours after a meal; we know that at any moment there are thousands of bacteria present in even a "clean" mouth; and that that combination of food and bacteria spells danger to the best of teeth. As a tooth is made, so will it resist those forces of destruction and remain sound.

It is like a dam, carefully constructed of the best of materials. Planned with the greatest of skill a dam when finally finished stands ready for years of service. To be strong enough to hold back great masses of water a dam must be perfect. A tiny crack anywhere may mean destruction to the whole edifice. So it is with teeth. We should have the dentist test our teeth for cracks the day they appear to see if they are well made, strong and perfect. Don't trust your eyes. A new tooth may look perfect, for these cracks are very tiny and many is the "fissure" in the top of a molar that has even escaped the sharp instrument of the dentist, so slight was the defect. This is the "crack in the dam." Here is the cause of most of our tooth troubles later, the real danger point of decay. All the toothbrushing in the world won't help in a case like this. The cracks are too small and the brush may merely force the food further into them instead of removing it.

When are teeth made? How can we help our children to form perfect teeth? What makes a

This is the age when teeth are built. Day by day the second teeth are forming under these baby teeth that have just appeared

fissure and how should it be treated? These are the natural questions that are bound to follow. They are the things that every thinking parent should know about teeth and the story is a simple one.

When Teeth Are Made

First of all when are teeth made? We do not need to know the whole table of tooth development and eruption. The important facts are these: the baby teeth begin to form three or four months before birth. At birth the baby has its full set of first teeth and the first year molar is beginning to form. Think of it! Six years before it appears! The second permanent molars begin to develop when the baby is three months old and the foundation for our third molars or "wisdom teeth" is laid when we are two years old. Briefly then, baby's first teeth are built before he is born and it is up to the mother to eat plenty of tooth building foods so that they will be strong and sound. Our second teeth are forming during the first twelve years of our life. At the age of twelve the job is finished. Then we can care for them and repair them but we can never build them over again. To have well-built teeth the child must have a healthy body and must eat foods that contain lime. Enamel, the white substance that covers the tooth, is practically all lime. This enamel is the hardest substance in the human body and it demands certain materials for its construction. The following list gives the kind and amount of food necessary for either a prospective mother, or a child of two years and older.

From birth to two years, breast milk, orange juice, cod liver oil and a gradual addition of green vegetable and cereal are the best safeguards for the child's growing teeth.

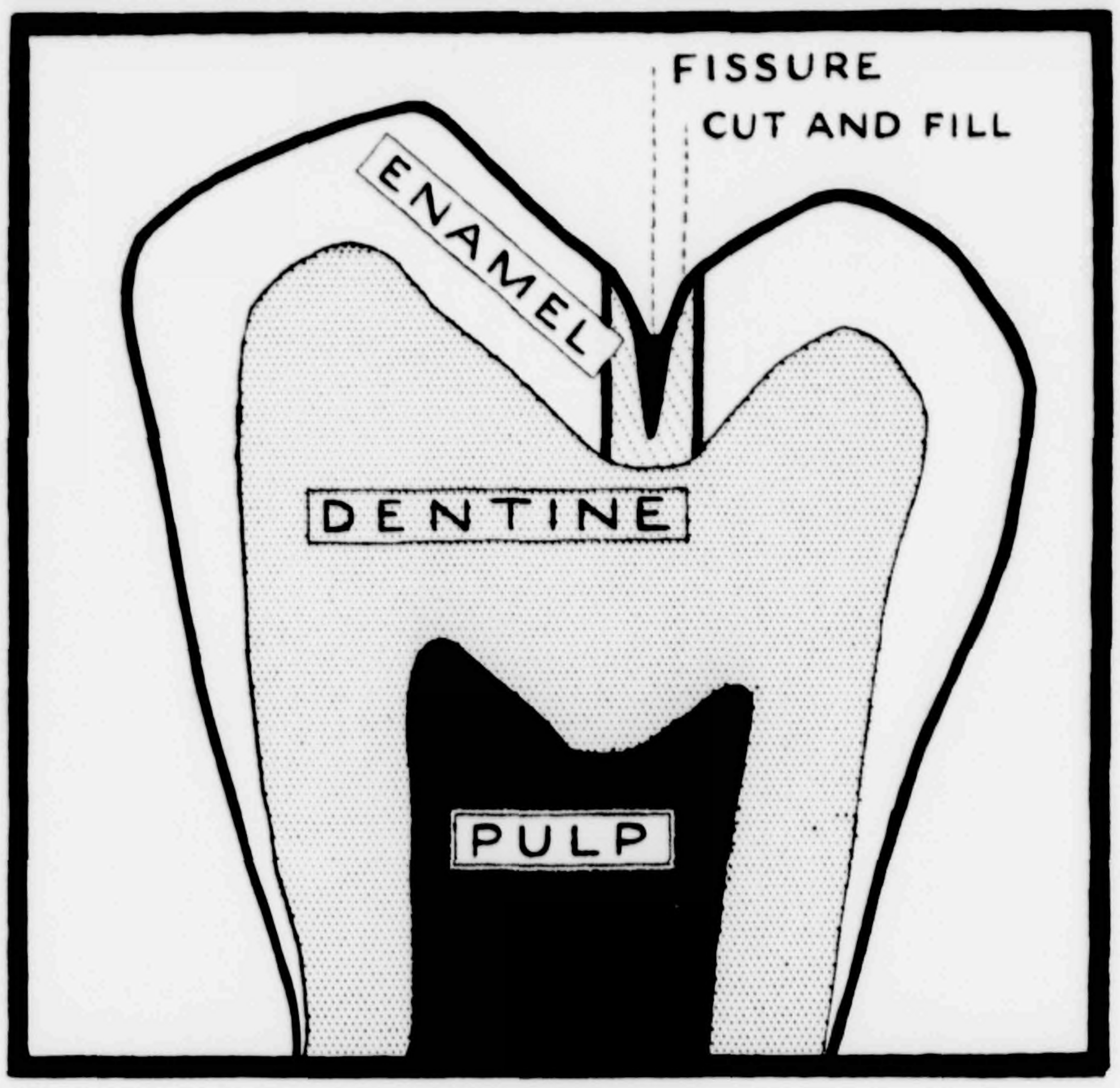
FOODS FOR TEETH

Each day you should have:

Four cups milk—either plain, in soup, puddings, or in cream sauce on vegetables.
One serving of spinach or beet greens, or cabbage, or lettuce or—
One serving of tomato.
Fruit—orange, or apple, or prunes, or raisins.
Graham or whole wheat or rye bread.
One serving of coarse, cooked cereal, such as oatmeal or cracked wheat.

How Are Teeth Made—Why Do We Have Fissures?

Teeth are made just as bones, nerves and blood vessels are made. Substances in our food are extracted in the process of digestion and carried to the scene of construction by the blood. There are to be found little sac-like places in the jaw. In these openings the tooth masons, which are cells, work. They collect lime and other minerals from the blood and build the tooth step by step. The inner part of the tooth is much like other soft tissues of the body but the enamel is a substance that is not to be duplicated elsewhere. It is laid down in little rod-like formations. These rods slant in different directions, depending upon



THE WEAK POINT IN A STRONG TOOTH

A microscopic view of a longitudinal section of what looked like a perfect tooth, shows a tiny fissure. Only a dentist can tell when these are present. This should be cut out and filled to prevent decay

the part of the tooth that is likely to stand up under the greatest strain brought to bear on it day after day as we chew our meals.

In the illustration above, showing a tooth that has been cut in half with a fissure in the center, the exterior covering of the tooth is the enamel that we have just been discussing. It is quite thin in proportion to the body of the tooth and once it is pierced the tooth is destroyed rapidly. The enamel is formed in layers, developing from certain "centers of calcification" and whenever these centers fail to coalesce we have what is called a fissure or a tiny "fault." In the illustration it may be noticed that the fissure lies in the groove, between the two points or cusps of the tooth. This is because the enamel was laid down in layers, starting from the center of each of the cusps, and the layers have failed to come together.

Here is the weak point, the cause of our troubles. The masons of the body for some reason have failed to make the joining smooth and there is the telltale defect like a tiny crack in a plastered wall. Our students of dental research are trying to discover exactly why the enamel fails to form perfectly, but we do not know yet. We only know that in the majority of our molars fissures *are* found and therefore must be treated. That is why, when a child acquires a new tooth, especially a molar, we should take him at once to the dentist and have the tiny grooves in that tooth examined with a needle-like "explorer" to be sure that there are no fissures. If the dentist finds them he will smooth them out, or if they are large enough will fill them. This is the new kind of dentistry.

As Doctor Cross, the distinguished director of the Fosyth Dental Infirmary in Boston, says: "Early attention or care, filling of fissures or pits was not practiced ten years ago." "Cleaning and brushing alone has practically no value and no effect on teeth in which these organic defects are permitted to remain *uncorrected.*"

The real story of teeth is still in the *making.* He who runs *far enough* may yet read it all. Meantime we may learn the *amazing facts of how* lime and other minerals from the food that we eat go to the jaw; how *the enamel is built, layer by layer* and why we find those tiny but *dangerous defects or fissures. It is truly a drama,* this story of the prenatal and early *building of our* own and our children's teeth. By the use of a little imagination and knowledge *now available* we may all prevent that drama from having a disastrous ending.

Dr. J. H. Kellogg.
Private Copy.

Abstract notes on

L'ALIMENTATION

et

LES REGIMES

chez l'homme sain et chez les malades.

by

Armand Gautier,

Member of the Institute and of the Academy of Medicine. Professor to the Faculty of Medicine of Paris.

~~Twelfth~~ Second Edition, Revised.

Paris

Masson et Cie, Editeurs

1904.

Food. Definition.

A food is a substance which,when introduced into the alimentary canal,is capable of undergoing digestion, absorption, and assimilation, thus becoming a part of the bodily structure and capable of supplying some bodily need.

JHK

CHAPTER I. CHAPTER II. CHAPTER III.

ALIMENTATION. ITS FUNCTION. MECHANISM OF ASSIMILATION.

A man loses daily one pound of flesh (blood and tissue).

Heat loss 2400 calories daily (9600 British thermal units).

Loss of water: by urine 44 ounces; by skin 23 ounces; by lungs 16 ounces.

Loss of oxygen, as CO_2: 1.5 pounds.

Loss of carbon: 1 pound--exhaled as CO_2 eight ounces; in other excretions eight ounces.

Loss of mineral salts through the urine and feces .75 ounces, more than half of which consists of sodium chloride.

Loss of iron one grain daily.

The food must replace all the above-mentioned loss.

FOODS consist of those materials, solid, liquid and gaseous, which when introduced into the body are capable of repairing the daily loss sustained by the organism and of maintaining its functions.

We lose five pounds of water daily, of which we take in 2 to 2.5 pints in the food. The balance of the five pints must be taken as drink.

The tissues of animals are chiefly composed of albuminoid or proteid tissues. The muscles and blood are one-fifth proteid; plasma one-twelfth; liver and brain one-eighth.

According to Gautier the average consumption of the various food elements by the people of Paris daily is:

Proteid	102 grams.
Fats	56.5 grams.
Carbohydrates	400.4 grams.

About 46% of the proteid was of animal origin, and 54 % of vegetable origin.

Uffelmann thinks these proportions could not be increased without danger. It is injurious that the weight of the proteid matter should exceed one-fourth that of the fats and the carbohydrates.

One gram of nitrogen loss corresponds to 3.36 grams of carbon, combined with the nitrogen in 6.25 grams of albumin.

One gram of carbon lost by the body represents 1.3 of fat.

M. Bordet (Bulletin generalx de therapeutique, Nov.,1902) cites the case of a man weighing 80 kilos (176 pounds), 70 years old, who for 20 years had lived on a daily ration of

Proteids	63 grams	(258 calories).
Fats	53 grams	(492 calories).
Carbohydrates	245 grams	(1004 calories).
Total		(1754 calories).

For the proportion of fats and carbohydrates to albumins, see Gautier, page 32.

"Experience has shown that for 100 parts of albumin there are required 50 to 68 of fats and 366 to 386 of carbohydrates."

A ration which introduces more than 60 % of the nitrogen in the form of animal food is too rich in flesh and exposes the subject to rheumatism, gout and skin disorders. This ration exposes to these various morbid states those who do not correct the effects of this excess of flesh food by muscular exercise.

CHAPTER IV.

The cinders of the skeleton weigh 2.2473 Kilograms.

The cinders of the soft parts weigh.4680 Kilograms.

Total weight of the body after burning 2.7153 Kilograms.

The above figures are for a man weighing 62.5 Kilograms (Volkmann).

Proportion of ashes was 4.3 % of the weight of the whole body.

The alkaline or earthy salts formed 0.76 % of the soft tissues.

The bones and cartilages contained five-sixths of the mineral salts of the whole body.

Animals fed on meat deprived of its salts by treating with hot water, even though starch, sugar and fats are added, live only 20 to 30 days; that is, they starve to death just as though they had had no food at all (Forster).

Total mineral matters eliminated daily 25.9 grams, of which twelve-sixteenths is lost through the urine, three-sixteenths by the feces, and one-sixteenth by the sweat.

Half the mineral lost is sodium chloride.

One grain of iron and small quantities of other elements required daily. Iodin required by the thyroid gland, arsenic by the skin, bromin by the hair; hence the necessity for varied foodstuffs.

Many of these substances are supplied in different proportions by different foodstuffs,--about as follows:

Bread	.7%
Flesh	1.2 %
Milk	.6 %
Eggs	.9 %
Fruits	.8 %
Fresh vegetables ..	1.1 %
Legumes	2.8 %
Potatoes	1.0 %
Cheese	2.7 %
Sugar	.6 %
Butter	.07%

About 70 % of the salts ordinarily derived from vegetables by those who subsist on a mixed diet.

Potash is generally derived from plants.

There are many albuminous and fatty substances and carbohydrates which cannot be utilized by the body.

Of such proteid substances are osséine, elastin, gelatin except in small quantities, cartilage, keratin. Some of these are soluble in the intestine, but cannot be assimilated, as elastin.

Products of excretion cannot ever be used as foods. They are toxins.

A man may assimilate 25 % of newly formed cellulose, such as is found in salads and fresh vegetables (Kniriem).

Gums and sugars other than those containing a number of carbon atoms multiples of three, are not assimilable. (Fischer) Some hinder the vital functions, some excite them.

Animal or vegetable fats having glycerin for the base are foods. This is not true of other fats, such as spermaceti, Chinese wax, and bees'-wax. None of these are assimilable. The same is true of vaselin.

Fatty acids and their salts, especially citrates, malates and alkaline tartrates, are true foods. The product of their oxidation is carbonic acid gas, water and soluble carbonates which increase the alkalinity of the body fluids and thus encourage oxidation and general metabolism.

CHAPTER V.

Table showing the time required for the digestion of various foods. According to Penzoldt.

A. BEVERAGES.	Ounces	Time in hours.
Pure water	4 to 8	1 to 2
Infusion of weak tea	12 to 20	2 to 3
Coffee	8	1 to 2
Coffee(cream)	8	2 to 3
Pure cocoa	8	1 to 2
Cocoa with milk	8	1 to 2
Beer	8	1 to 2
"	12 to 20	2 to 3
Light wine	8	1 to 2
Beef bouillon	8	1 to 2

	Ounces	Hours
B. FLESH FOODS.		
Beefsteak, cooked, (hot or cold)...	4	3 to 4
Beef, roasted, ...	10	4 to 5
Fillet of roast beef	4	3 to 4
Beef, raw, ~~roasted~~ lean...	10	3 to 4
Ham, raw or cooked	6	3 to 4
Veal roast, lean, hot or cold	4	3 to 4
Smoked meat	4	4 to 5
Beef-tongue, smoked	10	4 to 5
Sausage, raw beef................	4	2 to 3
Hare, roasted	10	4 to 5
Goose, average fat, roasted	10	4 to 5
Duck, roasted	10	4 to 5
Partridge, roasted	9	3 to 4
Pigeon, boiled	9	3 to 4
Pigeon, roasted	7	3 to 4
Chicken, boiled or roasted	10	3 to 4
Carp, boiled	8	2 to 3
Cod, boiled (fresh)	8	2 to 3
Eel, pickled	8	3 to 4
Salmon, boiled	8	3 to 4
Herring, salted or smoked	8	4 to 5
Caviar, salted	2.5	3 to 4
Oysters, raw	2.5	2 to 3
C. OTHER FOODS OF ANIMAL ORIGIN.		
Sweet-bread	10	2 to 3
Calves' feet, boiled	10	3 to 4
Calves' brains	10	2 to 3
Milk, boiled	4 to 8	1 to 2
Milk, boiled	12 to 20	2 to 3

Eggs in the shell	4	1 to 2.
Eggs, hard or omelette	4	2 to 3
Beef bouillon	8	1 to 2

D. VEGETABLES, COOKED.

Potatoes, stewed, with salt	6	2 to 3
Potato puree	6	2 to 3
Potatoes with green vegetables ..	6	3 to 4
Cauliflower	6	2 to 3
Asparagus	6	2 to 3
Bean broth	8	1 to 2
Rice, cooked with water	6	3 to 4
Turnip-cabbage	6	3 to 4
Carrots, boiled,.................	6	3 to 4
Spinach, boiled	6	3 to 4
Green beans, boiled	6	4 to 5
Pease puree	8	4 to 5
Lentils puree	6	4 to 5
Green peas, cooked with water ...	6	4 to 5

E. VEGETABLES, RAW.

Cucumber salad	6	3 to 4
Radishes	6	3 to 4

F. BREAD AND BISCUITS.

Bread, white, fresh or toasted, dry or with tea	2.5	2 to 3
" " "	6	3 to 4
Bread, rye	6	3 to 4
Biscuits, Albert	2	2 to 3
" "	6	3 to 4

G. FRUITS.

Apples	6	3 to 4
Cherries, raw	6	2 to 3
Cherries, stewed	6	2 to 3

For effects of cooking, see experiments by E. Jessen. Thompson's Dietetics, page 111.

Gautier states that the time required for gastric digestion is recognized as being four to six hours, and that six to seven hours should intervene between two meals.

Exposure to cold, severe muscular work, and infancy, are conditions that require more frequent feeding.

For the amount of the various foodstuffs absorbed, see Gautier, page 51. Partial table on next page of these notes.

TABLE SHOWING THE AMOUNT OF FOODSTUFFS ABSORBED (RÜBNER). Gautier p.51

Proportion utilized per hundred parts of

	Dried substance	Proteid	Fats	Carbohydrates	Salts
White bread	96.3	79	...	99	93
Rye bread	85.0	68-78	...	89	64
Macaroni	95.7	83	94	99	76
Rice	95.9	80	93	99	85
Milk	92.2	89-99	96-97	100	63
Eggs, whole	94.8	97	95	...	82
Meat, cooked	89.1 #		95	...	82
Potatoes	90.6	78	...	93	...
Potato puree with butter	95.0	80	...	96	...
Cabbage, boiled,..	85.1	...	...	...	...
Carrots	79.3	...	...	96	...
Pease puree	91.0	83	...	...	68
Fats	91.5	...	...	...	...

According to Atwater, the percentages of absorption are as follows:

	Proportion utilized per 100 parts. Proteid.	Fats.	Carbohydrates.
Meat, eggs and milk	97	95	98
Cereals	85	90	98
Legumes	78	90	97
Green vegetables	83	90	95
Average for foods of animal origin	97	95	98
Average for foods of vegetable origin.........	85	90	97
Average, ordinary mixed ration	92	95	97

A point not considered by Rübner, Gautier or Atwater is that meat contains a considerable proportion of extractives,--ossein, carnine, uric acid and other xanthin bodies, etc., which is soluble and is absorbed, and should not be reckoned as food material. The same is true of the elastin of flesh which is digested and absorbed but is not utilized, and true to a large extent also of the gelatins.

According to Gautier the amount of these unassimilable proteid substances found in beef is 1.29 parts per hundred parts of fresh beef, or 5 parts per hundred parts of dried beef. It thus appears that 5% of the proteid material reckoned by Atwater and others as absorbed and utilized by the body are not utilized at all but are excreted by the urine. Hence, this amount, or 5 % of the total weight of the dried flesh, upon which the estimate was based, must be added to the proteid content of the feces.

Correcting the figures given by Rübner and others by this factor, we find that the proportion of dried material digested and absorbed is less for cooked meat than for a number of staple articles of food, viz.; wheat bread, macaroni, rice, pease puree and potatoes.

It is also interesting to observe that the nutritive salts of wheat bread and rice are absorbed in considerably larger proportion than those of flesh.

J.H.K.

Digestion is only one half of the assimilative process. The tissues do not select from the blood substances of form suited to their needs, but out of the materials found in the blood, manufacture de novo the materials required for their use.

In the healthy animal or man suffering no change in state or weight, all the energy expended is derived from his food.

What are the needs of a man in perfect health? The losses of such a man consist in loss of heat, production of work and nervous or psychic phenomena.

Fifteen percent of the albumin consumed is converted into other waste matters than urea.

Burian and Schur claim to have shown that if a man does not take in any uric acid, he does not eliminate it; that uric acid is not formed from albumin.

In general the body makes actual use of only about nine-tenths of the energy taken in with the food.

Calories produced by the total combustion, in the calorimeter, of the principal non-nitrogenous food elements:

Glucose and its isomers	3,739 calories	per gram.
Inosite	3,702 "	
Glycerine	4,317 "	
Starch	4,227 "	
Dextrin	4,180 "	
Saccharose	3,962 "	
Lactose	3,777 "	
Citric acid	2,500 "	
Malic acid	4,549 "	
Butter	9,192 "	
Olive Oil	9,328 "	

Table showing the number of calories produced by one gram of the principal nitrogenous substances used as food: first, the total calories of total combusion in the calorimeter; second, the heat calculated by the transformation into H_2O, CO_2 and urea of one gram of substance.--

Oxamide	3,250	.....
Asparagin	3,395	2,306
Hippuric acid	5,659	5,490
Urea	2,690	0,000
Tyrosin	5,918	5,203
Taurin	2,503	0,000
Leucin	6,526	6,191
Uric acid	2,747	1,040

A man of 65 kilograms requires daily about 39 calories per kilogram of weight, when resting. If he stays actually in bed, he requires 31 calories per kilogram, according to Ranke, and 34 calories per kilogram, according to Tigerstedt, for each twenty-four hours.

Gautier's standard is as follows:

Albuminoids	395 calories
Fats	558 calories
Carbohydrates	1581 calories
Total	2,534 calories.

Table showing the quantity required for persons of different ages, according to Rübner:

		Daily ration.
Child weighing	4.03 Kilo.	368 calories.
Child weighing	11.80 "	966 "
Child weighing	16.40 "	1213 "
Child weighing	23.70 "	1411 "
Young man weighing	40.40 "	2106 "
Grown man weighing	67.00 "	2843 "

Isodynamic rations are those furnishing the same number of calories without reference to their composition.

CHAPTER VIII.

Isodynamic rations are those furnishing the same number of calories without reference to their composition.

Food elements are called isodynamic when they may replace each other without causing a change of state or weight in the subject.

The given quantities of the following alimentary principles are isodynamic, each giving, when burned in the body, 930 calories:

Fats	100 grams
Albumin (of muscle)	243 grams.
Legumin	257 grams
Cane-sugar	234 grams
Glucose	256 grams.

According to Atwater, the following quantities of the elements named give, when burned in the body, 100 calories of energy:

Proteid matters of animal origin	23.53 grams.
Proteid matters of vegetable origin	28.19 grams
Proteid matters of mixed origin	25.00 grams
Fat of animal origin	11.18 grams
Fat of vegetable origin	11.97 grams
Fat of mixed origin	11.23 grams
Starch	25.00 grams
Assimilable sugar	27.78 grams.

Carbohydrates may replace fats almost entirely in the diet, and also take the place of albumin to a much larger extent and much more satisfactorily than fat.

Flesh ingested.	Ternary substances.	Proteid lost.	Gain or loss of proteid
500 grams	250 grams fat	558grams	- 58 grams loss
500 grams	300 grams starch	466 grams	34 grams gain
800 grams	250 grams carbohydrate	745 grams	55 grams gain
800 grams	200 grams fat	773 grams	27 grams gain
2000 grams	250 grams carbohydrate	1792 grams	208 grams gain
2000 grams	250 grams fat	1883 grams	117 grams gain

According to Chauveau 2.35 parts of albumin are required to produce as much heat as one part of fat, and 2.29 parts of starch.

The same amount of cane-sugar as of albumin is required to produce a given amount of heat.

Twice as much albumin as fat is required to produce a given quantity of work.

Only three-fourths as much of starch and sugar as of albumin is required to support the body in doing a given amount of work.

MINIMUM ALBUMINOID RATION.--Hirschfeld, who weighed 73 kg. maintained nitrogenous equilibrium on 43.3 grams of albumin.

Klemperer maintained nitrogenous equilibrium in two subjects weighing 64 and 64 kg. on 30 grams of albumin.

A Japanese student weighing 46 kg. on 52 grams albumin.

Abyssinian weighing 52 kg. on 50 grams albumin.

Malay weighing 52 kg. on 60 grams albumin.

Gautier mentions as one of the advantages of a low proteid diet that the nitrogenous excreta are reduced to a minimum, and recommends this diet for the gouty, the rheumatic, and for persons suffering from disorders of the liver, heart and kidneys.

CHAPTER IX.

According to Atwater and Gautier a man engaged in fatiguing work requires about 1400 calories additional food. About 28% of this supplementary ration is utilized by good workers in mechanical energy.

A good worker can utilize about ten percent of the total energy of his foods in useful work.

A man at work radiates less heat through his skin than one in a state of repose, 60.3 % of the heat lost being radiated from the skin during work and 72 % during repose; although the absolute heat loss during work is greater than that in a state of repose, amounting to 568 grams in

During a state of repose heat loss by cutaneous and respiratory evaporation was 573 calories in Atwater's case, while in a state of work the amount was 1155 calories, or 582 calories additional.

The 1400 calories extra food required by a working man is thus distributed:

Additional heat radiation	568 calories
Additional heat lost by evaporation of water from the skin and lungs	582 calories.
Mechanical work done	255 calories

The mechanical work done represents 18 % of the total.

Some persons have greater facility for transforming energy into work.

An output of mechanical energy as high as 25% or 30% has been observed in good workers.

Albuminoids excite the transformation of energy into muscular work.

Muscular work itself appreciably increases the production of urea, but not to the extent which would be expected from the amount of proteid consumed. In the experiments of Pettenkoffer and Voit in which the amount of urea was not increased by work, the amount of proteid taken in repose was considerably in excess of that actually required by the body, and so the amount of urea was not increased by work.

"In hot or cold climates, workers instinctively increase their rations in starch and fatty substances, the principles the combustion of which is most suitable to furnish the energy apt to transform itself into mechanical work. Flesh is, nevertheless, the food which especially excites and regenerates the muscle. I say flesh, for in this regard experience has shown that it is not indifferent whether we furnish to a person engaged in arduous work, fish, beef, or an amount of bread and legumes containing an equal quantity of proteid. These bodies when of vegetable origin are assimilated only in the proportion of 83 %; while 96 % is taken into the blood when meat is eaten. The proteids of plants can be utilized only after a more difficult and prolonged work of assimilation than when the proteid is of animal origin. And vegetable proteids do not contain those nervous excitants, those alkaloids of muscular flesh, since the gluten and legumin do not furnish it."

"A man engaged in muscular work eight hours a day requires one-half more nourishment than when in a state of repose;to defend himself against the overheating of his organs he not only eliminates through the skin the excess of water which he consumes but also a part of that which in a state of repose passes out through the kidneys." (Atwater)

The average of two workers showed 357 grams of water less eliminated in the urine, and 1069 grams more eliminated by the lungs and the skin. The total excess eliminated from the body was 532 grams,--2473 in a state of repose and 3005 in a state of work.

CHAPTER X.

All the acts of tissue life are under the control of specific agents, or ferments.

Some of these ferments break down complex molecules into simpler ones; others carry nascent oxygen and hydrogen with which they are charged in the form of peroxides and hydrides to the living matter. These ferments excite the internal molecular transformations, assimilations, hydrations, oxidations, reductions, decompositions, etc.

The living cell is made up of two parts,--one portion fixed, persisting; the other portion detachable by the processes of nutrition. Under the action of ferments the latter element is disengaged by oxidation, etc., its place being supplied by new material brought by the blood, after having been enriched by digestion.

Six different ferments may be extracted from a common mould, the <u>aspergillus niger</u>, ---rennet which coagulates casein, casease which liquefies and digests the coagulated casein; lipase which digests fats; sucrase which converts cane-sugar into glucose and levulose; amylase which digests starch; and maltase which converts maltose into glucose (Duclaux, Gérard, Bourquelot).

The same is true of nearly all common vegetable and animal cells. From every animal cell there can always be extracted one or more proteolytic ferments which digests albuminoids, producing leucin, tyrosin and other useful products of disassimilation.

These ferments vary according to the food. The aspergillus niger sown upon glycerin or starch-paste secretes especially amylase; in milk it produces rennet and casease; with a solution of lactate of lime it produces sucrase without either amylase or rennet or casease.

In the same way fresh emulsions of liver or kidney injected into an animal of another species give rise to the gradual formation in the blood of a hepatolysin or a nephrolysin, capable of destroying the proteids of the liver or kidneys of animals of the same species as those which had furnished the emulsions.

Many of these ferments give rise to reversible actions. They seem to act until a certain equilibrium is established between the fermentable materials and the newly-formed products, equilibrium being re-established if the limit comes to be overreached. Thus, according to Croft-Hill, maltase which changes maltose into glucose, may, acting upon a rather concentrated solution of glucose, inversely reproduce, not precisely maltose, but an isomeric body very analogous, isomaltose. According to Poitevin, the lipase of the pancreas will reproduce olein in the presence of a mixture of oleic acid and glycerin.

Fischer and Armstrong have established that the diastase of kephir grains unites glucose and galactose to reproduce isomaltose, which kephir decomposes in more dilute solutions into glucose and galactose.

But one conceives, a priori, that only those diastatic actions should be reversible which are accompanied with only a very slight disengagement of heat, or none at all.

"Thus, I am sure, that pure stomach peptones in solutions sufficiently concentrated or dilute can not change into propepsin or albumin under the action of an excess of a feeble proportion of very active pepsin."

"The last remark in relation to these soluble ferments is that they often complement one another and render mutual assistance. Pawlow has shown that pure pancreatic juice does not digest albuminoid substances. On the contrary it dissolves them actively when a few drops of a cold infusion of intestine are added. This activity which is excited by the juice of the xxx glands of the intestinal mucosa, an activity which disappears, as that of nearly all the diastases, when the temperature is raised to 80° or 100° C., is due to an excitant or complementary ferment of the trypsin, enterokynase, which can be extracted from the intestinal mucous membrane."

"This excitant or complementary action of a ferment secreted by one cell upon the ferment or the function of a cell of another nature, appears to be a general phenomenon."

"It is thus that nutrition is influenced by the internal secretion of the thyroid glands, suprarenals, testicles, ovaries, etc. It may be that they excite directly the life of certain tissues; it may be that they render active the secretions of their ferments; it may be that they complement the action of these ferments, as does the erepsine of Conheim which transforms the pepsins and intestinal propepsins, formed by trypsin and enterokynase, into acid amines, when this erepsine is incapable of acting directly of itself upon primitive albuminoids."

HYDRATING AND DEHYDRATING FERMENTS.-- "Hydrating ferments are those caused by the introduction of water splitting up bodies in the heart of the cellular protoplasms. Thus, as we have said, in all animal cells there are true trypsins which digest and hydrate albuminoids in a slightly alkaline medium. Also there are found in nearly all the products of digestion, even, some albuminoids: peptones, propeptones, etc. In the vegetable kingdom the amylases, maltases, sucrases, lipases, etc., which ~~xige~~ hydrate the starches, the maltose, the sucrose, the fats, are the well known representatives of these diastases with action most frequently reversible. The ferments which hydrate albuminoid substances do not appear to be susceptible of reversibility."

The hydration induced by ferments in the proteid molecules, independent of direct oxidation, separate globulins, albumoses, protamins, etc.

The nucleoproteids, or proteids of the cell nucleus, are split up also by hydration, into the same derivatives with the addition of the puric ~~[illegible]~~ bases.

All these derivatives, the sugars, puric bases, uric acid, etc., and even urea, are formed without the intervention of exterior oxygen.

FERMENTS OF OXIDATION AND REDUCTION.-- The oxydases of Schmiedeberg and Jacquet are found almost exclusively in the white cells.

An oxidizing ferment has been found in the lacto-plasm; another in the hemo-lymph of crustaceans.

The reducing ferments of the liver, kidney, and other organs, easily transform by oxidation salicylic aldehyde into salicylic acid.

The laccase of the milk-tree and the tyrosinase of the mushrooms are oxidizing ferments of vegetable origin.

A thing unexpected, but due to the aptitude of the ferments to secondarily exercise inferse actions, is that the oxydases of the tissues, and particularly those of the liver, exhibit at the same time a reducing power proportionate to their oxidizing activity. They act as if, decomposing the combined or surrounding water, they carried the hydrogen to one molecule or part of a molecule, and oxygen to the other. The liver and the kidneys are the special seat of this singular ferment. The muscles and the brain contain less of it.

Helier has shown that of all the fluids of the body, the lymph and the arterial blood are the most reducing. After these come venous blood, muscles, pancreas, kidneys, lungs, spleen. The blood during digestion is charged with reducing agents, an effect which cannot be attributed to the action of a ferment.

SPLITTING FERMENTS AND FERMENTS OF RECOMPOSITION.--Büchner's ferment is obtained from beer in a fresh state. Under pressure of 500 atmospheres the cells give up a liquid which, mixed with a concentrated solution of glucose (15 to 20%) at once changes these cells into alcohol and CO_2.

Stoklasa and Cerny have found a ferment which changes glucose into two molecules of lactic acid.

There are ferments which produce disassimilation by splitting.

COAGULATING AND LIQUEFYING FERMENTS.-- Fibrin ferment which changes fibrinogen into fibrin.

Thrombin, which coagulates all plasmas of animal cells.

Rennet which clots the casein of milk.

Pectin, which coagulates certain fruit juices.

Casease which dissolves clotted casein.

Antithrombines, which dissolve clots.

Cytase, which liquefies the envelopes of cells,--a vegetable ferment.

PRODUCTS OF DISASSIMILATION.-- The complete disassimilation in a warm-blooded animal of 100 grams of albumin gives theoretically 165.4 grams of CO_2, 41.4 grams of water, 38 grams of urea, 4. 25 grams of sulphuric acid, absorbing at the same time 148 grams of oxygen borrowed from the air, and giving to the body 486 calories of heat.

The total nitrogen, however, is not found in the urea. The percentage proportion depends on the state of the body and the diet. In a healthy man, 100 parts of nitrogen are distributed thus in the urine:

In the form of urea..............	83 to 87
In the form of salts of ammonia ..	2 to 5.5
In the form of uric acid and xanthin bodies.............	1 to 3
In the form of other nitrogenous bodies..............	7 to 10

In health, nearly all the nitrogen is found in the liquid and solid excretions (urine, hair, beard, epidermis, feces).

On a flesh diet these toxic bodies (urea, uric acid, ammoniacal salts, etc.) accumulate and acidify the blood, excite the heart, intoxicate the subject, disturb the functions of the skin, lungs, liver or kidneys.

The puric bases are in part derived from the nucleoproteids of the cells of the body and partly introduced by food.

One hundred grams of urine contain 9 to 10 grams of xanthin, sarcin (same as hypoxanthin) and other purin bases, according to Krüger and Salomon.

Of these purin bases, uric acid is the most important. Amount eliminated by the urine, 0.3 to 0.5 grams daily. "Its weight may be raised by an exclusive meat diet to 2 grams in twenty-four hours."

Regarding the disassimilation of ternary bodies,--fats, starches, sugars, neutral fats, fatty acids. " All these bodies appear to be derivable from a direct or indirect splitting up of the albuminoids, with or without carbonic acid loss.

Under the influence of saponifying ferments, glycerine and fatty acids are produced from fats. The fatty acids unite with the alkalies of the blood and are gradually converted into CO_2 and water. Heat thus produced represents about 85% of the total energy thrown off by the body.

Oxalic acid may result from the oxidation of fats and sugars or the hydration of proteid bodies.

Oxybutyric acid and oxalic acid are toxic, acidifying the fluids of the body and preventing the action of the oxidizing ferments which require an alkaline medium. Hence there is a veritable acid cachexia, the origin of joint disease, arthritism, and a large number of diseases due to retarded nutrition.

ORIGIN OF VITAL ENERGY.-- The amount of energy represented by the ration of the average man is 2400 calories. How is this energy, which is contained in the food, utilized by the various organs in their work?

Nutritive principles, after being digested and deposited in the cell, are by the action of ferments hydrated, split and oxidized. This energy becomes real through the activity of the organs.

(See Gautier, page 131, for a history of the question of vital energy).

The hydration of proteids produces about one-tenth as much heat as the total combustion of proteids in the calorimeter. This is an anaerobic change, entirely independent of oxidation.

Sugar is transformed into CO_2 and fat, a part of the latent energy of the sugar being set free.

Some energy is set free in the body without the intervention of free oxygen, through hydration..

Oxidation is the most important source of vital heat, about 85 to 86 % of the total energy of the body being produced thus.

By means of ferments the sensory centers incessantly excite or reduce the activity of organs.

Translation of paragraphs beginning on page 132:

"The translation by hydration of the hydrates of carbon into sugar,of glycogen into glucose, render available a part of the latent energy of these principles. One gram of starch in translation into glucose and maltose sets free 0.0026 Calories. In inversion and hydration, cane-sugar loses 0.0112 Calories per gram of sugar."

"The molecular subdivisions may become sources of heat. When a sweet must ferments, it is heated, due to the transformation of its glucose into CO_2 and alcohol. This reaction produces 0.167 Calories per gram of glucose fermented. Similar modifications, consisting in simple molecular subdivisions, are taking place each instant at various points in the body. It is now known that our organs contain an alcoholic ferment. The transformation of sugar into CO_2 and fat is an example of molecular change capable of setting free a part of the molecular energy of the constituent elements of the body."

"Some simple isomeric modifications may also give rise to energy..... The transformation of glucose into lactic acid, of levulose into glucose, are examples of isomeric transformations taking place in our organs capable of furnishing energy without the intervention of free oxygen. "

"But, as Lavoisier observed, the phenomena of oxidation are the most important source of force and vital heat. These phenomena produce 85 to 86% of the total available energy. To obtain the true quantities of heat resulting from oxidations taking place within our bodies, it is necessary to deduct about 14% of the total quantity of calories actually produced."

"It is by means of ferments that the sensory centers excite or reduce the activity of organs without ceasing, supplied by aliments charged with latent energy. Slowly or rapidly, according to the number and mode of succession, the agents which give rise to hydration, molecular splitting, oxidation, being set at work, the animal disposes at this or that point a variable quantity of energy, which in each organ appears under the form of heat, chemical action, etc., constituting thus the elementary functional acts, of which the disposition and the succession, controlled by the director, the nervous system, constitute the state of life."

PART TWO. Chapter XI.

Before we can calculate rations, we must understand the nature of foods.

Put in here a table showing the composition of all the different common foods, animal and vegetable. See Gautier page 136. Show also, in addition to the percentage composition of proteids or albuminoids, fats and carbohydrates, the percentage of salts, and the calories per ounce of proteid, fat and carbohydrate, also total calories per ounce.

	Percentage				Calories per ounce			
Name of Food.	Prot.	Fat.	Carb.	Salts.	P.	F.	C.	Total

ANALYSIS OF THE FOREGOING TABLE.

Proteids.-- Proteids are found in flesh foods in proportions of 13 to 23%,--in beef, mutton, birds, fish, also in nuts.

In peas, beans, and lentils in the proportion of 25% and upwards.

Proteids are also found in the proportion of from 8% to 13% in bread, flour, and eggs.

From 2% to 7% in rice, milk and dried fruits.

The proportion of proteid falls to 1.5% to 3% in mother's milk, potatoes, cabbage, and spinach.

Proteids are below one percent in acid and watery fruits, and in honey.

Fats.-- Fats are frouna in the proportion of 85% to 90% in butter, oils, and clear fats.

From 45% to 62% in nuts.

From 15% to 50% in yolk of eggs and in fat meats.

From 2% to 15% in fish.

From 2% to 8% in birds.

From 2% to 4% in milk and cereals.

From 1% to 2% in bread and dried vegetables.

Less than one percent in sweet potatoes and green vegetables.

Fats are absent in most fruits, with the exception of olives and nuts.

Carbohydrates.-- Carbohydrates (starch and sugar) are contained in the following proportions:

In grains and cereal meals, 58% to 78%.

In bread, peas, beans and lentils, 46% to 57%.

In sweet potatoes, potatoes, and manioc, 16% to 28%.

In almonds, apples, cherries, raisins and roots, 7% to 15%.

In fruits and milk, 5% to 9%.

In herbaceous vegetables, 1 to 4 %

In eggs and butter, XXXX .5% to 1.2%.

Mineral Salts.-- The mineral salts vary in animal matters from 0.2% in milk to 1.9% in beef.

Mineral salts in vegetable matters are present from 0.5% in fruits to 3.5% in peas.

"Each food tends to modify the living tissues and the functions of the individual in a manner peculiar to itself; those of animal origin by increasing the acidity of the fluids, by lessening oxidations, by introducing into the fluids proteid derivatives of an exciting and sometimes injurious nature; those of vegetable origin on the contrary alkalinize the fluids and convey to them in abundance and in a form easily assimilable the iron, phosphorus, alkalies, lime, magnesium, etc., necessary for them.

CLASSIFICATION OF FOODS.

Organic: meats, milk, grains, vegetables, fruits.

Inorganic: water, common saltx, various other salts.

Division of Organic Foodstuffs.---

1. Those of animal origin:--flesh of mammals, birds, fish, crustaceans, mollusks, eggs, milk, derivatives of meat and milk.

2. Organic foods of vegetable origin:---bread, meals of various kinds, legumes (peas, beans, lentils), potatoes, manioc and other edible roots, herbaceous vegetables, and fruits, sweet, acid and oily. Also foods derived from the vegetable kingdom,--sugar, honey, vegetable oils, malt preparations, fruit juices.

3. Mineral foods (?).

FLESH FOODS.

The amount of flesh food consumed has increased everywhere in Europe with the increase of modern activity and luxury. Before the Revolution the French peasants ate almost no meat at all.

"According to the comissary reports," says Taine (Origines de la France contemporaine), "the basis of his (the peasant's) diet was oats; in the district of Troyes, Buckwheat; in Marche and Limousin, buckwheat with chestunts and radishes; in Auvergne, buckwheat, chestnuts,curdled milk, and a little salted goat; in Beauce, a mixture of barley and rye; in Berry, a mixture of barley and oats. None at all of wheat bread; none at all of flesh of the shambles: at the most, he killed one hog a year."

The average consumption of meat in France in 1852 was 20 kilo. per capita per year; in 1904 38 kilo. In England at the present time the consumption of meat annually is 59 kilo. per capita.

Statistics given by Gautier show a decided tendency to a diminution in consumption of flesh in France in the ten years, 1887 to 1896 outside of the city of Paris.

THE NATURE OF FLESH FOOD.

There are two parts,--insoluble and soluble.

(a) The insoluble part contains myosin, 8% to 11%. It coagulates after death. It forms the fibrils of the striated muscles.

Myostroin is present in proportion of 4% to 5%. It forms the striae of the red muscles. It is essentially composed of one or of many nucleo-proteids, which by degeneration produce nucleins, and finally purin bodies,--guanin, adenin, uric acid, etc. (Gautier p 153).

Myostroin is the principal source of uric acid derived from flesh foods by simple hydration giving rise to "uric acid and other allied compounds which play so important a role in the disorders in which their elimination becomes imperfect."

Ossein composes in the flesh the sarcolemma and interfibrillar membranes. It is changed by cooking to gelatin.

(b) The soluble part of lean flesh forms two to three per cent of the weight of the flesh, fresh.

One per cent is myoalbumin. This is coagulated and forms a scum when flesh is cooked.

There is also one-half to two percent of so-called peptones, the amount depending upon the length of time the meat has been kept.

The ossein is not digestible.

There is no proof that the peptones are useful.

This leaves myosin (8%) and myostroin (4%) the only useful elements, myoalbumin being lost in cooking. There are also two per cent of extractives representing waste matters.

When flesh is burned, there is left an excess of acid, concerning which Gautier says: "It follows that the destruction of flesh in the body tends to acidify the blood with both mineral and organic acids (uric acid, lactic acid, etc.) which are derived from its decompositions."

See table on page 156 of Gautier. This table shows 1.2 % of creatin, xanthin and other bodies allied to uric acid.

Extractives have a slightly bitter taste. They contribute to the flavor of meats and modify and raise the flavor of lean meat; for it is known that the flesh of animals which have been overworked or subjected to violent exercise is very rich in extractives and are not pleasant and agreeable to eat.

The flesh of animals xxx is influenced by their food. The flesh of young animals fattened on milk differs from that of grown animals. The flesh of animals fattened in the stable on the perfumed hay of certain regions, is greatly modified by the food. Animals fattened with cabbage, oil cakes, and the residues of the butcher shop or fish have a disagreeable taste. The sea taste of certain species of ducks which live on fish is well known.

The barnyard fowl has very succulent and perfumed flesh when fed on grain, especially rice. These same animals have flesh of a despicable flavor if fed on flesh or oil cake, as observed in fowls fattened on the refuse of large cities. (Gautier page 161).

Castrated animals have a fatter and more succulent flesh than other animals of the same species. Compare the flavor of beef with that of the bull; that of the capon with that of the cock or the ordinary fowl.

Animals in heat, the cow, the bull and the buck, furnish flesh of a bad flavor, strongly suggesting the odor of the animal.

Animals fattened in a stall have a smaller proportion of myosin; hence more of myostroin and more of uric acid. Veal is of this character, and hence more difficult of digestion and less healthful than beef.

White meats have less extractives than red meats. White meats are easy of digestion only in the case of the barnyard fowl.

The flesh of very young animals contains a larger amount of extractives and hence are less wholesome than older ones. The flesh of animals two or three weeks old may be toxic.

The flesh of the donkey and the mule contains more extractives than beef.

The flesh of an animal that has not been bled is much more rich in extractives, having nearly five per cent.

BEEF JUICE.--- From 33% to 50% of juice may be obtained from flesh. Often recommended for consumptives. The reaction is neutral to litmus paper.

Gautier says he has tried beef-juice in the large doses recommended by Richet for consumptives,--a liter a day or more,-- but has not seen any good effects.

Beef juice contains 47 to 70 grams of extractives to the liter.

ROASTED MEATS.-- The temperature inside is 85 to 75° C.

Roasted meat may lose one-fifth to one-fourth of its weight of water.

BOILED BEEF loses 7.5% of its constituents (reckoned dry). Water takes up extractives or leucomaines (creatin, amphicreatin, crusocreatin and analogous bases). A pound of flesh gives about one-half pound of juice.

~~[illegible]~~ Boiling meat has a temperature of 97° two centimeters below the surface.

In boiling, the flesh is acted upon by the heat much more intensely than in roasting.

BOUILLON.-- Bouillon contains 18 to 23 grams of dry extract per liter, which contains 1.3 grams of purin bases in 1000 parts of dry material. This is equivalent to one-half grain of uric acid to the quart.

Bouillon contains 7.5 grams of proteid matters to the liter, representing 37.7 calories.

There is about an equal amount of gelatin in beef. This does not count as a food. The actual food value of bouillon, hence, is practically 30 calories to the liter, or less than one calory to the ounce. This is with the supposition that the fat has been filtered out.

"It should not be forgotten than these bases (the extractives of beef tea) are all toxic in small doses. A guinea pig weighing 410 grams received daily for several days subcutaneous injections of from 5 to 12 milligrams of sarcine ~~(0.005 to 0.012 grams)~~ (0.08 to 0.18 grains). The urine became colored strongly brown and albuminous; the animal lay still, crying out at the least contact; suppression of the urine was soon complete; and death followed rapidly. At the autopsy there was found epithelial nephritis. (Gaucher)."

These substances when taken into the stomach, not injected under the skin, have effects similar to those of caffein and thein.

"The organic extractive matters of bouillon belong in great part to the creatinic and puric series, and the use of this food increases appreciably the excretion of uric acid and of bodies of the uric acid group. It is, then, not to be recommended in arthritics, gouty, rheumatics, sufferers from cardiac disease, neurasthenics, etc." Gautier, page 176.

MEAT EXTRACTS.-- Liebig's extract of beef contains about 9% of extractives which produce uric acdd. (Gautier, page 178).

Muller (Thèses de Paris, 1871, No. 77)added an ounce of Liebig's extract of beef to his daily diet. The result was diarrhea. A dog weighing 6.5 kg. was fed daily six ounces of bread and six ounces of water, two-thirds of an ounce of fat and two-thirds of an ounce of Liebig's extract every twenty-four hours. It had diarrhea on the sixth day and died in collapse on the ninth.

Gautier says that Liebig's extract should not be given in greater quantity than one-twelfth the weight of the total proteid of the food,and should not add more than two grams of potash to the daily diet. He thinks when this precaution is observed that these products are more favorable than harmful to the growth of animals.

For a person taking a normal daily ration of 48 grams of albuminoids, the allowance according to Gaution would be about three and a half grams of Liebig's extract (less than one dram, or about one teaspoonful).

PEPTONES.-- Peptones are formed by digestion of flesh with hydrochloric acid or other acids in the proportion of from 1 to four to one thousand (1:1000 to 4:1000)with pepsin or papaine, or with water made slightly alkaline with carbonate of soda with pancreas hashed-up.

Generally a little alcohol is added to preserving mixtures.

Experiments of Deitters (Beiträge zur Lehre vom Stoffwechsel, Berlin, 1892) and others have shown that if these peptones do not replace more than 69% of the albuminoids habitually obtained from meat, the nitrogen balance was not disturbed.

(Gautier says that the peptones are assimilated, but it seems otherwise to me since the proteids may have been taken in larger quantity than was needed by the system).

CHAPTER XIV.

Meats are preserved by cooking at 230° F.

The Billancourt factory, preparing meats for the army, cooks it for two and a half hours at 120° C (248° F.).

Preserved meat is about three fourths solid meat and one fourth bouillon.

Meats which have been frozen are soft and watery after thawing out, because of the action of the ferments which they contain, producing peptones. They act rapidly after meat has been thawed. This is not due to the breaking down of muscular tissue.

Certain fish,--salmon, pike, herring,--may contain cysticercus, which may give rise to special tapeworms.

Flesh in which decomposition has occurred contains very highly toxic ptomains (collidines, hydrocollidines, choline, nevrine, tetra- and pentamethylene diamines), and other poisons which may give rise to fatal infections and inflammations even after two or three days.

The flesh of young animals is sometimes purgative.

CHAPTER XV.

Wild game is less digestible than butcher's meat. The special taste is due to the violent exertion of the animal before death and the retention of the blood. The large amount of extractives which it contains gives rise to intestinal disorders, cutaneous eruptions, hepatic and renal congestions.

Fowls, arranged in the order of their digestibility, decreasing, are: Chicken, turkey, guinea fowl, pigeon, duck, goose.

The flesh of the pigeon is rich in substances which produce uric acid.

White meats often owe their lack of color to the fact that the blood was thoroughly let out of the animal at the time of the killing.

The white meats of veal and kid are more difficult of digestion than the red meats of beef and mutton.

White meats contain nearly as much extractives as red meats. Some, as the rabbit, veal, kid and pigeon, introduce more uric acid into the system than do the red meats or even the dark meats of game.

With the exception of the dark meats of wild game which are more fibrous and contain more blood and extractives, the color of a meat is not an index of its digestibility.

The heart muscle contains more extractives which give rise to uric acid than other flesh.

The spleen contains a great quantity of extractives,--guanin, zanthin, cholesterin. "This flesh cannot be otherwise than a very bad food." Gautier.

Gautier calls attention to the fact that the kidneys of old animals and of carnivorous animals are unwholesome. This is a very suggestive fact.

The liver is liable to contain large numbers of infectious germs. It contains a great quantity of extractives which go to form uric acid. (See I. Walker Hall).

The lung contains a large amount of uric acid.

The composition of the brain is very similar to that of the yolk of egg. There is a little more proteid.

Sweetbread , or thymus of the calf, is exceedingly rich in extractives. It furnishes 70 grains of uric acid to the pound(I. Walker Hall).

Blood.--Blood is a food which is very hard of digestion and difficult of assimilation. It is likely to contain infectious germs.

Fish.-- Less nutritive and more likely to produce disturbances than ordinary flesh. It may produce urticaria and eczema. Especially contra-

Cautier page 206.

indicated in persons suffering from gout, arthritis, diseases of the kidney, bladder, etc.

The flesh of fish is affected by the water in which they live. Those living in stagnant water have a disagreeable flavor and may become poisonous.

Fish readily undergoes decomposition and it may then produce cutaneous irritations, eczema, diarrhea.

The flesh of certain fish is always poisonous, such as the toad-fish. When eaten, it produces redness of the tongue, vomiting, diarrhea, pains in the joints, dysuria, pruritis, dilatation of the pupils, hard and frequent pulse, syncope.

Serpents.-- The flesh of serpents is sometimes used as food. It is often substituted for eels.

Oysters have a low nutritive value. They often contain the germs of typhoid fever.

Clams, lobsters, and crabs often produce eczema, urticaria, nausea, purgation.

MILK.

The average consumption of milk in London is 40 liters a year per capita. In Paris the average consumption of milk yearly for each inhabitant is 60 liters.

With the addition of bread, milk makes a complete diet and will sustain life indefinitely.

Milk consists of plasma, containing globules of butter, having a diameter of 1/2500 to 1/25000 of an inch. Each globule is surrounded by an envelope of proteid substance. Milk contains about 1,500,000 of these globules per cubic millimeter.

Milk also contains fine particles of phosphates.

The average density of mother's milk is 1.030; of cow's milk 1.032.

Pure cow's milk freezes at - 0.53, an excellent test of its purity. When water is added, the freezing point rises (31°F.).

The reaction of milk is neutral to litmus paper, and acid to phenolphthalein. The acidity is due to the proteid matters of the milk.

Casein is not perfectly dissolved in milk; it is suspended. It will not pass through the porcelain filter, even when assisted by a vacuum. Mineral salts precipitate casein from its semi-opalescent solution by separating phosphates from it and seizing the potash and the lime which is combined with it, thus rendering it insoluble.

Milk also contains albumin which is coagulated by heat, known as lactalbumin.

These proteid substances together form 1.5 to 5.5 percent of the weight of the milk.

Milk contains neither proteoses nor peptones.

Milks from different sources differ. Mother's milk is not coagulated by dilute acids.

The fat of milk consists of oleomargarin, with two percent of butyrin and a small quantity of stearin and myristin.

Commercial butter contains along with the fat globules, lactalbumin, casein, lactose, and serum, besides soluble ferments and microbes.

The proportion of butter is variable in different milks. Mother's milk contains 10 to 60 grams of butter to the liter; cow's milk 30 to 80 grams to the liter.

The lactose found in milk does not exist in the blood of the animal. It is formed only in the mammary gland. It is produced by all warm-blooded animals. It has the formula $C_{12}H_{22}O_{11}$. It is fermentable. It is precipitated by cupro-potassic reagent, but not in the same proportion as glucose.

Mother's milk contains lactose in the quantity of 25 to 70 grams to the liter; the milk of the cow and the mare 35 to 50 grams to the liter; the milk of the ass 50 to 75 grams to the liter.

Milk contains lecithins. Cow's milk contains about 1 gram to the liter; mother's milk 1.75 grams to the liter. Lecithin is a combination of fats, phosphorus and proteids. It is one of the best forms for the assimilation of phosphorus.

Nucleon is a proteid containing phosphorus. This is the principal agent for the assimilation of phosphorus, lime and iron. (Siegfried. Bull., t.XVI, p. 146; t. XVIII, p. 912 and 913). (See page 213 of Gautier).

Mother's milk contains more than twice as much nucleon as cow's milk.

Milk also contains a trace of citric acid, also traces of urea and creatin, also diastatic ferments and bacteria. The ferments or diastases are found in the whey. One of these when injected under the skin lowers the temperature in fever. Another slowly dissolves casein, another dissolves and hydrates starch.

Mother's milk contains about two-thirds as much mineral matter as cow's milk.

Mother's milk contains 3.5 to 7 milligrams of iron per liter. It seems to be united with the casein. (Friedjung and Jolles). See p. 214, Gautier.

A liter of cow's milk furnishes 750 calories.

"Mother's milk is opaline, rather sweet, alkaline to litmus paper, almost without odor. It does not coagulate, even with heat, after the addition of dilute acetic acid; but when rennet is added light flocculent curds form. The casein of mother's milk is not the same as that of cow's milk; it is not precipitated by chloride of sodium but by an excess of ammonium sulphate. It is a sort of lactalbumin. It differs from the casein of cow's milk in that its digestion leaves no residue of nucleinic matters. The lactalbumin of mother's milk also differs from that of cow's milk in its rotary power." (Gautier page 214.)

"The sugar of mother's milk also differs from that of cow's milk, being sweeter and crystalizing in a different manner." (Béchamp).

"Mother's milk is richer than other milks, especially richer than cow's milk, in lecithins, nucleons and organic phosphorus prepared for direct assimilation."

The butter of mother's milk melts at 30° C.

A nursing mother furnishes from the third to the sixth month from 1000to 1300 c.c. of milk daily.

A diet rich in albuminoids increases the amount of butter and of sugar.

An excess of fats in the diet lessens rather than increases the amount of fat in the milk. *

A scanty diet diminishes the proteid and the fat but not the sugar.

Deficiency of proteids diminishes the quantity of milk and its richness in fat.

Anemic and cachectic mothers furnish a small quantity of milk, poor in proteids and in fats. Nursing is not good either for them or for their infants.

Mother's milk is also affected by violent emotions, as anger, and disappointment.

The cabbage, cruciferae, leeks and onions give to the milk their taste and odor.

The amount of fat in mother's milk is increased by rest.

After the age of thirty-two years mother's milk contains less minxeral substance.

The return of menstruation decreases the secretion of milk. It does not otherwise alter it except to render it slightly laxative at the menstrual period.

The milk secretion diminishes during acude disease but the proportion of casein and salts increases.

A child should not be nursed by a syphilitic or tuberculous woman.

Alcohol, opium, quinin, iodide of potash, Glauber's salts appear in the milk, also mercury and arsenic. The same is true of toxins and ptomains which may be found in the mother's blood.

Mother's milk, according to the researches of Honigmarun and Escherich, may contain pus-producing germs.

COW'S MILK.

The casein is easily precipitated by dilute acetic acid at a temperature of 40° to 50° C.

Fatigue diminishes the amount of butter in cow's milk.

The milk is much affected by the food of the cow.

Composition of Cow's milk, Mother's milk, Goat's milk, Donkey's milk.

	Cow's milk	Mother's milk	Goat's milk	Donkey's milk
Specific gravity	1.032	1.030	.....	1.032
Water	864.3	874.1	869.5	914.0
Casein	.....	10.3	....	} 12.3
Albumin	33.3	12.6	44.3	
Butter	42.0	37.8	60.7	31.0
Lactose	52.8	62.1	48.5	69.3
Mineral salts.	7.6	3.1	9.1	4.5

THE BACTERIA OF MILK.

Lactic acid ferment, which coagulates milk and forms lactic acid.

Thyrothrix tenuis which clots milk and then rapidly liquefies the casein.

Thyrothrix filiformis which peptonizes the casein, acting like trypsin.

Thyrothrix distortus and geniculatus which produces acetic acid, valerianate of ammonia and leucin.

Thyrothrix turbidus which first coagulates milk, then liquefies the casein, producing ammonia, butyric acid, leucin and tyrosin.

Thyrothrix urocephalum which dissolves casein and produces a butyric odor.

Thyrothrix claviformis which first coagulates, then liquefies the milk. It acts upon both the casein and the sugar of milk, forming peptones, alcohol, carbonic acid, fatty acids and hydrogen.

Thyrothrix catenula which coagulates the casein, produces peptones, and hydrogen sulphide.

Bacillus butyricus, which transforms the sugar of milk into butyric acid; dissolves casein.

There are also found in milk: Bacillus subtilis, Bacillus coli communis, and other pus-forming germs derived from the fecal matters, and sometimes also yeast and the germs of typhoid fever, tuberculosis, diphtheria, and scarlet fever.

"These microorganisms are the agents which produce spontaneous changes in milk and the ripening of cheese." (Gautier)

The sterilization of milk destroys the germs; but boiling also destroys the soluble ferments, changes the taste and composition of milk and renders a portion of the proteids insoluble.

Cooked milk, though it may be more wholesome, is less nourishing and less easily assimilable than raw milk.

Boiling for a few minutes alone is not sufficient to sterilize milk.

SKIMMED MILK.

Table showing the composition of skimmed milk and cream. (Duclaux)

	Normal milk	Skimmed milk	Cream
Water	87.25	89.70	58.63
Dry extract	12.75	10.30	41.37
Fatty matters	3.50	0.77	35.00
Casein	3.90	4.02	2.75
Sugar of milk	4.60	4.74	3.12
Mineral matters	0.75	0.77	0.50

Skimmed milk contains a trifle more casein and sugar of milk, also a larger proportion of salts than does ordinary milk. The amount of fat is reduced to one fifth.

Cream contains only about two-thirds as much water as ~~xxx~~ milk, ten times as much fat, a little more than half as much casein, two-thirds as much sugar of milk, and two-thirds the amount of mineral matters.

Good cream contains one-third its volume of fat.

BUTTERMILK.

Buttermilk is the residium, after the milk has been churned and the fat removed.

Contains albumin and casein in fine flocculi, salts, water, and sugar. According to Thompson the sugar is largely converted into lactic acid. According to Hutchinson, the loss of milk-sugar from the formation of lactic acid is too small to be of any consequence, as only 1/4 to 1/3 of one percent of lactic acid is present.

It should be drunk fresh, for it soon decomposes.

In composition it resembles skimmed milk, containing a little more fat and a little less carbohydrate and proteid matters. The following is the chemical analysis of buttermilk, according to Yeo:

Water	88.0
Nitrogenous matter	4.1
Fatty matter	0.7
Lactine	6.4
Saline matter	0.8

PRESERVATION OF MILK.

Milk is pasteurized by heating at 158 to 167° F.; for from twenty to thirty minutes. It should then be cooled quickly. It will keep for several days.

For permanent preservation it must be heated for a few minutes at 225° to 230° F.; or better an hour at 212° F. This heating should be repeated to insure long preservation.

To keep indefinitely milk must be heated to 110° C. (230° F.) two or three times, with a few days interval between the heatings.

Heating milk above 176° F. changes it. It destroys its enzymes; it breaks up the emulsion of the fats; the casein is rendered less assimilable; the lactalbumins and lactoglobulins are coagulated; the sugar of milk is caramelized and rendered acid, giving to milk which has been heated above 100° C. a yellowish color and a peculiar taste. Nevertheless, such milk heated at 106° to 112° C. is easily digestible by young infants.

Sterilization should be made immediately after the milk is drawn from the cow to prevent the formation of toxins in the milk.

Milk that has been heated over 80° C. can be recognized by the destruction of its oxydase. To make the test, add to 10 c.c. of milk one or two drops of oxygenated water, two or three drops of a 2 % solution of paraphenylenediamine. If the milk has not been heated above 80° C. there will appear a grayish blue tint which soon changes to indigo blue. The milk retains its natural color if it has been boiled.

It has been claimed that sterilized milk produces rickets. Statistics do not sustain this idea.

Sterilized milk enables us to combat diarrhea and dysentery, but, according to Budin, it should not be given during the first months of infancy.

One of the leading objections to the use of sterilized milk has been the destruction of its oxydases.

Commercial agents for the preservation of milk are all harmful. Bozax and other substances which prevent the souring of milk do not kill the germs; so when the milk is taken into the intestine the germs resume their activity.

Modified Milk.-- By properly feeding the cow the composition of the milk may be made such that by the addition of a few grams of sugar of milk to the liter, it will very closely resemble mother's milk.

Richt dilutes the cow's milk with half its volume of boiled water, adding 15 grams of white of egg to the liter.

"These modified milks are, it is true, only a gross imitation of human milk. They differ very materially in the nature of their casein and of their sugar (if cane-sugar is emmployed); but when well sterilized, they seem to render good service."

Various modifications of milk have been made which are well accepted by the young infant after the sixth or the eighth month, and may be gradually substituted for mother's milk. A well-known preparation consists of concentrated cow's milk with ordinary sugar, and of a powder prepared by making a paste of wheat flower without either salt or yeast, carefully cooking it in an oven until it becomes dry and crusty and the starch has been changed in large part into dextrin. This biscuit is ground to a fine powder, then mixed with condensed milk; the whole is dried, pulverized, sterilized and bottled from from air germs. This is a good preparation which permits weaning without any shock to the child or burden to the mother, and it may sometimes be used by convalescents.

Gautier p. 228.

CREAM

Cream contains, besides butter, casein, lactose, sugar, phosphatic salts, and most of the germs which are found in the stomach, carried up with the cream as it rises. They adhere to the fat particles in the churning.

The digestion of cream is difficult when it is taken in large quantity.

Cream is unwholesome if itxh the milk has not been properly cared for or if it has been obtained from sick cows.

Cream undergoes changes very rapidly because of the large number of microbes which it contains.

In summer especially, whipped cream has often given rise to serious illness.

WHEY.

Whey may be obtained from sour milk or by coagulating the casein with rennet, or lab ferment.

Whey produced by lab ferment contains a proteose which results from the breaking up of the caseinogen (caséogène). Proteose is not found in the whey resulting from the souring of milk or by acidifying it.

There is also found in whey about two percent of lactalbumin.

There are also found very active hydrating and oxidizing ferments.

There is also found the sugar of milk and the mineral salts with the exception of the earthy phosphates, most of which are removed with the cream or remain with the coagulated casein.

Whey obtained from cow's milk has the following composition:

Water	933.0 grams	
Albuminoids	10.5	
Fats	1.0	
Sugar of milk	44.0	
Lactic acid, etc.	3.3	
Mineral matters	8.2	(Fleischmann).

Whey is slightly nutritive from its phosphates, sugar and albuminoids. It is also diuretic and slightly laxative.

Whey is useful as a food only if it is desired to give the system an opportunity to free itself from residual proteids; hence will be employed in affections of the liver, chronic constipation, and in infectious maladies, et cetera.

BUTTERMILK.

See page 41 of these notes.

Buttermilk has about half the nutritive value of ordinary milk.

It usually contains some lactic acid.

The following is the composition of buttermilk, according to Lam: (See page 41 of these notes for the composition according to Yeo).

Dry residue(average)	8.7 to 9.8 grams in 100 grams.
Fat	0.5 to 0.9
Casein and lactalbumin	2.5 to 2.7
Lactine or sugar of milk	3.0 to 3.5

In use it should be sterilized. A little sugar may be added.

It is useful in feeding badly nourished infants.

Gautier page 231.

KOUMYS (KUMYS)

Kumys is the fermented milk of the mare. It is made by mixing ten volumes of warm mare's milk with one volume of x koumys previously prepared. Plase in a cool place in summer and in a warm place in winter. Stir it occasionally. At the end of two or three hours fermentation begins, which is first lactic, and then alcoholic. The liquid becomes acid, then alcoholic. After four or five hours, it is placed in bottles, sealed, and kept in a cool place. It is ready for use in a few days. It is slightly intoxicating.

At first the casein is in fine curds, which however dissolve when water is added. Later these curds are dissolved under the action of lactic acid.

Kumys contains four grams of peptone to the liter.

Kumys contains as much alcohol as small beer.

It also contains enzymes similar to those found in fresh meat juice.

KEFIR.

A preparation similar to kumys, made by the mountaineers of the Caucasus and by the Tartars from the milk of cows and sheep.

The milk is fermented by the addition of kefir grains which they claim were first introduced by Mahomet. These grains contain a yeast, Saccharomyces mycoderma, which produces alcohol, and a bacterium, Dispora caucasica, which peptonizes the casein.

The kefir is mixed with a little warm water. To this milk is added and allowed to stand for a couple of days, at a medium temperature, being agitated at intervals. After a few days the milk is turned off to be used and fresh milk is supplied.

Kefir contains less alcohol than kumys,--about three-fourths of one per cent. It contains a little less than one per cent of lactic acid.

When kept for a long time kefir becomes very acid and undergoes other changes.

Kefir has been recommended in apepsia, vomiting of pregnancy, chronic enteritis, tuberculosis.

Under its use urea increases; uric acid diminishes; the acidity of the urine also diminishes.

Kefir, like kumys, is contraindicated in affections of the kidneys, bladder, heart, and in hemorrhages and plethora.

Composition of kefir(Hammersten) after two days, two analyses:-

Water	882.6	890.9	gr. in 1000 gr.
Alcohol	7.0	6.8	
Lactic acid	8.1	6.0	
Sugar	27.8	29.0	
Fatty matters	53.5	31.0	
Casein	29.8	27.4	
Lactalbumin	2.8	1.7	
Peptones	0.5	0.7	
Salts	7.9	6.5	

YAOURT.

This is a preparation of clotted milk.

Widely used in the Orient.

Milk is boiled until it is concentrated to two-thirds its original volume. It is then put in bottles and still further condensed until a skin is formed over the top. It is then cooled to 30°or 40° C. when a little of the old yaourt is injected under the skin without breaking it. Four or five hours later there will be found a thick, firm, creamy clot.

Yaourt will keep four or five days but it soon sours.

It is used as a diuretic and in cases of dysentery.

Yourt in the Orient is mixed with many other foods and may be eaten with sugar, salt, etc.

Gautier page 234.

PREPARATIONS OF CASEIN.

Casein has the advantage over other animal proteids that while having the composition of muscular flesh it is digested without residue and without toxins.

It is now widely used in therapeutics, having been introduced by Salkowski, of Berlin.

Salkowski's method of preparation was the following: Casein was separated from skimmed milk by adding a dilute acid. It was then re-dissolved by the addition of the smallest possible amount of ammonia.

This substance and numerous analogous preparations (plasmon, tropon, senatogene, nutrase, etc) all contain with the casein more or less nucleins, phosphates, and various other salts.

The composition of these milk powders, according to Gautier, is as follows:

	Tropon	Plasmon	Nutrase	Eucasein
Albuminoid matters	90	77.3	85	80
Sugar of milk	..	2.8	..	..
Fats	..	1.3	1	2
Extractive matters	..	1.1	..	..
Water	9	11.3	14 (Water and Mineral salts)	20 (Water and Mineral salts)
Mineral salts	1	6.2		

Eulactol is a condensed skimmed milk, containing of proteid, 28%; fats, 44%; lactose, etc., 46%. (These figures amount to more than 100%.-J.T.C.)

These preparations should be prepared as freshly as possible, as the butter then contain makes them easily to become rancid on exposure to the air through oxidation. They have the advantage that they introduce into the system a very small amount of material which can be converted into extractives, either urinary or biliary.

CHEESES.

Milk is curdled by the rennet of the young calf or an infusion in warm water of the testicles of the calf.

"Highly flavored cheese(roquefort, gorgonzola, munster) should not be given to invalids." (Gautier).

EGGS.

An egg weighs about two ounces, of which the shell weighs a quarter of an ounce, the white of the egg an ounce and a quarter, and the yolk of the egg half an ounce.

The white of egg coagulates at a temperature of 70° to 80° C.

The white of egg contains about 12% albumin.

The white of the egg contains a substance analogous to the fibrinogen of the blood which coagulates on agitation. This accounts for the change which takes place in the white of egg as the result of beating or whipping with fork or spoon.

About 1/25 of the dry matter of the egg white consists of salts.

Yolk of egg is food stored up for the young chick. It contains all the elements needed for nutrition. It is especially rich in fats, also lecithin, a proteid compound containing phosphorus, which is of great value in nutrition, especially in blood-building.

The following is the composition of the yolk of egg:

Water	51.03
Proteids	16.12
Fatty substances	31.39
Soluble non-nitrogenous matter	0.48
Salts	1.01

One-fourth of the fatty matters is lecithin.

The yolk of egg is one-half water, one-third fat, one-sixth proteid, one percent salts.

The yolk of egg contains a large amount of assimilable phosphorus.

The yolk of egg also contains a large amount of hematogen, a substance which is exceedingly rich in organic iron, which is in a form easily assimilable.

The yolk of one egg contains 2 milligrams of iron, of which

Gautier page 240

60 milligrams are required every twenty-four hours.

The yolk of an egg contains two grams of lecithins which greatly stimulate general nutrition. More than one-fourth of the fat of the yolk of egg is made up of lecithins.

The caloric value of the yolk of one egg is:

Proteid	10.8	
Fat	41.3	
Carbohydrate		
Total		52.1

The caloric value of the white of one egg is:

Proteid	15.5	
Fat	.6	
Carbohydrate		
Total		16.1

The caloric value of the whole of one egg is:

Proteid	26.3	
Fat	41.9	
Carbohydrate		
Total		68.2

"By its albumins, its fats, its organic phosphorus, its iron, the egg, as well as muscular flesh, and better still than the latter, is suited to furnish to the young animal the material essential to the formation of blood, muscles, and nerve tissue. Thus, fresh eggs in the shell, or cooked, constitute a food readily assimilable, reparative, and easy of digestion."

The shell of egg is porous. Microbes and spores of molds may penetrate the shell when the egg is kept for a long time. Odors may also be absorbed by the egg through the shell.

FATS.

The fats of beef, mutton and pork are rich in stearine in the deeper tissues of the animal, and in palmitin and olein in the peripheral tissues and in the skin. See Gautier page 244 for table showing composition.

Codliver oil is extracted from the livers of various varieties of codfish (Gadus). After removal from the fish the livers are left to themselves until a fermentation takes place by which the oil is separated and comes to the surface. The livers are then heated by hot water or steam. Codliver oil contains in addition to fats, lecithins, and bases analogous to ptomains (Gautier).

Fats, after being emulsified, and in part saponified, in the intestine, are in great part transformed while passing through the intestinal wall into the specific fat peculiar to the animal.

Fatty substances are useful in the preparation of food but their absolute necessity has not been demonstrated.

Fats may be formed in the body from the albuminoids and especially from sugars and starches.

Fats are of all foods those which introduce into the body for a given weight the largest amount of latent energy.

Fats are of all the various combustible elements stored in our tissues, those which disappear the most easily; hence they may be regarded as food principles which protect the albuminoids.

However, their action is less in this respect than the hydrates of carbon, but no matter what the amount of fats or hydrates of carbon taken, the destruction of proteid elements cannot be entirely prevented.

BUTTER.

Butter readily becomes rancid because of the large amount of microbes and diastases which it contains, having derived them from the milk.

Its melting point is 26.5^{0} C.(79.7^{0} F.).

Butter is of all fat bodies one of the most easily digestible when fresh. It may be taken for many weeks spread on bread, in quantities of 100 grams or more a day.

The following is the composition of butter:

	Fresh Butter			Salted Butter
	Cantal	Isigny	Isigny	Isigny
Water	13.40	14.24	12.40	12.36
Fatty matters	84.30	84.82	86.71	80.56
Salt (NaCl)	0.94	....	....	5.08
Sugar of Milk	0.60	0.50	0.16	0.57
Casein and salts	0.76	0.44	0.73	1.43

Butter has a slightly acid reaction.

Butter is very much influenced by the food of the cow.

VEGETABLE FOODS.

In our climate 77% of the foodstuffs of the avery man's consumption is drawn from the vegetable kingdom. Bread constitutes about 21% of the ordinary ration; next come cereals, fresh vegetables, peas, beans, lentils, roots, tubers and fruits.

Vegetable fats are in general as easily assimilable as animal fats.

Vegetables also contain lecithins,--proteid bodies containing fats and phosphorus. According to Schultze and Stieger cereals contain 0.52 to 0.74 per cent of lecithins.

Vegetables are also rich in nucleins in which phosphorus exists in an organic state easily assimilable. Grains and tubers are very rich in this element. Nearly two thirds of the nucleins we eat are provided by this substance.

Vegetables also contain in combination with magnesium and potash a large amount of organic phosphorus.

The following table shows the amount of phosphorus contained in certain grains:

Hemp seed	1.46%
Peas	0.37
Lentils	0.30
Beans	0.51

"Cereal preparations thus permit us to introduce into the system large quantities of phosphorus under assimilable form without charging the diet with an excess of albuminoids or of proteid wastes. These preparations are also especially valuable to the growth of young animals, and excellent for convalescents and infants, a fact which was known to the ancient Greeks." Gautier.

The following table shows the amount of phosphoric acid contained in various cereals:

Corn	1.040 per cent.
Rye	1.030
Barley	0.930
Oats	0.840
Buckwheat	1.718
Beans	0.839
Peas	0.821

Green vegetables and legumes play also an important part in the diet by supplying salts of potash, soda, magnesium, lime,-- bases which are essential to the tissues. These bases are found in plants inthe form of albuminates, malates,citrates, tartrates, etc. The organic part of these salts being oxidized in the body, the bases combine with the acids uric, hippuric, lactic, sulphuric, phosphoric, etc. which result from the disassimilation of animal tissues. By this means the necessary alkalinity of the fluids is maintained.

From this point of view vegetables fill in the diet of animals (?) a place of first importance. Potash salts are especially prominent. According to Boussingault there are to be found of this element in 100 grams of dried material,

In spinach	4.5 grams
In potatoes	3.2
In turnips	3.7
In cabbage	2.6
In chicory (endive)	1.7

Of the 4.5 grams of potash (K_2O) and 1.1 grams of soda(Na_2O) contained in the daily ration, the average adult receives from vegetables 3.2 grams of potash and 0.65 grams of soda.

Of the 1.15 grams of lime and 0.65 grams of magnesium of the daily ration, vegetables supply 0.80 grams of lime and 0.50 grams of magnesium.

"We eliminate each day through the urine about 2 grams of sulphuric acid and 2.5 grams of phosphoric acid,(SO_3) and (P_2O_5),which are derived from the sulphur and phosphorus of albumins and nucleins. These acids are saturated by alkalies furnished by plants. A small amount of ammonia, formed by the tissues, also combines with the acids; but in man very little ammonia is form comparatively, although in carnivorous animals ammonia is formed in large amount." Gautier.

CLASSIFICATION OF VEGETABLE FOODS.

There are five groups of foodstuffs furnished us by plants:

1. Cereals and their derivatives

2. Vegetable seeds and legumes,--beans, peas and lentils.

3. Roots and tubers,--potatoes, sweet potatoes, yams, Jerusalem artichokes.

4. Herbaceous vegetables,--spinach, chicory(endive)cabbage, etc.

5. Fruits,--apples, pears, peaches, strawberries, raspberries, bananas, almonds, walnuts, chestnuts, etc.

CEREALS

Rice is of all cereals richest in starch. Rye is next.

Corn and oatmeal contain the largest amount of fats, of which rice contains the least.

Wheat contains the largest amount of assimilable proteid matters. Buckwheat is next, then rye, barley and oats. Corn and rice contain the least.

The proportions of the elements found in the meals of the grains differs somewhat from those found in the grains themselves. Flour of wheat and buckwheat contain the most starch. Oatmeal contains the largest amount of proteid, of which buckwheat flour and rice flour contain the least. Cornmeal and oatmeal are richest in fat, wheat flour and rice flour being the poorest.

The cereals form the basis of human diet. Although generally the most wholesome these foodstuffs may introduce into the system poisonous substances. Rice may be infected with a mould, the spores of which are not destroyed by cooking. Corn may be affected by a fungus which gives rise to pellagra. Rye when affected with ergot may cause gangrene of the extremities. Wheat may be rendered unwholesome by the poisonous seeds of darnel and smut(Lollium temulentum and Agrostemma).

WHEAT.

Wheat contains from 10% to 16% of gluten,--an average of 12%,--and 60% to 75% of starch.

Hard wheats, grown in hot countries, contain as much as 18% of gluten. They produce 82 to 83 pounds of flour to the 100 pounds of grain, which gives 140 to 143 pounds of bread to 100 pounds of flour.

The soft wheats give 72 to 78 pounds of flour to 100 pounds of grain, and 132 to 136 pounds of bread to the 100 pounds of flour.

The following table shows the comparative composition of flour and bran:

	Flour	Bran
Water	15.54	12.67
Nitrogenous matters	11.17	12.99
Fats	1.07	2.88
~~xamidon~~ Starch	70.43	31.31
Cellulose	0.98	34.67
Ash	0.81	5.58

It will be noticed that the bran contains a larger percentage of proteids than does the flour, and less than half as much starch; more than twice as much fat, and seven times as much of salts. In other words, the salts are almost exclusively contained in the bran. In a given quantity of wheat the bran contains three-fourths of the salts and more than three-fourths of the phosphorus.

The gluten of wheat consists of four substances: Gluten fibrin, gluten casein, mucedin, and gliadin or vegetable gelatin.

The starch of wheat is in the form of grains about 1/1200 of an inch in diameter.

CORRECTION

★ ★

PRECEDING IMAGE HAS BEEN REFILMED TO ASSURE LEGIBILITY OR TO CORRECT A POSSIBLE ERROR

CEREALS

Rice is of all cereals richest in starch. Rye is next.

Corn and oatmeal contain the largest amount of fats, of which rice contains the least.

Wheat contains the largest amount of assimilable proteid matters. Buckwheat is next, then rye, barley and oats. Corn and rice contain the least.

The proportions of the elements found in the meals of the grains differs somewhat from those found in the grains themselves. Flour of wheat and buckwheat contain the most starch. Oatmeal contains the largest amount of proteid, of which buckwheat flour and rice flour contain the least. Cornmeal and oatmeal are richest in fat, wheat flour and rice flour being the poorest.

The cereals form the basis of human diet. Although generally the most wholesome these foodstuffs may introduce into the system poisonous substances. Rice may be infected with a mould, the spores of which are not destroyed by cooking. Corn may be affected by a fungus which gives rise to pellagra. Rye when affected with ergot may cause gangrene of the extremities. Wheat may be rendered unwholesome by the poisonous seeds of darnel and smut(Lollium temulentum and Agrostemma).

WHEAT.

Wheat contains from 10% to 16% of gluten,--an average of 12%,--and 60% to 75% of starch.

Hard wheats, grown in hot countries, contain as much as 18% of gluten. They produce 82 to 83 pounds of flour to the 100 pounds of grain, which gives 140 to 143 pounds of bread to 100 pounds of flour.

The soft wheats give 72 to 78 pounds of flour to 100 pounds of grain, and 132 to 136 pounds of bread to the 100 pounds of flour.

The following table shows the comparative composition of flour and bran:

	Flour	Bran
Water	15.54	12.67
Nitrogenous matters	11.17	12.99
Fats	1.07	2.88
Starch	70.43	31.31
Cellulose	0.98	34.67
Ash	0.81	5.58

It will be noticed that the bran contains a larger percentage of proteids than does the flour, and less than half as much starch; more than twice as much fat, and <u>seven times as much of salts</u>. In other words, the salts are almost exclusively contained in the bran. In a given quantity of wheat the bran contains three-fourths of the salts and more than three-fourths of the phosphorus.

The gluten of wheat consists of four substances: Gluten fibrin, gluten casein, mucedin, and gliadin or vegetable gelatin.

The starch of wheat is in the form of grains about 1/1200 of an inch in diameter.

RYE.

Rye can be grown in the very poorest soils, hence can be grown in soils in which wheat cannot be grown.

Rye makes a somewhat sour bread, which keeps well, but it is less digestible than wheat bread.

The following table shows the comparative composition of bread made from bolted rye flour and from unbolted rye flour(Pumpernickel).

	Bolted rye flour bread.	Pumpernickel.
Water	42.27	43.42
Nitrogenous matters	6.11	7.59
Fats	0.43	1.51
Sugar	2.31	3.25
Starch	46.94	41.87
Cellulose	0.49	0.94
Ash	1.46	1.42

A mixture of rye flour and wheat flour constitutes meslin, (meteil), which gives a bread easy to keep and of fairly good taste.

The consumption of rye bread made from flour from grain invaded by the Claviceps purpurea or ergot may occasion epidemics characterized by gangrene of the extremities.

BARLEY.

Barley grows quickly, only four months being required to mature a crop; hence it is adapted to countries which have a short season as well as to the hottest countries.

Barley does not make a good bread. The bread has an inferior flavor.

Barley gruel is mucilaginous and contains sxly 1% ot 2% of albuminoids and 5% or 6% of hydrates of carbon. It is good for feeding patients who require little nourishment.

OATS.

Used much in the form of gruels and mushes. Less used now than formerly.

Oatmeal is rich in organic phosphorus and lecithins.

It is slightly laxative.

Oatmeal makes a coarse bread.

RICE.

One of the most easily digestible of grains, especially when eaten nearly dry. It requires the addition of fat.

BUCKWHEAT.

So-called black wheat.

Comes from Central Asia.

Its nutritive value is almost equal to that of wheat but it has a less agreeable flavor.

DECOCTIONS OF CEREALS.

Decoctions of cereals or thin gruels are much used in diet for the sick. Rice water combats diarrhea. Oatmeal water and barley water are much used as refreshing drinks, especially by laborers in Northern countries. These decoctions contain a large amount of organic salts. An ounce of barley in a quart of water boiled two hours and filtered, contains nearly 0.1 gram of organic phosphorus; hence very useful in convalescence and in the feeding of children, and to improve the quality of milk. Bread water consisting of well-toasted bread boiled in water, strained, contains a considerable amount of proteids, sugar and dextrin, in combination with organic phosphorus. The toasting doubles the amount of soluble proteids.

WHEAT BREAD.

Wheat bread originated in Egypt.

In Egypt and in Greece bread is made by yeast made from raisins. Some raisin juice is mixed with wheat flour and formed into little cones which are dried in the sun. This is a sort of yeast containing moulds and yeast which are found on the surface of the raisin skin. In making bread one of these cones is reduced to a powder and then mixed with the dough.

The consumption of bread in Paris alone is 1,980,000 pounds daily.

In 1668 members of the University of Paris opposed the use of yeast. Opposition was broken down, however, and the use of yeast was permitted by Act of Parliament in 1770. Previous to that time raising bread with yeast was reserved for special occasions for "pains de luxe."

In the raising of bread some portion of starch is converted by the diastases of the yeast into dextrin and sugar.

In the baking the surface of the loaf is exposed to a temperature of 250^{0} C., but the interior of the loaf comes out of the oven without having reached a temperature as high as 100^{0} C. This temperature destroys the yeast but it does not destroy all of the germs.

Ordinary bread consists of two-thirds solid matter and one-third water.

Bread can be made to retain more water by the addition of a little rice or corn, lime water, potatoes and various salts.

Good bread should be sonorous, should be light, should have a minimum of 22% of brown, brittle crust, difficult to detach from the crumb. The center of the loaf should be elastic and should have large cavities. After the bread has cooled, with moderate pressure between the thumb and the finger the crumb should not adhere together, that is should not be sticky so as to form a solid mass, but should slowly recover its first

Gautier page 268.

volume. It should not stick to the fingers when rubbed between the hands. Good bread should be capable of absorbing considerable water without becoming sticky. The color of the crumb should be clear yellowish white. It should be slightly translucent. It should have a faint odor of wheat. There should be no trace of sourness, mustiness, nor odor of fermentation. Drying up, without toasting, good wheat bread should not lose more than 36% of its weight. Cut into slices a centimeter thick and left in the air, good bread in drying should not lose more than 25% of its weight in two weeks.

Bread containing too much water is heavy; it is not sonorous; the crumb is pasty, and when rolled between the fingers there is left a visible unctuous trace. The crust of such bread weighs less than one-sixth of the total weight.

Bread should be made with machinery rather than by hand.

The finest and whitest flour should not be selected as this is poor in gluten and in salts. ~~When bread~~

When bread is made by hand, the dough is contaminated by sweat, and by epithelium from the skin.

When bread is first removed from the oven, the crumb is sticky. After twelve or fifteen hours it becomes stale and crumbles under the fingers. This is not due to loss of moisture, for it has been shown that the loss of moisture is not over two per cent, and if the bread is placed in the oven for a short time it returns to the original condition of fresh bread. Lindet has shown that this change is due to the transformation of starch into amylodextrin which constitutes about ten per cent of the bread when it comes out of the oven. At the end of twelve to twenty-four hours a portion of this is returned to the state of starch. When the bread is exposed to the heat of the oven again, the amylodextrin reappears.

The following analyses show the relative properties of bread, bread crumb and bread crust, the crust being 22.5% and the crumb 77.5% of the bread.

	Entire bread.	Crust.	Crumb.
Water	38.30	17.15	44.45
Nitrogenous matter, soluble	1.86	5.70	0.75
" " insoluble	6.24	7.50	5.92
Soluble non-nitrogenous material	4.04	4.88	3.79
Starch	47.84	62.58	45.55
Fats	0.81	1.18	0.70
Mineral matters	0.91	1.21	0.84

In the above table it will be noticed that the crust contains more than twice as much soluble material as the crumb.

It is also noticeable that the soluble proteid matters are nearly eight times as much in the crust as in the crumb of the bread. Hence the importance of making small loaves instead of large loaves and making the bread in such a manner as to give a thick crust and as much crust as possible. (J.H.K.)

The crust of bread is more nourishing than the crumb, more soluble in water, richer in proteid material, more easily digestible, and more stimulating to the stomach. (Gautier)

The fashion of trimming off the crust in serving bread is a bad one. The custom might well be reversed. Damp crust, however, is tough and hard to chew. Crust should always be served warm, dry, and fresh from the oven in order that it may be crisp and easily chewed. As ordinarily served crust of bread is more difficult to masticate than almost any other article of food, that is it requires a longer time to reduce it to a fluid state. (J.H.K.).

According to Gautier the amount of

According to Gautier the amount of salts contained in bread is nearly one per cent, of which the greater part is organic phosphorus. Bread contains a larger percentage of this essential element than does meat. It is noticeable, however, that the amount of phosphorus is in fact so large that only about one-half of it can be neutralized by the bases contained in the bread after its proteids have been oxidized in the system. So that bread, as well as meat, tends to diminish the alkalinity of the blood. On this account bread should not be used too exclusively as an article of diet, and its use should be supplemented by fresh vegetables and fruits which contain an excess of alkaline substances whereby the excess of acid of the bread may be neutralized.

Hence a bread and meat diet is by no means an ideal diet, but rather one tending to produce rheumatism, neurasthenia, and the various other disorders which result from lowering of the alkalinity of the blood, leading to the deposit of acid wastes,--urates, etc.--in the body, and the lowering of the vital resistance.

When the bran is left in the flour the dough is likely to browned during the process of panification through the action of the cerealine of the grain, a ferment which is connected with the bran.

This bread has far greater nutritive value on account of the proteids and phosphorus furnished by the breads containing a larger proportion of the bran.

Magendie (Compt.rendus, Acad. sciences, t.XXVIII, p.40) fed two dogs, one on white bread, the other on bread made of wholewheat flour. At the end of fifty days the dog fed on fine white bread died while the other dog continued in good health indefinitely.

The ancients ate only whole meal bread and the majority of the people of Europe still employ whole wheat meal.

Graham or whole wheat bread is less completely absorbed than fine flour bread since it stimulates peristaltic activity.

Experiments have shown that of the various sorts of bread, the following proportions are absorbed:

Fine flour bread	95%
Rye bread	85% to 90%
Graham or wholewheat bread	Still less.

Patent flour contains less salts, also a smaller proportion of proteids, than does flour ground with stones. The latter sort of flour contains about twice the amount of mineral matter, nearly twice as much phosphorus, and five to ten per cent more proteids.

Graham or wholewheat bread is likely to be less light and porous than fine ~~whi~~ flour bread. This is due to the action of the cerealin forming some of the starch into dextrin, thus causing it to absorb more water, and producing a tendency to heaviness. This difficulty may be obviated by sifting out the bran, scalding it or exposing it to dry heat or moist heat in an oven, and then returning it to the flour. (J.H.K.)

Breads made from inferior flour are likely to have a bitter taste.

Bread which contains too much water or which is insufficiently baked is likely to mould quickly, especially in a warm season.

One variety of mould, the Oidium auruntiacum, produces a pale orange efflorescence on the surface of the bread; another, the Oidium nigricans, produces a blackish color of the interior of the loaf. Green may appear upon both the outside and the interior of the loaf. All these moulds are more or less toxic and produce diarrhea.

Smut, darnel and rust sometimes infect the wheat and may give wheat flour toxic properties. It may also be contaminated with flour worms.

The nutritive properties of bread may be increased by the addition of gluten or dried casein.

Gluten bread for diabetics is prepared by preparing gluten at boiling temperature, pulverizing it fine and making it into dough with a little flour, water and butter, or more often by adding to ordinary flour some powdered gluten and raising in the usual way.

So-called gluten breads contain from five to eight percent and sometimes as high as twenty-five percent of starch.

Attempts have been made to replace gluten breads by breads of soja beans, but the taste is disagreeable. Breads have also been made with ordinary wheat flour to which almond meal has been added.

It has been proposed to make a bread for the army consisting of wheat flour heated at 140° C., then mixed with the meals of peas, beans, and lentils, and finally cooked in the baker's oven. These preparations mixed with water and boiled give foods with an agreeable taste and high nutritive value.

LEGUMES.

A man may be nourished by bread and meat but he cannot indefinitely remain in health on this diet. Both of these foods tend to lessen the alkalinity of the blood; sooner or later scorbutic symptoms appear. The use of salted meats is not the cause of scurvy. During the siege of Paris, 1870-71, scurvy attacked the population, which had not been provisioned with salted meats, but which lacked vegetables.

Vegetables furnish a large amount of alkaline bases combined with organic acids. The oxidation of the acid portions of these molecules transforms them into carbonates, leaving the bases to combine with phosphoric, uric and other acids which arise from the destruction of the nucleoproteids, and also the sulphuric acid which rises from the oxidation of the albuminoids.

The acids produced by the burning of cereals leaves a large excess of alkaline bases. The same thing is true when these several substances are oxidized in the body/

Woehler has shown that when tartrates, citrates, malates, etc., whether taken by the mouth or introduced into the bowels, pass through the oxidations which they undergo in the tissues, there are left behind carbonates of potash and soda which alkalinize the blood and the urine.

In 100 parts of ashes of lima beans there are found 20 parts, and in ordinary beans 17 parts, of potash in excess of the amount necessary to neutralize the acids which are present.

The following table shows the amount of mineral substances found in 100 parts of each of the substances named, calculated dry:

Lettuce	13 to 22 parts.
Spinach	16 to 20
Celery	16 to 20
Cabbage	10 to 12

Brussels sprouts	10
Cauliflower	9
Turnip	8
Potato	3.8

All these foods are then very strongly alkaline.

The same thing is true of fruits. Even the most acid fruits contain a great quantity of alkalias combined with the organic acids. When these are oxidized in the body, the alkaline bases left behind increase the alkalinity of the blood by combining with the proteid acid wastes. This is true of such fruits as apples, pears, peaches, cherries, currants, strawberries, grapes, tomatoes, etc.

Vegetables and fruits also aid peristalsis by the cellulose which they introduce into the alimentary canal.

Of fresh vegetables 250 to 300 grams a day are on the average sufficient and necessary.

LEGUMINOUS SEEDS.

These include peas, chick peas, beans, navy beans, lentils.

The leguminous seeds are of all foods, not excepting meat, the most rich in albuminous and carbonaceous principles. They are highly nutritive products and it may be said that they are complete foods. Rübner has been able to maintain nitrogenous and carbonaceous equilibrium in persons experimented upon on a diet consisting solely of 520 grams a day of dried peas, boiled.

It is true that the digestibility of legumes is slightly less that that of meat and of bread and their nutritive principles are assimilated with a little greater difficulty, but their high value in proteids, carbohydrates and phosphorus should give them a large place in the daily ration. The Germans have well understood this in adopting for the army ration sausages and tablets of legumes.

Peas, beans and lentils may be preserved for a long time, a year at least, without material deterioration of their nutritive properties. They are very little subject to the attacks of insects, and may be dried and sterilized,--properties which are highly valuable and practical.

The proteid matters of the leguminous seeds consist of legumin, a sort of vegetable casein which is easily digestible.

Legumin forms with alkalies soluble salts, but with lime and magnesium it forms insoluble combinations which explains the hardness of these foods when they are cooked in very hard water. In such cases it is good to add to the water a little carbonate of soda,--five to eight grains to the quart of water,--which precipitates the earthy salts.

The legumin is always accompanied in these seeds by nucleins, compounds containing a large amount of phosphorus. These compounds are the most abundant in the seeds when in a green or undeveloped state.

The cooking of peas converts a large part of the starch which they contain into amylodextrin. The cellulose is so softened by cooking that at least half of it may be absorbed in the intestine.

The green coloring matter, chlorophyl, of these and other vegetables has no nutritive value.

Some legumes, especially lima beans, beans, and peas, are remarkably rich in magnesia, which is present in some varieties in quantities twice as great as the lime.

Organic phosphorus is present in green peas to the extent of one-fourth of one precent, and in beans nearly one-fifth of one percent.

A considerable amount of iron is also found present, amounting to from one to two and one-half percent of the total ash, which averages about three percent.

BEANS.--The digestion of beans is difficult only in cases in which intestinal digestion is weakened by disease. The digestion of beans, however, is generally accompanied by the formation of gas.

Green beans are contraindicated for rheumatics.

PEAS.-- The composition of peas is nearly the same as that of beans. Dried peas may contain as much as 23.5% of proteids, which is more than is found in beef.

Petits pois are very rich in proteids.

Split peas have a higher nutritive value than ordinary dried peas.

Soups and purees of peas are very easily assimilable. They contain (the purees) about 70 to 80% of water.

String beans and half-grown peas eaten with the pod are rich in sugar, in assimilable cellulose, inosite and nucleins.

Diabetes

LENTILS.-- Closely allied in composition to beans, but they contain less cellulose.

The small lentils of Egypt and the South of France are more highly flavored and contain more nirtogen than the larger varieties, the seeds of some of which are at least twice as large.

Comparative table showing the composition of peas, beans, lentils, lima beans, and the soja bean.

	Peas.	Beans.	Lentils.	Lima beans.	Soja bean.
Water	12.40	12.95	12.60	15.20	10.65
Nitrogenous material	21.18	23.69	22.38	19.48	36.63
Fatty material	1.31	1.65	1.01	1.72	13.87
Sugar and starch	58.65	54.46	59.26	56.94	29:42
Cellulose	4.21	6.55	3.26	3.54	4.90
Ash	2.88	2.66	2.32	3.39	4.77

BEANS (FEVES).-- Beans are widely used in many countries. There are many varieties but the composition of all of them is practically the same. This is a very highly nutritive food containing a large proportion of nitrogenous material.

According to Pliny it was used larged as a food by the people of Northern Italy.

It should be more extensively used than it is.

With the hull removed, beans have good flavor and are highly nourishing.

The following is the composition of beans with the hulls removed:

Water	10.90
Nitrogenous matter	26.98
Fatty matter	1.12
Starch, sugar, etc.	56.74
Cellulose	1.16
Ash	3.10

"A pound of beans contains much more nourishment than a pound of meat." Gautier.

The little beans of Egypt, brown or black in color, and round in shape, contain the largest amount of nitrogen.

SOJA BEANS.-- These oleaginous beans or peas have been cultivated in China, also in Japan, from remote antiquity. This seed contains a larger proportion of proteid than almost any other known food.

Soja beans contain only about half as much starch as is found in beans and peas, but the deficiency is made up by fats which are almost wholly lacking in peas and beans.

It is also much richer in mineral matters than peas or beans, as will be seen by reference to the table on the preceding page of these notes.

Unfortunately, this bean has not a very agreeable flavor.

In Japan the soja bean is used by mixing it with rice or first cooking, and then fermenting, producing a sort of sauce known as "soy."

LEGUMINOUS FLOURS OR MEALS.-- These undergo a slight torrefaction by which they are sterilized. Their flavor is also modified, the starch being changed to dextrin which is very easily digestible.

Sometimes the seeds before torrefaction are submitted to a short period of germination, by which a part of the proteid appears to be peptonized and the starch rendered soluble. The sprouts are removed by special mills, and the grains are dried and ground. These are the so-called diastatic or diastased flours. These flours are prepared from wheat, oatmeal, corn, and various other grains with or without the addition of leguminous seeds.

Boussingault(Memoires, t. IV) relates that he has seen Indians eating a meal made from corn which had been slightly sprouted, then baked and ground. In eating the meal, they simply mixed it with a little river water.

Yolks of eggs are added to some of these meals. They are all mixed up together, dried and ground.

In some cases phosphates or powdered milk is added. In some cases a part of the germinated grain is torrefied. It is then ground up with another portion which has not been torrefied, thus leaving some of the diastase intact and active.

Cooked with water these preparations are very good for young infants after the seventh or eighth month. Before this age they are not well supported. The starchy and ~~albuminous matters do~~ leguminous matters do not digest very well in young stomachs, but they are excellent in the second year. They are also good for convalescents, but in many dyspeptics the sugars and dextrins ferment too quickly in the stomach. Fermentation in some cases will begin before there has been opportunity for the secretion of hydrochloric acid.

PRESERVING LEGUMES.-- In canning beans either with or without meat the temperature of 235° F. is required.

An excellent bean soup is prepared by cooking beans briefly, drying them, then grinding and mixing 60 parts of bean flour with 30 parts of fat. The hulls of the beans are removed. Put up in tins and sterilize at 115° C.

23
207
32
239

BUDS, BULBS, TUBERS AND ROOTS.

In this class we place

1. The legumes which are eaten in the state of buds or young shoots, such as the asparagus, artichoke, cabbage.

2. The tubers, as the potato, Jerusalem artichoke, the sweet potato, the yam.

3. The bulbs, as the onion, leek, garlic.

4. The roots, as the carrot, the turnip, etc.

ASPARAGUS consists of sprouts or leaves. It contains a large amount of nucleoproteids, mannite, also a substance which gives to the urine a peculiar odor.

ARTICHOKE.--The artichoke is rich in inulin, a special form of starch useful in diabetes. It also contains a large amount of highly nutritive proteids. A small amount of manganese is found among the salts furnished by this plant.

The CABBAGE is chiefly water, only five to ten percent of solid matter being present. It is not very easily digestible, but may be a valuable source of salts when better vegetables are lacking.

CAULIFLOWER is easily digestible and more delicate in flavor.

The ONION and LEEK have somewhat doubtful nutritive value. They contain no ordinary starch. These vegetable products must be regarded as condiments rather than foods.

THE POTATO

The potato was first introduced into Italy and Spain from South America, and later into England and France. There was much prejudice against its use, since it was thought to be a cause of leprosy. It was a hundred years before it was established as a regular article of diet. It now stands nearly next to bread as a universal foodstuff.

The potato contains 70 to 80% water.

The amount of proteids in the potato is exceedingly small.

The potato is rich in starch, which is one of the most easily digestible of all starches.

The juice of the potato contains both malic acid and citric acid.

Potatoes when cooked in water lose a little of their flavor, but they do not materially lose in weight.

Three pounds of boiled potatoes are about equal in value to one pound of ordinary white bread.

Potatoes are very rich in potash salts, which constitute more than half the weight of their ash. Most of the potash present is combined with citric acid and malic acid, which are oxidized in the system, leaving the potash free to neutralize the acid wastes which may be present. The potato is on this account one of the best of all foods for alkalinizing the blood.

Only a mere trace of sodium chloride is found in the potato.

The free use of the potato tends to produce obesity.

SWEET POTATOES.

The sweet potato has a somewhat higher nutritive value than the potato, containing 9 to 16% of starch and 2 to 10% of sugar.

It also contains about double theamount of salts and a little less nitrogen than is found in the Irish potato.

Chinese yams contain 15 to 17% of starch, 2.4 to 2.6% of proteids, besides citrates and other salts.

THE JERUSALEM ARTICHOKE.

This vegetable is rich in inulin, a form of carbohydrate which may be eaten with impunity by diabetics.

It also contains a considerable amount of tartrates, malates and citrates, and other salts. It

Its flavor is similar to that of the artichoke proper.

The TURNIP is a very watery root, containing about 8% of carbohydrates.

SALSIFY is a starchy root rich in mucilaginous substances and mannite.

The CARROT is a highly flavored, fleshy root, containing starch, cane-sugar and mannite.

The EDIBLE BEET is a fleshy root which contains about 9% of starch and sugar. The sugar beet contains 10 to 15% of cane-sugar.

TAPIOCA, ARROW ROOT AND SAGO are starches very from different vegetable sources. They all have about the same nutritive value.

SALEP is prepared from the bulbs of different varieties of orchids. It contains a considerable amount of starch, gums, and mucilage. When boiled in water, it acquires the consistency of ordinary jelly. It has considerable nutritive value.

GREENS OR HERBACEOUS VEGETABLES.

These products contain only a small amount of nutritive principles. Few of them contain more than two or three percent of carbohydrates, and this consists largely of inosite, mucilages, and other substances which may be only in part assimilable.

The proportion of albuminoids or fats contained in these products is also exceedingly small.

The chief value of these food stuffs lies in the fact that they contain a large amount of citric, malic, and tartaric acids, combined with alkaline bases which serve to alkalinize the blood. These substances must enter largely into the dietary as a means of offsetting or neutralizing the acid products which are the result of the assimilation of breads and other cereal products.

The albuminoids of green vegetables consist chiefly of vegetable albuminoids,--legumins and vegetable caseins.

MUSH-ROOMS.-- Mushrooms contain from four to eight percent of proteids. They also contain a considerable proportion of malates, citrates, and mannite. Their nutritive value, however, is small. When the water in which they are boiled, is concentrated, it has a strong flavor of extract of meat.

LETTUCE, CHICKORY,WATER-CRESS, CORN-SALAD, RHUBARB, SPINACH, TETRAGON, WHITE BEET.-- The chief value of these products is in the earthy salts which they furnish,--potash, sodium, lime, magnesium, phosphates, iron in the form of hematogen, etc.

Of eight parts of solid material, there is 1.24, or nearly one-seventh, of mineral salts.

Of the 12% of solid matter in spinach, one-sixth consists of salts. (See table prepared under discussion of diet in anemia).

These vegetables contain a considerable amount of Cellulose, but Kniriem has shown that the cellulose of young vegetables as well as that of fruits, is digested and absorbed to the extent of fifty percent.

The nutritive matters contain in green vegetables rarely exceed one-twentieth of the total weight of the fresh material.

In chickory, lettuce and the artichoke, the starch is replaced by inulin, which renders these foods suitable for diabetics.

Many of these vegetables also contain mannite.

Green vegetables may be classified as neutral and acid. Chickory, lettuce, corn-salad, dandelion, tetragone, cardoon, the white beet, celery and spinach belong to the neutral vegetables; sorrel, rhubarb,etc., belong to the second class.

Lettuce is rich in alkaline citrates.

The leaves of the beet as well as those of the cardoon contain a laxative principle. Like spinach, it is rich in mucilaginous principles and in sugars together with many organic salts of potash and lime.

Acid legumes owe their acidity sometimes to oxalates, sometimes to citrates and malates.

Sorrel and rhubarb owe their acidity to the oxalate of potash. They must be forbidden to gouty patients, rheumatics and oxalurics.

Watercress is very rich in organic salts. It also contains iodin in an organic state. It is a diuretic and antiscorbutic.

The VEGETABLE FRUITS are the tomato, the egg-plant, the cucumber, the melon, the pumpkin, the squash,

The tomato contains a large amount of acid salts,--citrates and malates,-- but contains only a small percentage of oxalates, contrary to the general opinion. It is particularly good for persons suffering from rheumatism, gout, and uratic deposits.

CAYENNE.-- This is a dangerous condiment and it should be forbidden to be used.

The WATERMELON is an excellent food. The juice contains about 6% of sugar and carbohydrates, and 1% of proteids. The sweet taste is due to cane-sugar. The seeds are slightly emetic.

FRUITS.

There are three classes of fruits,--acid fruits, sweet fruits, starchy or fatty fruits.

ACID FRUITS.

Acid fruits contain 72% to 90% water.

Low proteid percentage, rarely more than one-half to one percent.

Always contain acid.

Juice of agreeable perfume.

Cellulose in large part soluble in the intestine.

Not tissue-building but chiefly refreshing.

Afford a small amount of carbohydrate food in a form ready for immediate absorption and assimilation.

Their acidity is chiefly due to acid salts,--malates, citrates, tartrates, fumarates, etc. Percentage of acidity 0.2 to 1.5 percent.

The acids combine with alkaline bases. "These salts or alkaline bases are transformed in the body by the complete combustion of their organic part into soluble carbonates which serve to alkalinize the body fluids."

The acids and large amount of water of fruits render them diuretic and laxative, especially when they are not quite ripe.

The sugar of ripe fruits consists chiefly of equal parts of glucose ~~glycogen~~ and levulose, with a little saccharose.

The following table shows the composition of various rosaceous fruits: (next page)

	Apples	Pears	Plums	Green-gage plums	Prunes (dried)	Mirabelles
Water	84.79	83.03	81.18	78.30	19.80	79.4
Proteids	0.36	0.36	0.78	0.42	2/37	0.4
Free acid (See note 1)	0.82	0.20	0.85	0.38	....	0.5
Sugar	7.22	8.26	6.15	10.9	46.3	4.0
Various non-nitrogenous substances	4.81	3.54	4.92	9.28	25.14	10.1
Cellulose	1.51	4.30	5.41	0.62	4.13	5.0
Ash	0.49	0.31	0.71	0.48	1.86	0.6

Note.--The free acid is expressed in weight of malic acid.

	Peaches.	Apricots.	Cherries.	Quince.	Strawberries	Raspberries
Water	80.0	81.2	79.82	71.70	87.66	85.7
Proteids	0.6	0.5	0.67	1.12	0.54	0.4
Free acids(see note above)	.9	1.2	0.91	0.61	0/93	1.4
Sugar	4.5	4.7	10.24	6.70	6.28	3.9
Various non-nit. matters	7.2	6.3	1.76	0.69	1.01	0.7
Cellulose	6.1	5.3	6.07	18.79	2.32	7.4
Ash	0.7	0.8	0.73	0.47	0.81	0.5

Note.--The sugar of peaches and apricots, according to Balland, is respectively 6.2% and 8.1%.

In all fruits the alkaline bases are in excess of acids. Strawberries furnish more than twice the amount of salts as pears or apples,---- about the same amount of potash, twice as much soda as apples and seven times as much as pears, ten times as much iron, twice as much phosphorus.

Strawberries contain in each 1000 parts of fresh berries 0.5 parts of iron, 2.2 of sodium oxide, 1.2 of oxide of lime.

The following table shows the amount of mineral salts found in 1000 parts of ash of some common fruits:

Apples	3.65 parts
Pears	3.57
Prunes(plums)	4.80
Cherries	6.58
Strawberries	7.56

The amount of water contained in dried fruits is from thirty to thirty-three percent.

The apricot comes from China.

The peach, though having a Persian name, also comes from China.

The pear-tree and the apple-tree are pre-historic in Europe.

Strawberries contain a salicylic compound which often causes an eruption of the skin,--nettle rash.

The following table shows the percentage composition of various other common fruits:

	Oranges	Currants	Grapes Black	Raisins Pulp & skin	Pomegranate Edible portion
Water	86.70	92.90	78.17	19.80	84.20
Proteids	0.69	0.31	1.96	0.45	0.59
Fats	0.26	0.65	.....	0.56	0.15
Sugars	11.43	5.46	14.36	76.70	11.86
Cellulose and extractives	0.93	1.43	0.59	1.85	2.91
Ash	0.28	0.15	....	0.64	0.29
Acidity	....	....	0.79	....	0.220

GRAPES have an acidity, expressed in sulphuric acid, of .03 to 1.2 per cent. The sugar may reach 25 per cent.

Lemon juice is useful in dropsy, yellow fever, scurvy. In large doses it is strongly diuretic.

Strongly acid fruits may contain from 4 to 10 percent of acid, estimated as hydrochloric acid.

SWEET FRUITS.

The sweet fruits comprise the banana, the fig and the date, etc.

There are various varieties of figs,--violet, green, gray, and white.

The following table shows the percentage composition of fresh and dried figs: (Balland)

	Fresh figs.	Dried figs.
Water	84.80	0.00
Proteids	0.79	5.20
Fats	0.32	2.10
Sugars, extractives	12.15 (1)	79.94
Cellulose	1.23	8.06
Ash	0.71	4.70

(1) This yields 8.3 of sugar.

The DATE is the principal nourishment of African countries bordering on the Mediterranean, of Persia, and some parts of India.

The following is the composition of the fresh date: (Balland)

Water	24.50
Proteids, including pectin)	1.96
Tannic acid and glucose	67.10 (2)
Fats	0.06

Cellulose	5.05
Mineral matter	1.32

(x) This yields 51.3 of sugar.

The BANANA is a staple food in the tropics. Bananas contain a large amount of alkaline salts, especially ~~salt~~ phosphates of potassium and soda, and chloride of potassium.

The following table shows the percentage composition of the banana pulp, also banana flour: (Marcano and A.Müntz, C. Rend., t. LXXXVIII, p. 158)

	Banana pulp	Banana Meal.
Water	73.8	....
Cane-sgar	8.5	....
Invert sugar	6.4	....
Starch	3.3	66.1
Cellulose	0.2	1.6
Pectose	0.6	1.4
Nitrogenous matter	1.6	2.9
Organic acids, extractives	4.2	....
Mineral matters	1.1	2.2
(Total food value	26.0	74.2)

STARCHY AND OILY FRUITS.

The starchy and oily fruits comprise nuts,-almonds, chestnuts, hazel nuts, cocoanut, bread fruit, etc. They have a very high nutritive value.

Characterized also by the small amount of water which they contain, rarely yielding more than 30 to 33% of water in the fresh state.

Small amount of ~~x~~ oil.

The following table shows the percentage composition of some starchy or oily fruits: (The first three are Balland's)

	Walnuts.	Hazel-nuts	Almonds Sweet	Cacao nuts.	Chestnut.
Proteid matter	11.05	15.58	5.67	13 to 18	4.46
Fats and oils	41.98	61.16	2.19	45 to 49	0.87
Alkaloids	.....	.....	.....	1.5to 2.0	.....
Sugars	17.5	13.22	0.42	0.3 to26	19.90
Cellulose	1.6	3.84	0.39	5 to 80	3.79
Starch	.....	.....	.....	14 to 18	15.55
Ash	1.30	2.70	0.96	3 to 5	1.51
Water	26.50	3.50	88.0	5.6 to 6.3	53.71

The BREAD FRUIT is a green fruit as x large as the head. On the surface may be found forty or fifty nodules resembling chestnuts which are eaten fried. The pulp is rich in starch. It is cooked and eaten as bread by natives of the South Sea Islands.

The Milk Tree of the same family gives milk, thicker than cow's milk, with acid reaction. It is much used by the Indians of South America.

The following table shows the percentage composition of vegetable milk: (Boussingault, Comptes rendus, t. LXXXVII, p. 277)

Saponifiable material	35.2
Sugars	2.8
Casein, albumin	1.7
Phosphates,alkaline & earthy)	0.5
Indeterminate substances	1.8
Water	58.0

OLIVES.-- Green olives contain very little fat,--14%.

Ripe olives contain, according to Atwater 25% fat. (Atwater also states that green olives contain from 20 to 27% fat) J.T.C.

Green olives contain much chlorophyl and mannite. These are replaced by oil in the process of ripening.

AROMATIC AND NERVINE FOODS.

Gautier says that tea and coffee and only a step removed from ether, morphine and caffein. They act upon the nerves producing a nervous tension. They permit a person to consume for a time at the expense of his reserve energy, fats, sugar, proteids, etc.

Tea and coffee prevent the inhibitory action of the trophic centers in fatigue. This is true of tea, coffee, cocoa and alcohol.

A similar property exists to some extent in all our other foods. The flavors and odors, of cooking legumes, of sweet fruits, of dishes which we relish, act upon us before then have had an opportunity to be assimilated. A thirsty man finds his thirst relieved before the water which he drinks has had time to enter the blood. Hunger is appeased when food is taken into the stomach and before any of the nutritive elements (save some of the more volatile elements) have had time to be absorbed.

Nansen recounts that he drank with delight the blood of the seals which he killed.

All foods have an instant action upon the nerves and before they have been absorbed, causing greater disposition to activity through the reflex effect exercised through the excitor , olefactory and digestive nerves. They excite trophic, assimilative and psychic centers before they enter the blood.

In the normal state a healthy man uses in the form of work 8.5% to 10% of the total energy of his food. A good worker furnishes in the form of useful work only 6.5% to 9% of the energy of the food. Cutaneous evaporation and radiation of heat represents fourteen-fifteenths of the total energy dissipated.

Coffee elevates the internal temperature.

According to Pawlow the first effect of food upon the stomach and the intestine is psychic.

All the aromatic principles of the food,--mustard, pepper, pepper-sauce, etc.--as well as alcohol, diminish metabolism and urinary nitrogenous excretion. They also diminish the amount of oxygen and CO_2, and lower the temperature of the subject, thus reducing vital activity after having excited it through reflex actions provoked at the start. But although they thus lessen disassimilation, there is not a corresponding or proportional profit in the output of caloric or mechanical energy produced by the animal machine. So they are not true food sparers.

It has been suggested, however, that the so-called nervine foods diminish the amount of energy required to carry on the functions of the body. Thus, under the use of these agents, there is a better general utilization of the food; but experience has shown that these excitant substances do not assist in prolonging the life of animals; neither do they preserve, still less increase, their weight,when, the food being insufficient, these excitants are added to the daily ration. It is, is it, possible with their use to maintain the normal functions with a smaller amount of proteid matters, while replacing the albuminoid substances with an isodynamic amount of fat, sugar, and starch? May one, then, thanks to the nervine foods,diminish the activity of the animal machine and consequently the daily need of proteid matters? This hypothesis appears in certain cases to be proven by the facts. (Gautier).

With a daily ration in which the proteids are extremely reduced, some of the populations of South America, Africa and some of the islands of the Indian Ocean, consuming at the same time an abundance of nervine foods, are able to accomplish a considerable amount of work. The strongly spiced rice of the Malays and of the Japanese,the couscous moistened with many cups of coffee of the Arab, the bread rubbed with garlic or chocolate of the Spaniard, the spiced cassava with rum of the mulatto and the black, enable them to resist fatigues, to undergo which ordinary laborers would necessitate a notable increase of meat. But outside of the economic or physiologic question, there is still to be considered the question of reducing the proteid elements in cases of disease, in which it is necessary to reduce as much as possible the amount of nitrogenous wastes, the toxins, and the uratic deposits. (Gautier)

It is said that gelatinous matters prevent the rapid disassimilation of proteid bodies which is excited by the toxins of tuberculosis, by thyroidin, and by phosphorus, etc.

Javal claims that the addition of a very small amount of common salt to the food very sensibly diminishes the loss of urinary ~~protei~~ nitrogen, and increases the nitrogen-urea coefficient.

CLASSIFICATION OF NERVINE FOODS.

(a) Aromatic foodstuffs,--coffee, tea, cocoa, etc.

(b) Alcoholic liquors,--wine, beer, cider, ...alcohol, etc.

(c) Condiments,--spices, vinegar, etc.

(a) AROMATIC FOODSTUFFS.

These include tea, coffee, cocoa, kola, mate, guarana.

These foods contain all the alkaloids of the purin family; that is, they are related to xanthin and uric, etc.

Caffein and thein (1,3,7-trimethylxanthin) is found in coffee, tea, kola, guarana, mate, cocoa.

Theophyllin (1,3-dimethylxanthin) is found as an alkaloid of tea.

Theobromin (3,7-dimethylxanthin) is isomeric with the preceding. It is found in cocoa with caffein, etc.

The use of coffee is rapidly increasing. It has increased in France 600% in seventh-five years.

Caffein raises the internal temperature and reduces the temperature of the skin. (Leblond) In moderate doses it stimulates the action of the heart and raises arterial pressure by constricting the peripheral vessels. It excites central activity. In large doses it depresses the nervous system, and the cerebral centers, increases the excitability of the muscles facilitating activity, and to some degree destroys the sense of fatigue. Mosso has shown that under its influence the work of the first hour can be quadrupled. Gautier.

Coffee contains 1.24 percent of caffein, or three grains to the cup.

"As a true food, coffee has no value". Gautier.

A large amount of coffee produces insomnia, hallucinations, disturbances of the circulation, muscular weakness, precordial distress and dyspnea. A person may become a slave to coffee as well as to alcohol or morphine.

Coffee must be forbidden to persons having a rheumatic diathesis, those whose urine shows a deposit of urates, those who have gravel, gastralgia, dyspepsia, and are subjects of Bright's disease.

Coffee is the best antidote for opium or morphine poisoning.

Tea contains 3.58% of thein, or four grains to the cup. It also contains hypoxanthin and adenin and 30% of tannin (Kossel); also xanthin (Baginsky).

The theophyllin of tea disturbs the stomach and produces vomiting.

The cocoa bean contains one to three percent of theobromin.

Chocolate is a food difficult of digestion because of the amount of fat contained in it. It also contains a large amount of oxalic acid. It is contraindicated in those who are exposed to the üric acid or oxalic diathesis, arthritics, rheumatics, those suffering from gravel, hyper-chlorhydria, and those who do not secure sufficient physical exercise.

Kola, mate, guarana and cocoa contain caffein and other puric bases. Kola contains 2.35 % of caffein. Mate,or Paraguay tea, contains 0.55%. Cocoa contains 1% of cocain.

(b) ALCOHOLIC BEVERAGES.

Alcohol in large doses is a toxic agent, destroying protoplasm. The use of alcohol produces an excessive loss of nitrogen.

Chauveau (Comptes rend. Acad. sciences, t.CXXXII,p.65and 100) showed that when alcohol was substituted for one-third (isodynamically) of the carbohydrates in the ration of a dog, the dog was able to do less muscular work and the weight of the animal either remained at a standstill or was lessened. The dog without alcohol ran ten kilometers in an hour on his wheel. The dog receiving alcohol only ran seven kilometers in the same time.

Says Chauveau (loc. cit., p. 114):" The partial substitution of alcohol for sugar in isodynamic proportion in the daily ration entails: first, a diminution of the absolute value of the muscular work; second, the standstill or actual decrease of the body weight."

"Is alcohol a food or is it a ~~stimulating~~ simple drink? It is not a food, for to merit this name it is necessary that the potential energy that is found in wine in the form of organic acids should be incorporated into our tissues, but it is not. The alcohols are in some way substitutes for true foods. It is doubtful whether they can ever be employed by the body in the execution of its physiologic work." (Chauveau, Discours à la Soc. nationale d'agriculture, 11 ~~décembre~~ décembre, 1901).

Apple juice contains on an average 120 grams of sugar to the liter.

Apple juice owes its anti-gout properties to the acids,- malates,-- which excite the activity of the kidneys and alkalinize the blood.

Beer contains an ounce of alcohol to the quart and an equal amount of extract. Beer produces obesity, dilates the stomach, and predisposes to diabetes, gout, arteriosclerosis and heart disease. It is universally admitted by the Germans that beer taken at meals produces disordered digestion.

ALCOHOLISM.

The abuse of alcohol is, like the abuse of opium, a plague of humanity. In Africa, in America, in Australia, it is likely to cause entire populations to disappear. It menaces and injures the most vigorous races. From year to year the danger increases.

The consumption of alcohol per capita is 7 liters a year in Paris, 8 liters in Germany, 9 liters in Holland, 16 liters in St. Petersburg.

Alcohol transmits its injuries by heredity. The children of drunkards are subject to epilepsy, meningitis, tuberculosis, diphtheria, scrofula. They become nervous, violent, vicious, and reproduce new generations of degenerates and idiots.

Among twelve pups of a dog which had for eight months received daily 11 grams of absinthe, two were born dead, several others died (seven othes) a little while after death from tuberculosis, enteritis and epileptic attacks.

(c) CONDIMENTS.

The large use of condiments quickly exhausts and irritates the mucous membrane of the stomach and destroys the appetite.

So-called condiments are substances which contain volatile oils.

See Gautier, page 371 to 374, about condiments.

The most dangerous of all is Cayenne pepper (Capsicum baccatum or fastigiatum) which comes from India and Java.

Vinegar contains 40 to 60 grams of uric acid to the liter. (Roberts has shown that vinegar inhibits the salivary activity in the stomach).

Chloride of sodium increases the secretion of the gastric juice. It is usually employed in quantity of 6 to 8 grams daily.

Sugar is both a condiment and a food. France consumes yearly 160,000,000 kilogrammes of sugar, and England three times as much.

Sugar of milk is found in some vegetables and in milk. Cow's milk contains 40 to 50 grams to the liter. It is not very soluble. It dissolves in six parts of water. It is fermentable.

Fruit sugar consists of equal parts of glucose and levulose. The same is true of honey. Honey is regurgitated by the bee after having nourished itself upon the nectar of the flowers. Honey is slightly laxative especially the highly colored varieties.

CONDIMENTS OF ANIMAL ORIGIN.--Preparations of half-fermented fish, caviar, cheese, extracts of meat.

INORGANIC FOODSTUFFS.

Fresh muscles contain 1.1 to 1.3% of mineral salts.

Blood contains 0.9 to 1.15% of mineral salts.

Fresh bones contain from 34 to 37% of mineral salts.

Mineral salts are constantly eliminated through the urine, feces, sweat, and epithelial desquamation.

Adults lose daily 26 to 27 grams of salts, of which about half consist of common salt.

Growing animals require a larger proportion of salts in their diet than do adult animals.

The young infant requires each week 3 to 3.8 grams of phosphate of lime to support growth.

The infant requires daily in his milk and his other foods.27 grams of lime and about .10 grams of phosphorus.

The salts regulate the nutritive exchanges. When salts are removed from the food cachexia and death result.

Forster (Zeitsch. fur Biolog., t. IX, p. 297 (1873); See also R. Tigerstedt, Lehrbuch der Physiolog., 1897) gave a dog powdered meat, from which by boiling in water all but .8% of ash had been removed. He added starch and fat in normal proportion. The animal died in 26 to 36 days. At the same time, he observed that a dog deprived entirely of food lived 40 to 60 days.

Kemmerich gave a dog meat from which the salts had been removed by boiling in water. He added to this some residue obtained by incinerating meat bouillon. To another dog he gave common salt. The first dog prospered; the second did not gain in weight.

Flesh food contains an excess of phosphorus and sulphur over the bases.

Meats, bread and cereals diminish the alkalinity of the blood.

Fruits and vegetables increase the alkalinity of the blood.

The following table shows the amount of bases and acids found in various foodstuffs:

For 1000 parts fresh	Bases					Acids		
	K_2O	Na_2O	CaO	MgO	Fe_2O_3	P_2O_5	SO_3	Cl
Flesh meat	3.50	0.55	0.51	0.40	0.03	4.20	2.20	0.60
Liver	3.00	1.20	0.15	0.01	0.20	4.60	0.09	4.30
Brains	1.15	1.00	0.03	0.41	0.08	1.13	0.14	0.40
Mother's milk	2.03	0.59	0.85	0.17	0.01	1.22	....	1.12
Cow's milk	2.39	1.50	2.16	0.28	0.004	2.65	....	2.28
Wheat bread	1.69		0.89	....	.....	3.35	0.119	....
Kidney-beans	13.20	2.80	1.97	2.11	0.35	11.50	1.60	0.80
Peas	9.58	3.75	0.68	2.41	0.27	9.67	0.99	0.14
Beans	6.24	5.71	2.17	2.66	o.30	11.38	0.40	0.24
Cauliflower	0.26	0.11	0.17	0.02	0.004	0.13	0.11	0.06
Apples	1.30	0.95	0.15	0.32	0.05	0.50	0.22	....

Carnivorous animals which have a deficiency of alkalies have a mechanism for forming ammonia to make up the deficiency.

The following table shows the average bodily needs of mineral substances for each twenty-four hours.

Bases		Acids	
K_2O	3.22 grams	P_2O_5	3.9 grams
Na_2O	7.70	SO_3	2.03
CaO	1.47	SO_2	0.25
MgO	0.56	Cl	8.50
Fe_2O_3	0.04	CO_2	0.05

The ration for twenty-four hours containing 107 grams of albumin, corresponds to one gram of sulphur, the oxidation of four-fifths of which in the body gives two grams of SO_3,--sulphuric anhydride. The organic phosphorus is by oxidation transformed into 0.3 grams of P_2O_5 daily. These acids require to neutralize them 2.3 grams of K_2O. This is the minimum daily requirement.

Vegetable foods alone can furnish us organic salts which can be transformed into carbonates in the body.

The following table shows the number of grams of potash and sodium in 1000 grams of dried substance of each of the foods named:

Rice	1	0.03
Oats	5 to 6	0.1 to 0.4
Wheat	5 to 6	0.1 to 0.4
Rye	5 to 6	0.L to 0.4
Barley	5 to 6	0.1 to 0.4
Apples	11	0.1
Peas	12	0.2
Milk of the herbivora	9 to 17	1.0 to 10.0
Hay	6 to 18	0.3 to 1.5
Beef	19	3.0
Bullock's blood	2	19.0
Dog's milk	5 to 6	2 to 3
Mother's milk	5 to 6	1 to 2
Kidney beans	21	0.1
Potatoes	20 to 28	0.3 to 0.6
Strawberries	22	0.2

Flesh and milk contain salts of sodium in very small quantities. There is 0.07% of sodium chloride in muscle flesh; 0.1% in milk.

The tissues are alkalinized by potash. Soda plays a very small role except in the blood. The ingestion of potash salts accelerates organic combustion much better than soda or its salts.

Plants choose potash in preference to soda, and convert them into salts with organic acids. (See Gautier page 385).

"Plants are the means of accelerating the organic combustions by introducing salts of potash. They manifest a peculiar aptitude for salts in soils the poorest in potash, and even in those in which soda predominates, to choose the potash necessary to supply their needs, and to transform them by a method which still escapes us into salts of organic acids."

"Carried to our tissues by foodstuffs these salts are transformed into carbonates, thanks to the oxidation of their combustible part, it may be in the cells, or it may be in the blood of herbivorous and omnivorous animals where they come in contact with chloride of sodium. With chloride of sodium they undergo a double decomposition, from which results carbonate or bicarbonate of sodium, which increases the alkalinity of the blood plasma, and chloride of potassium which is in part eliminated by the kidneys. The carbonates of potash and soda, as well as the soda set free by the production of hydrochloric acid in the stomach which combines with the peptones, later combine with phosphoric and sulphuric acids derived from the oxidation of the phosphorus and of the sulphur of the albuminoids. These phosphates, sulphates and other sodium salts thus become useless and are rejected with the urine and the feces. We lose each day 9 to 14 grams of common salt, and two to four grams of potash (K_2O) by the urine. In consequence the animal needs an incessant supply of alkaline salts. Salts of potash are required in the state of assimilable and combustible organic salts. Salts of sodium are also required in the form of chloride of sodium, of which the negative element, the chlorine, passes into the gastric juice, while the basic element alkalinizes the plasma and forms biliary salts. In omnivora a small part of the acids originating from organic combustion is also saturated by a small amount of ammonia formed in minute proportion at the expense of the albuminoids. These ammoniacal salts are in part rejected by the urine."

"Common sodium and the salts of potash having disappeared by double decomposition and then by elimination through the kidneys, the need of these alkalies is felt anew. Hence, a constant supply of alkaline bases is necessary."

"On the contrary, in the carnivora the production of ammonia being preponderant, the necessity for salts of soda or potash diminishes or disappears. Thus, while frugivorous and omnivorous races seek alkaline salts, carnivorous individuals and races in great measure avoid these salts."

"Chloride of sodium should be added to the food in quantity as much more abundant as it is more vegetable. An amount of 8 or 9 grams per day is ordinarily sufficient."

"Whatever may be the diet, sodium chloride remains very constant in quantity in the blood, except in complete and prolonged abstinence, in which cases it may be reduced to one-third of the ordinary amount."

"Voit and others have shown that sodium chloride or chloride of potash when administered to animals with their food produce polyuria and azoturia(Voit, Untersuch. u. d. Einfluss des Kocksatz,1860; Dehn, Pfluger's Arch., Bd. XIII, p.367; Schaumann, Dissertat., Halle, 1893). Under the influence of sodium chloride urea is eliminated in much greater abundance although the amount of water ingested may not be increased. Voit found in one experiment lasting 49 days an increase of 106 grams of urea above the ordinary. The other alkaline salts have a similar action, but it is less pronounced."

"These salts aid the kidneys in the elimination of the products of disassimilation: urea, complex amides, leukomaines, glucose in diabetes, etc. It may be that these bodies combine directly with these salts. It may that the products of decomposition of the tissues are dissolved and conveyed out of the body by soda, as is the case with biliary acids. The introduction of salt into the body increases the secretion of hydrochloric acid (Dastre, Linnossier)."

"The influence of chloride of sodium may in part be due to the minute quantities of arsenic which common salt always contains."

"The complete deprivation of salt lessens the amount eliminated by the urine. From the third day the quantity diminishes to 2 grams, then to 1 gram or a little below, and after that it remains constant. If salt is then given to the animal, it accumulates in the blood until the normal percentage is reached. When deprived of salt, on the other hand, the animal tends to dehydrate itself. The practice of withholding salt in edema and dropsy of Bright's disease is based upon this fact."

ALKALINE EARTHY SALTS.--"The salts of lime and magnesia are not less indispensable than the alkaline salts. They are furnished in very unequal proportion by the various foodstuffs.

For 100 parts of dried substance	CaO	MgO
Cow's milk	1.51	0.20
Egg yolk	0.38	0.06
White of egg	0.13	0.13
Mother's milk	0.243	0.05
Beef	0.029	0.15
Brains	0.080	0.24
Wheat	0.065	0.24
Potato	0.10	0.19
Peas	0.137	0.220

Lime and magnesia are found in the body:

(1) In organic form in the form of lecithins, lecithalbumins, etc.

also in some complex forms in which they cannot be detected without destroying the organic molecule ~~xx~~ of which they form a part. This is true, especially, of magnesium.

(2) In semi-organic form, combined with albumins and complex substances under the form of albuminates, from which they ~~xxxxxx~~ can be easily separated by feeble acids and by dialysis.

(3) In the form of mineral or organic salts, soluble or insoluble, (sulphates, lactates, phosphates, etc.) which renders possible the circulation and excretion of these combinations.

It is interesting the note the amount of magnesium and lime found in the tissues of the same animal, the dog for instance. The following table indicates the number of milligrams per thousand grams of fresh tissues: (Dr. F. Aloy, Le calcium et le magnesium chez les etres vivants, Toulouse, 1897)

	Dog, 10.5 kg.		Dog 13.2 kg.	
	Ca	Mg	Ca	Mg
Brains	28	84	14	72
Muscle	147	270	196	332
Defibrinated Blood				
Serum	80	24	50	12
Globules	Trace	0.05	None	0.02
Hair	185	19	280	22
Aponeuroses	130	0	180	36
Bone (tibia)	21000	450	18900	631
Heart	357	440	380	498
Liver	175	48	259	66
Kidney	238	126	350	192
Spleen	392	54	448	72

It appears that magnesium predominates in the brain, muscle, blood-globules, thymus gland, and the suprarenal capsules.

Eggs are also rich in magnesium.

Lime cannot replace magnesium.

"As to foods, magnesium accompanied by phosphates of potash are especially encountered in grains. It is abundant in wheat, bread, potatoes, and other tubercles, also in the other vegetables. It is always accompanied by phosphorus. Lime, though rare in these various parts of animals, and plants, exceeds magnesium in other organs. It is the base which is particularly abundant in the leafy parts of plants;in animals it abounds in the tissues which form the framework of the body,--the bones, connective tissue and cartilage. We may remark that in the brain magnesium is four times as abundant as lime. Probably it exists in the brain, in part at least, in an organic state, as I (gautier) have shown for chlorophyl."

"Magnesium is, then, the specific metal of organs most highly differentiated, and calcium that of the tissues which form the body framework. According to Boussingault 100 parts of vegetable ash has the following composition:

	K_2O	CaO	MgO	P_2O_5
Wheat grain	30.12	3.0	16.26	48.30
Wheat straw	16.17	7.28	4.70	4.14

The excretion of lime is irregular and varies with the diet. Magnesium does not vary in this way. Its excretion varies with that of urea or nitrogen.

According to Mairet and Thorion brain work increases greatly the excretion of lime and magnesia.

Experiments of Chossat, Boussingault, Kemmerich, and others, made upon pigeons, pigs, dogs and men, have shown that when the system is deprived of lime, this element is assimilated even when taken in the mineral state of phosphates and carbonates in the food or in drinking.

Chossat showed in 1842 that pigeons nourished on wheat have fragile bones.

The mineral bases may, then, be assimilated, but assimilation takes place infinitely better if the chalk and magnesia are presented to the animal under organic form, the metal remaining, so to speak, latent in these combinations, as in bread and milk, dried legumes, etc.

Vaudin (Bull. Soc. Chim., t. XXVII, p.416) has shown that the phosphates are dissolved by the sugar of milk, and that the products formed in the diastatic digestion of starch dissolve many insoluble earthy salts.

When an excess of chalk or magnesium is taken, the excess is eliminated by the intestine, only a very small amount being eliminated by the kidneys.

IRON,MANGANESE.--Iron is constantly eliminated, even in a state of starvation. The greater part of it is derived from the destruction of red blood-cells. The elimination of iron is greatly increased when fever is present, according to Salkowski.

Boussingault (C. rend., t. LXIV, p. 1353) determined that the body daily requires 0.06 to 0.08 grams daily of iron. That is about 1 to 1 1/2 grains daily.

Iron exists in organic and latent state in many foods.

The following is a table showing the number of milligrams of iron in 100 grams of fresh substance: (Boussingault and Bunge)

Gautier page 391.

Butcher's meat	37.5
Pig's blood	63.4
Veal	2.7
Fish	7.5
Eggs	5.7
White bread	4.8
White kidney beans	7.4
Lentils	8.3
Potatoes	6.6

The following table shows the number of milligrams of iron in 100 grams of dried substance:

Hemaglobin	340
Hematogen	290
Pork blood	622
Egg yolk	10 to 24
Cow's milk	2.3
Mother's milk	2.3 to 3.2
Egg white	traces
Wheat flour	1.6
Wheat bran	8.8
Bread	1.3
Cabbage(yellow interior leaves)	4.5
Cabbage(green exterior leaves)	17.
Peas	6.4
Potatoes	6.4
Lentils	9.5
White kidney beans	8.3
Carrots	8.

Rye		4.9
Wheat		5.5
Rice	1 to	2
Apples		13
Cherries (pulp)		10
Strawberries		9
Hazel-nuts (peeled)		4.3
Almonds (hulled)		4.9
Figs		3.7

Iron is found in most vegetables in a metallo-organic form, combined with protoplasm, and is comparable to hemoglobin and hematogen.

Milk of all foods contains the least iron. The reason for this, as given by Bunge, is that during fetal life the embryo accumulates organic iron in the form of hematogen from the mother's blood, and stores it up in its liver where it is found in great abundance at its birth. Hematogen, very rich in iron, is comparable to hemoglobin. It is used by the animal as its blood is formed. Lapicque found in 100 grams of liver washed free from blood in an animal eleven days old 0.20 grams of iron; twenty-one days old 0.14 grams; three months old 0.043 grams; six months old 0.040 grams of iron. (Krüger has also shown that the liver of the fetus contains ten times as much iron as does that of the adult animal.)

The yolk of egg contains hematogen stored for the young chick.

A similar substance has been found by Stoklasa in the nuclei of vegetable cells. A kilogram of dried peas contains 0.9 grams. (Bull.Soc. Chim., t. XVII, p. 523). One hundred grams of this substance contains 1.68 grams of iron.

Manganese is found in cauliflower, asparagus, raisins, wheat and corn. (Compt. rend., t. LXXV, p. 1213).

Mineral iron in the form of salts or mineral organic acids is known to be absorbed from the alimentary canal. These salts are eliminated by the kidneys and some of them accumulate in the liver. Most of the iron we assimilate is derived from the foods, from ferruginous nucleo-proteids and hemoglobins. Iron is eliminated in very minute quantities by the urine and the bile.

Iron introduced as a medicine or in the food accelerates the intra-organic oxidations,--the oxidation of carbohydrates as well as of proteids. Boussingault estimates the daily need of iron to be 60 to 90 milligrams.

CHLORINE, FLUORINE, BROMINE, IODINE.-- These elements are derived in part, chlorine chiefly, from common salt, fluorine from drinking water, and bromine and iodine from nucleoproteids. Iodine predominates in the thyroid gland, which contains 75 to 130 milligrams in every 100 grams. Other organs contain a much smaller proportion,--blood 0.4 milligrams per 100 grams of substance, heart 0.5 mg.; brain 1.1 mg.; liver, kidney and spleen 0.15 mg.

Certain foods are especially rich in iodine, as shown by the following table from Bourcet (These de Paris, 1900): this table shows the amount of iodine per kilogram of fresh substance:

Asparagus	0.24
~~Leeks~~ Garlic	0.21
Pine-apple	0.31
Carrots	0.134
Mushrooms	0.172
Cabbage(white hearted)	0.21
Strawberries	0.17
Wheat ~~flour~~ meal	0.007

Barley meal	0.009
Green beans	0.32
Dried kidney beans	0.014
Sorrel	0.12
Household bread	0.000
Green peas	0.080
Potatoes	0.010
Leeks	0.12
Pears	0.017
Raisins	0.020 to 0.000
Rice	0.17
Milk	0.012
Tomatoes	0.023
Artichokes	0.017

Fruits and foods which are rich in starch contain very little iodine.

SULPHUR, PHOSPHORUS andCORRESPONDING ACIDS.-- Sulphur is introduced into the system chiefly through animal and vegetable albuminoids. Four-fifths reappears in the state of sulphates or phenolsulphates in the urine. One-fifth is converted into cystine taurin, and other bodies. A small amount of sulphur is lost in the epidermis, the nails and the hair.

The adult loses one gram of sulphur a day. It has not been demonstrated that the mineral sulphur of foods can enter into the formation of the albuminoids of the tissues.

Phosphorus and its compounds are indispensable to the fixation of albuminoid material in animals, and to their growth. It is derived from our foods in the form of phosphates and organic phosphorated compounds,-- lecithins, nucleins, nucleon or phosphocarnic acid, lecithalbumins, etc.

Organic phosphorus, directly assimilable, is found in animal substances as follows: (The amount is expressed in P_2O_5)

	Mother's milk grams per liter	Cow's milk per liter	Egg-yolk one	Per 100 gr. fresh meat.
Casein	0.132	0.580	....	....
Vitelline	.....	.....	0.059	0.060
Lecithin	0.133	0.091	0.071	0.039
Nuclein	0.171	0.087	.....	0.008
Other compounds insoluble in water	.....	.....	.....	0.128
Compounds soluble in water, not precipitated by CaO	.....	.....	.....	0.039
	0.456	0.758	0.130	0.274

The phosphorus of the brain, liver, thymus gland, kidney and milk is nearly all of it in organic state. Yolk of egg and nervous tissue are rich in nucleins and phosphorus. Thymus contains 12 grams of phosphorus per kilogram; the heart muscle 10 grams. These two organs contain a higher percentage of total phosphorus than any other. The brain contains 8 grams, the liver 5 grams, kidneys 4.5 grams, per kilogram. Organs rich in organic phosphorus are the thymus, brain, muscles, liver, kidney, in decreasing order (Percival) (Compt. Rend. Acad. science, Dec.1,1902).

Phosphorus is chiefly assimilated in the organic form. It has not been known that the soluble phosphates, alkaline or earthy, are assimilated except with great difficulty. Gilbert and Posternak (La medication phosphorée, p.36 and on) recently made experiments on men which showed that out of 3.8 grams of inorganic phosphorus ingested within 5 days, only 0.127 grams was retained. When the phosphoric acid was added in the organic form it was all assimilated. .033 %

In the herbivora the alimentary phosphates which are excreted are excreted chiefly in the feces, while in carnivorous animals the urine contains phosphates in combination with the fixed bases,--the alkaline and ammoniacal phosphates. In the herbivora the phosphates are prevented from escaping in the urine by the large amount of alkaline phosphates found in the blood.

The daily elimination of phosphorus in the urine is 1.70 grams, representing 3.9 grams of anhydride phosphoric acid (P_2O_5), of which 1 to 1.3% is incompletely oxidized. The great part of the phosphorus simply passes through the body, entering and leaving in the state of phosphates.

Arsenic is found in very small amount in the body, especially in the epidermis, the hair, the nails, thyroid gland and brain. Gautier thinks that arsenic plays the same role as phosphorus. Arsenic is found in certain vegetables in very minute quantities, especially the cabbage and the radish, and in some cereals. Gautier believes that most of the arsenic is derived from common salt.

Silicum.--This is found especially in connective tissue. The loss is chiefly through the hair and epidermis. In herbivorous animals silicum is chiefly eliminated through the feces and the hair.

WATER.

Water boiled for three or four minutes is rendered harmless, even when it contains pathogenic germs.

Such water allowed to stand over nigh becomes aerated and clear.

Using great care, permanganate of potash may be used to purify water, adding a few drops until a permanent rose tint is produced. This disappears on boiling.

RATIONAL PREPARATION OF FOODS.

Cooking renders food more digestible and develops pleasant flavors, but most important of all it sterilizes the food, destroying all living things.

Cooking does not change the fats, nor to any extent the sugars. It hydrates and swells the grains of starch producing dextrines and assimilable sugars.

Cooking by softening the food renders thorough mastication possible and increases solubility.

Cooking does for man, with reference to the cereals, what the energetic stomach of the granivora does for them.

Heat coagulates albumin and gelatinizes or softens membranes.

Roasting produces an internal temperature in a mass of meat of 70 to 85^{0} C.

According to Liebig 60^{0} C.(140^{0} F.) of heat cooks meat.

Cooking renders meat more digestible, and more easily masticated. It also destroys its natural ferments.

TEMPERATURE OF FOODS.-- Cold drinks enfeeble the stomach by their continual excitation.

Cold drinks cause visceral rheumatisms which disappear when hot drinks are substituted (Gautier).

Cold foods are easily digested by strong stomachs.

Foods are to be avoided when at a very high temperature. According to Kostjurin and Spoeth, food taken into the stomach at 50^{0} C. produces malaise, hyperemise of the mucous membranes, hinders the production of the digestive juices, and diminishes the efficiency of the digestive ferments.

Water at 60^{0} C., passed into the stomagh of dogs and rabbits, even when followed immediately by cold water, produced inflammation and swelling, and sometimes ulcers.

Proper temperatures.--

Drinking water	9 to 12	degrees Centigrade.
Food	40 to 50	" "

It is desirable that at least one dish should be taken hot.

Warmth of the food favors the liquefaction of gelatins and the emulsion of fats.

The desire to warm up the stomach after eating cold food may be a cause of drunkenness.

SEASONING.-- Condiments for seasoning our foods are a fictitious rather than a true need. Rich sauces, in fact, retard digestion. Spices hasten digestion but irritate the lining of the digestive canal.

All these preparations afford an artificial satisfaction to a jaded and debilitated appetite. They are injurious in febrile cases, and in cases of gastralgia.

Meats too long kept or too highly spiced may lead to excessive consumption of food.

CULINARY VESSELS.--Vessels lined with enamel containing lead give up some of the lead to vinager or salt water boiled in them for sometime.

Vessels of copper are practically safe. If any copper is communicated to the food it is quickly recognized by the metallic taste.

Aluminium is not good, as it is readily affected by foodstuffs.

THE NUMBER OF DAILY MEALS.

Like the ancient Greeks, our ancestors made three meals,--two light ones, one in the morning on rising, the other in the evening after sunset,xx and the principal meal in the middle of the day followed by a siesta of two hours. The needs of modern activity have replaced the mid-day hearty meal by a light meal without a siesta, and introduced a hearty meal at six or even seven o'clock in the evening. To these principal meals there is added in France and Germany a little breakfast on rising, and for children lunch at four or five o'clock.

In England in well-to-do families, also in Germany in many families, breakfast is taken at nine o'clock; dinner at two, the principal repast; the "gouter" at five o'clock,with tea or coffee, bread and butter; and supper just before going to bed.

Fifty years ago in France the custom was to take a light breakfast on rising at six o'clock; dinner at eleven o'clock; the principal repast,supper at six .

The meals may vary with the occupation. The sedentary man may take a light breakfast. The farmer should take a heartier breakfast.

It is best not to take all the food for the day in one meal. The effect will be to overcharge the body with nutriment for several hours after eating.

Pawlow has shown that pepsin is not secreted for some time after meat is taken into the stomach. The acid of the gastric juice excites pancreatic and intestinal secretion.

Insufficient mastication, hasty eating disturbs this function. One should eat slowly and masticate thoroughly. Insufficient mastication induces slow and imperfect digestion and intestinal catarrh.

Meat badly masticated digests more easily than bread or vegetables which are eaten too rapidly. Fr. Strümpell found 40% of the nitrogen absorbed after swallowing half-chewed a plate of boiled lentils. The same is true of other vegetables and bread which is too soft and badly mingled with the saliva.

During eating one should not do brain work, reading, calculations, or intense thought of any sort.

COMPOSITION OF MEALS.

Arctic people live almost wholly on the flesh and the fat of seals.

The Arab on the contrary is satisfied with a few dates and a little couscous.

Natives of Naples easily subsist almost entirely on macaroni.

The average Frenchman eats 39 kilograms of meat annually.

The Englishman eats 59 kilograms of meat annually.

In France the consumption of meat on the average is 72 kilograms in the cities, and only 19 kilograms per capita annually in the country. The peasant takes scarcely 26 grams of meat at each meal.

" Then, at the present time meat may be said to be only a condiment for the peasant."

"The city dweller on the contrary consumes more meat than he should. In Paris daily consumption of meat is 260 grams — and with many persons double this quantity. Like the opium smoker, the person who is accustomed to meat, feels that something is lacking when he does not indulge in his habitual excess. It is the illusion of the morphinomaniac, the tobacco user, the one addicted to the use of alcohol, etc.; a troublesome exaggeration of the man living in luxury who believes that he is meeting a real necessity when he is only gratifying an appetite which he has himself created, and who gratifies himself at the expense of making himself sick, and often imagines that in so doing he is defending the interests of his health."

The average man who does not work with his arms should not eat more than 250 grams or 300 grams of meat or fish a day (an egg counts for 40 grams of meat). The average man should take one-sixth less. The other food should be in the proper proportion.

"Contrary to the case of the man engaged in sedentary employment, the diet of the peasant is deficient in meat. His diet is too exclusively of vegetable origin, and necessitates the constant digestion of bulky dishes which nourish him badly,--potatoes, green vegetables, fruits, etc., which furnish him with an insufficient amount of nitrogen. This is the cause of the gastralgia, dyspepsia and intestinal inflammation so frequent in this class." Gautier

"By reason of his defective food, and in spite of the many other good conditions, the average life of the peasant is shorter than that of the bourgeois and the laborer of the cities."

"The man who works with his hands should consume daily at least 500 grams of meat, 750 grams of bread, and 80 to 100 grams of fat. A regime consisting of 300 grams of meat, 250 grams of milk, 100 grams of dried legumes, 70 to 80 grams of pork or lard, 200 grams of potatoes, will yield this amount of nourishment."

" Bread and meat and fresh or dried vegetables constitute the rational basis of meals. If it is necessary for reasons of hygiene or economy to give preference to one of these classes of foods, it is toward the vegetables that it would be wise to lean, without excluding meat or at least fish from the principal meal." Gautier.

"Nitrogenous foods are particularly indicated at puberty and are instinctively sought at that period. In girls of 14 to 16 and in boys of 16 to 19 the diet should be rich in proteids."

In boarding schools proteid is usually deficient.

"It is not wise, in health especially, for those who are not subjected to fatiguing exercise to allow one's self to eat sufficiently at meals to entirely satisfy the appetite."

Cold drinks and hot drinks stimulate the contractions of the xx stomach and thus carry into the intestine the portion of the meal already rendered soluble.

The intestinal and hepatic secretions are excited by muscular flesh.

The weight of the meals of the peasants and laborers in poor countries often amounts to 1000 to 1500 grams without furnishing sufficient amount of the principal nutritive elements.

Hypochlorhydrics should not distend their stomachs at meals by drinking, but it is not necessary that they should abstain from drinking at meals if thirsty. Hot and cold drinks in moderate quantity increase the secretion of gastric juice.

According to Von Mering and Moritz liquids pass rapidly from the stomach, being forced out from the stomach by jets into the small intestine. Five hundred cubic centimeters of water passed through the pylorus in half an hour. Meat remains in the stomach more than three hours.

Water taken at meals by carrying away some of the dissolved foodstuffs encourages the digestion of that which remains.

"There are some tables from which vegetables are almost wholly banished. The reason assigned is that they are not nourishing enough or that they are not agreeable to palates accustomed to the more pronounced flavor of meats; sometimes because their preparations requires more care and time than the housekeeper can give, for example in families where the housekeeper works outside. The attempt is made to compensate for the deficiency of vegetables by an excess of meat. This is a very dangerous error. The infants of parents fed on such a diet are nervous, cachectic, eczematous. Later they will become rheumatic, gouty, subject to calculi and migrain, neurotic. I do not doubt that the degeneracy that is apparent in many wealthy families is the result of a diet too exclusively composed of flesh which they have gradually adopted." ~~Gautier~~.

ADJUVANTS OF DIGESTION.

Exercise, physical work, walking, gymnastics, hydrotherapy, massage, a visit to the mountains or the sea-shore encourage digestion. Sea-bathing favorably excite the assimilative functions.

On the other hand appetite rapidly disappears, especially with invalids and infants, when deprived of fresh air.

Should exercise be taken immediately after eating? Young and vigorous persons do not need to rest after meals. Aged persons, persons suffering from gastralgia and hyperchlorhydria, chlorosis, neurasthenia, persons with slow digestion, those who have vertigo, drowsiness, migrain, muscular weakness, palpitations of the heart, etc., during digestion,--such should rest a little, an hour at least, after each meal. Avoid severe mental work after eating, also.

Massage, especially abdominal massage may take the place of exercise, and it will hasten digestion. It is particularly good for constipation.

Hydrotherapy, especially cold baths, are good in the same way.

Condiments excite the digestive functions. They must be used very prudently, especially spicy and acrid substances, as the excitation which they produce diminishes little by little, and hence the quantity of these dangerous agents must be increased from day to day. The distressing results of these dangerous agents are gastritis and enteritis, and the disappearance of appetite. It is better to avoid the use of these excitants, or if they are taken at all, it should be only with the very greatest reserve.

P A R T   T H R E E .

ALIMENTARY REGIMES.

The daily ration of the average man in France is 107 grams of proteids, 65 grams of fat, and about 400 grams of carbohydrates.

"We have shown that the quantity of proteids may be reduced to 80 grams a day in a man who does not work physically, on condition that his foods furnish him at the same time at least 50 grams of fat and 485 grams of carbohydrates."

The laborer who does eight to ten hours of work needs a daily ration of 135 grams of proteids, 85 to 100 grams of fat, and 500 to 900 grams of carbohydrates.

It is important that there should be a slight excess of the fundamental alimentary principles. Excess, however, becomes a danger if it passes beyond small limits.

The fats and albuminoids of flesh, if not utilized and burned, accumulate with all their waste elements in the body, and produce obesity, visceral congestion, neuropathic conditions, atthritis, and diseases of the skin.

A diet which is excellent for the out-of-door laborer becomes a most deplorable diet for the sedentary man who takes little exercise, for the artist, the student, and for those who devote themselves to intellectual pursuits.

For the young man, whose organs are in a normal state, a slight excess of foods should have no other effect than to necessitate greater activity of the lungs, muscles, skin and kidneys. But this is not true of the old man or the man whose constitution and temperament are naturally defective. In him the excess of food will every day increase vital decline; hepatic and pulmonary congestions, arteriosclerosis, changes in the kidneys, fatty degeneration of the various organs, etc., will become daily more aggravated. There will thus be daily established, if not yet a disease, at least the predisposition to disease, a diathetic state, and a morbid temperament.

Since, then, it is necessary to eat a sufficient quantity, the diet should be proportioned to our needs, and regulated, not only by our natural appetite, but by our reason aided, when it fails, by scientific observations, and not by erroneous customs or by artificial stimulation.

INFLUENCE OF DIET ON THE CHARACTER OF INDIVIDUALS AND RACES.

"Diet by its poverty or its excess exercises an influence upon the general health; but it exercises perhaps a still more decided influence by its character. It is a fact of universal knowledge that the people who are the most active, the most rugged, the most aggressive, are great eaters of meat. I will cite only the English and the Germans. Graminivorous or frugivorous people are nearly always pacific. This is true of most of the nations of central Asia for whom rice and vegetables with a little pork and fish constitute almost the sole diet. One can scarcely avoid connecting with these facts the remark that carnivorous animals are generally violent and dangerous while herbivorous animals on the contrary are easy to raise and to domesticate."

"A flesh diet, whether more or less exclusive, has an influence greater than that of race in the determination of the character of the individual, whether gentle or violent. We know that the white rats of our laboratories, as long as they are nourished on bread and grain are very easily handled, while they become vicious and bite when fed on flesh. The same observation has been made in relation to the horse, and even for the dog which is omnivorous. Liebig related that a bear kept in the museum of Giessen was very gentle and quiet as long as he was nourished exclusively on bread and vegetables. After a few days of flesh regime the animal was rendered violent and dangerous to its keeper. The animal's keepers amused themselves by thus periodically modifying the character of the animal. 'It is known,' Liebig added, 'that the irascibility of hogs may be increased by a meat regimen to the point at which they will attack men.' (Nouvelles lettres sur la chimie; 35th letter)."

"The meat regimen, then, certainly influences the personality. It renders us more aggressive, hardier, more wilful.. I do not speak of its injurious influence upon the general health, as I shall later speak of exclusive regimes, my sole object here being to demonstrate its special effects upon the moral qualities on individuals."

"Reciprocally, it is certain that a dietary too exclusively vegetable lessens the violence of the temperament and softens the manners. This has been well understood by all founders of religious orders, both in Europe and in India, in eliminating or proscribing flesh foods. A vegetable diet is less completely assimilated, as we have seen. It imposes upon the animal a large amount of intestinal work, whereby a portion of the energy of the food is diverted to these inferior functions. It introduces into the system much less than do flesh foods of those bitter bases, those sapid extractive matters which are excitants of the heart, which increase the circulation of the muscles, and excite mechanical energy. It is then noteworthy that a diet too exclusively vegetable sensibly weakens and softens the will. The diet alone is perhaps sufficient to transform the wolf and the savage cat, animals carnivorous and most dangerous, into the domestic cat and dog."

"If the diet acts thus upon the development of the organs and the character, it is impossible to deny that it also acts upon races to modify them. Lamarck and Darwin have thought that the food which creates the interior medium was with the influence exercised by the exterior medium and selection the preponderant cause of the variations observed in animals and plants. Without sharing this opinion, for reasons which I have elsewhere given, I believe notwithstanding that the qualities peculiar to each individual and to each race are notably affected by the continuous influence of diet; and reciprocally when habits are formed and a temperament created by an atavism reaching back through a long period, special regimes often become necessary to races thus modified. An Englishman or a Hollander deprived of flesh becomes more rapidly debilitated than a native of southern France or Italy, and the latter with the same nourishment, if almost exclusively vegetable, will produce much more work than a native of the northern countries." Gautier.

INFLUENCE OF DIET UPON MENTAL ACTIVITY, AND UPON THE DIGESTIVE FUNCTIONS.

"The influence of diet upon the physical vigor and the character of races, accords, naturally, with its effect upon intellectual aptitude. We have seen that man has need in order that he shall be able to furnish mechanical work, not only of food abundant in fats and carbohydrates, but also especially rich in flesh. This regime which develops muscular force, energy, vigor, violence even, is on the contrary little favorable to the culture of artistic or scientific aptitudes. To those who devote themselves to mental speculations, who are required to exercise the mind in observation or generalization, to develop and make use of artistic sentiments, to cultivate the abstract sciences, etc., bread, green vegetables, a little ripe fruit, wine (?), and as proteid nourishment 150 to 200 grams of flesh, fish or fowl daily, eggs, milk and other foods easily digestible (rice, carrots, cauliflower, asparagus, mushrooms, potatoes in small quantities, etc.), and finally some aromatic condiments as coffee, tea, etc., are more suitable than a diet consisting too largely of meat. And this so much the more, as nearly all those who devote themselves to work especially requiring exercise of the mind or of the imagination, take in general an insufficient amount of exercise physically, and are thus easy subjects of rheumatism, gout, hepatic congestion, cerebral and renal congestions. These predispositions are still further increased by the use of coffee, tea, alcohol and tobacco, and the employment of condiments which momentarily excite the appetite, which sedentary occupations tend to diminish. Such persons should avoid all dishes which are of difficult digestion; also those which must be taken in large quantity (such as liquid foods), excessive quantities of flesh food, also the starch of vegetables such as dried beans, lentils, etc."

"For persons who devote themselves chiefly to mental activity of any sort, the diet must be one which is adapted to their degree of activity or inactivity and to the climate in which they live, since psychic activity, as we have seen, requires no sensible expenditure of energy. Without doubt all cerebral work consumes energy corresponding to the effort made to place the sensorial machine in a condition to receive the impression, to transform it into material form, and afterwards present it to the inner consciousness. All cerebral work, then, occasions a real expense, felt and known to all those who know how to observe. All impressions, as has been directly demonstrated by Moritz Schiff, raise the temperature of the brain, and of the body, and consequently occassion the expenditure of energy. But this expenditure is so feeble that it is inappreciable from the standpoint of diet. It has been recognized, in fact, that intellectual fatigue increases neither the total amount of urinary nitrogen, and consequently the amount oa albuminoids metabolized, neither the combustion of fats not the amount of phosphorus excreted in a given time. (Speck, Arch. f. exp. Pathol. u. Pharm., Bd. XV, p.81; C. Voit, Zeitsch. f. Biolog., Bd. XIV, p.57)"

"A last remark: One must not engage in intellectual work during a meal, neither immediately after eating; since the body has need at this time that the blood should flow not to the brain but to the stomach."

"During sleep the destruction of the proteid elements of our tissues does not appear to vary; that of the body fat diminishes much, without a proportionate diminution of the quantity of oxygen absorbed. Hence, there is often an accumulation of oxygen in the body during sleep, especially in the young infant." (Mad^{e}. Bres; CH. Bouchard). Gautier.

VARIATIONS OF DIET WITH MECHANICAL WORK.

The amount of work done by a good laborer in a day of eight to ten hours is 260,000 to 280,000 kilogram-meters, of which 25 to 65 % is utilized, according to the nature of the work and of the machine.

A man who produced 260,000 kilogram-meters of work, ate the following,--bread 400 grams; fat 24 grams; flesh 200 grams; fresh vegetables 200 grams; wine 1 liter.

This meal contained the following elements:

Proteid	78.5 grams
Fats	35.5 grams
Carbohydrates	339.0 grams, including 130 derived from the liter of wine.

30% utilized in work

See a later reference to this subject, where it will be more fully discussed.

VARIATIONS OF DIET ACCORDING TO THE HEIGHT AND THE WEIGHT.

"In a state of rest 72% of the energy derived from the food is loss at the surface of the body in the form of radiant and conducted heat; 28% is transformed into work of various sorts and carried off with the latent heat of vaporization with the water lost through the lungs and the skin. The heat lost at the surface of the body is proportionate to the area of the body surface S. That lost by work and by the vaporization of water through the lungs and the skin is proportionate to the weight of the individual P."

"Supposing conditions to be normal, let us represent by m the heat lost per unit of surface S, expressed in square decimeters; and by n the heat lost or energy dissipated at the same time per unit of weight expressed in kilograms. Representing by C the amount of heat or calories corresponding to the total energy expended in twenty-four hours, we have the following formula:

mS plus nP equals C.

We know, thus, that between the energy mS radiated by the surface and that nP lost in the form of work, heat of vaporization, etc., there exists an experimental relation

$$\frac{mS}{nP} \text{ equals } \frac{72}{28}$$

"On the other hand, for normal or average cases it is possible to know the habitual relation which exists between the weight of the body and its surface. Bordier, at my request, studied this relation, and the following are the results obtained in adult men, thanks to his 'intégrateur de surface':

Height inches	Surface area S Square feet	Weight P pounds	Relation $\frac{P}{S}$

XXXX See next page for table.

Height in inches	Surface (S) Sq. ft.	Weight (P) pounds	Relation $\frac{P}{S}$
71.6	20.8	162	.128
69.8	20.7	165	.126
68.0	19.3	148	.130
66.2	18.0	143	.126
64.00	18.3	134	.136
62.0	17.2	122	.141
		General average	.131

It appears from the above table that if the surface (S) is expressed in feet, and the Weight (P) is expressed in pounds, the relation

$$\frac{P}{S} \text{ equals } .131$$

If the surface (S) is expressed in square decimeters, and the weight (P) is expressed in kilograms, the relation

$$\frac{P}{S} \text{ equals } 0.37$$

The average energy expressed in calories lost by a man in a state of equilibrium in the form of mechanical work or latent heat of vaporization of water, per kilogram of body weight is 10.1 calories. That which is lost at the same time by radiation or conduction per square decimeter of body surface is 9.59 calories. Let the former figure be represented by **m** and the latter by **n**. Knowing these coefficients, the number of calories (x) necessary for maintenance of a man of given weight can be found by referring to the table. (See table on page 451 of Gautier). In using the table given above, and the formula

mS plus nP equals C,or x.

let m equal 89.1,and n equal 4.6. Thus, supposing a man weighs 165 pounds and his skin surface is 20.7 square feet; then

20.7 x 89.1, plus 165 x 4.6, equals 2603 calories.

Small persons must eat more in proportion to their weight than large persons because their skin has a greater area.

Rübner's table showing the amount of calories necessary according to the weight of the body, the individual being neither obese nore emaciated:

Body weight		Calories needed		Calories needed daily	
Kilograms	pounds.	Rübner	J.H.K.	Per kg.	Per pound (Rübner)
50	110	2472	1740	49.4	22.4
60	132	2792	2000	46.5	21.1
70	154	3094	2200	42.2	19.2
80	176	3372	2400	42.1	19.1

The figures in the third column of the above table (Rubner) are too high.

The amount of calories needed per unit of body weight varies greatly, according to the weight of the body, and diminishes as the weight of the body increases.

Bordier showed that between 20 and 30 years a normal man weighs in kilograms the number indicated by his height expressed in centimeters diminished by 105.

Experience has shown that a person may lose one-tenth of the weight normal for his height without injury. The loss of weight is at the expense of the fat and the water. There is very little expense of the actual flesh.

The weight may be increased one-tenth above normal before obesity begins.

For a person having a height of 1.65 meters the normal weight is 60 kilograms. Normal minimum 54 kilograms; normal maximum 56 kilograms.

Gautier page 454.

VARIATIONS OF DIET WITH CLIMATE AND SEASONS.

More food is required for cold weather and cold countries; less food in warm weather and warm countries.

The Spanish Catalans live on a diet not exceeding 1900 to 2000 calories. They are good-natured, healthy, strong muscled, and able to do a large amount of work.

Lapicque (Bull. Soc. Biologie, 4 th. March, 1893 and 3rd Feb., 1894) in his voyage estimated the diet of the Abyssinians of Ghinder, living at an altitude of 900 meters, with average temperature of 17^{0} C., to be as follows: proteid 50 grams; fat 30 grams; carbohydrates 360 grams, for a man having a weight of 52 kilograms. This represents 1950 calories gross, or 1823 calories utilizable.

In the less elevated parts of Abyssinia with a temperature averaging that of the summer in France, workmen received a diet comprising 2200 calories daily. Subtracting 400 calories for work, there remain 1700 calories for maintenance ration.

Japanese oarsmen received daily 2050 calories. The average weight of these men was 52.6 kilograms. Subtracting 400 for indispensable current work, there remained 1650 calories for maintenance. The quantity of albuminoids did not exceed one gram, and the fats and carbohydrates 4.5 grams per kilogram of body weight, when they did not work; and the fats and carbohydrates did not exceed 6 to 7 grams when they worked.

According to Maurel (Archives de medècine navale, t. LXXIV, p. 366; t. LXXV, p.5 and 81, 1900 and 1901) the ration of maintenance in intertropical countries isfive-sixths that of temperate climates. In the climate of France the amount of proteid required is not less than 1.2 grams per kilogram, Fats should not exceed one gram per kilogram, especially in hot countries. Carbohydrates and sugars reach 3.8 to 4.0 grams in these hot countries. Alcohol should not exceed

40 to 50 grams per day.

Moderate work should increase the ration about one sixth.

Warm seasons and countries correspond to a temperature of 77 to 86 degrees F.

During the cold season of the intertropical zone there is a daily average of 68 to 77° (winters of Senegal, Madagascar).

The average temperature in temperate countries corresponds to 50° to 68° (Central Europe).

The winter of the temperate zone has an average temperature of 41 to 50 degrees.

The winter of cold countries has an average temperature below 41 degrees.

Maintenance Ration according to climate. (Maurel)

Climate and Season	Cal. per kg.	Calories daily for a man of 60 kg.	70 kg.	80 kg.
Warm countries, warm season . .	30	1800	2100	2400
Warm countries, cold season, and summer of temperate countries	35	2100	2450	2800
Temperate countries, intermediary season; and summer of cold countries	40	2400	2800	3200
Temperate countries, cold season; and intermediary season of cold countries . .	45	2700	3150	3600
Cold countries, cold season . .	50	3000	3500	4000

In applying these ideas, the weight must be normal.

To find the normal weight, subtract from the height in centimeters 105. This gives the weight in kilograms for a person between 20 and 30 years. For a person between 40 and 60 years, subtract 100 from the height in centimeters to find the weight in kilograms.

For a person who is working hard the number of calories should be increased 400 to 1400 calories, according to the case.

Liebig noted the fact that lean meat is of all foods that which produces least heat, while fats and carbohydrates give the most.

The Esquimos of Greenland are sometimes seen to drink several liters of fish oil daily.

In tropical countries and in the hot seasons, the fats, the greatest producers of heat, instinctively enter only to a feeble degree into the daily ration.

In warm countries, because of the great amount of evaporation from the surface of the body, the diet includes a large amount of herbaceous foods, acid fruits, and watery drinks, which replace the water evaporated from the skin by restoring the blood to its normal condition. In such countries one must avoid especially foods too fat and foods too starchy, and an excess of proteid elements, which much more rapidly than in cold climates produce congestion of the brain and liver. A very interesting thing is that for the same habits and the same occupation and an equal amount of work, a laborer consumes nearly the same amount of proteid matters in a cold or moist climate as in a warm dry one.

The amount of fat and carbohydrates is increased in cold countries. French laborers consume 157 grams of proteid daily. The Astrakan carpenter requires 144 grams of proteids daily, but he also needs 766 grams of ternary matters. The North Russian peasant receives 135 grams of albumin in winter, with 955 ~~xxlxx~~ grams of fats and carbohydrates. The German woodcutter receives 155 grams of proteid with 1084 grams of fats and carbohydrates.

Albuminoids must be increased with the amount of work, although the increase is much less than for fats and carbohydrates. Proteids are not increased according to the coldness of the climate but rather in proportion to the fatigue of the worker.

According to Russian authorities the Russian peasant consumes more meat and fish in summer than in winter.

A man, weighing 76 kilograms, fasting, excreted the following quantities of CO_2 and urinary nitrogen during six hours, with a temperature gradually decreasing as shown in the following table:

Temperature	CO_2 eliminated	Total urinary N.
80.6° F.	160.0 grams	4.0 grams
75.2°	164.8	3.4
60.8°	158.0	4.0
48.2°	192.0	4.2
39.2°	210.7	4.2

In proportion as the temperature of the medium is lowered, there is not an increased loss of proteids, and consequently more is not consumed; but there is combustion of an increased quantity of carbon derived from the fats and carbohydrates which decrease in proportion to the lowering of the temperature. Consequently the need of fats and carbohydrates is felt the more as the temperature diminishes. It appears, however, as has been remarked, that for equal weight and equal work the natives of tropical countries eat nearly as much as those of cold countries (Lapicque). The enormous evaporation from the skin in very warm climates will perhaps explain the necessity for a diet sufficient to replace the loss of latent heat.

THE ADAPTATION OF DIET TO AGE AND INDIVIDUAL NEEDS.

Metabolism of infants is more active than that of adults. The infant needs more airm, more proteids, more fats. The infant produces more CO_2, mofe urea and more heat for his body weight than does the adult.

Age of Subject	Av. Wt. of body Kilograms	Pounds	Urea daily per kilogram	CO_2 daily per kilogram.
7 months	7	15.5	1.60	36.00
18 months	9	20.0	1.35	30.00
3 years	13	28.6	0.90	22.00
5 years	16	35.2	0.76	21.00
7 years	19	41.8	0.74	20.0
9 to 10 years	25	55	0.69	15.00
13 to 15 years	33	72.6	0.60	14.16
16 years	36 to 45	79.2 to 99	0.50	12.7
19 years	56	123.2	....	....
25 to 30 years	65 to 70	143 to 154	0.50	....
35 years	65 to 70	143 to 154	....	12.0

Gautier page 462.

Table showing alimentary principles needed according to age.

Modified from Flügge.

Age of Individual.	Average weight pounds	Number of Calories needed daily Prot.	Fat	Carbo.	Total	Per pound
End of 1st week.	7.7	53	149	63	265	34.4
5th month	16.7	140	339	174	653	39.1
12th month	21.1	157	357	315	829	39.3
18 month	23.7	177	402	398	977	37.1
2nd year	26.4	197	390	492	1079	40.9
4th year	33.0	235	421	619	1275	38.6
6th year	39.6	229	368	738	1335	33.9
10 year	57.2	267	388	963	1618	28.3
14 year	89.0	332	376	1245	1953	22.0
20th year	143.0	480	544	1599	2623	18.3
			400	800		

REGIME OF THE NEWBORN.

The best food is mother's milk.

The young infant during the first weeks should be fed every two hours; then every three hours during the day and two feedings during the night. He should have eight feedings of two and three-fourths ounces each daily during the first month; 100 grams the second month; 120 grams the third; 140 to 150 the fourth to the sixth months.

During the two or three first months the child should gain 28 to 34 grams (about one ounce) in weight every twenty-four hours.

When mother's milk fails, give the child donkey's milk, or better still that of the mare, not boiled, and collected with antiseptic care.

Cow's milk is preferred to that of the goat which is too rich in casein and in butter, too odorous, too different from mother's milk by constitution and by the special characteristics of its proteid.

Milk should be obtained from a healthy cow three or four years old.

The child should receive every day 175 to 180 grams of milk.

Sterilized milk is more easily digestible than fresh milk which has not been boiled. It has been said that such milk causes constipation in infants, anemia and pallor.

The objection that milk boiled or sterilized loses its salts of lime, being precipitated by the citric acid,disappearing with the boiling, is purely theoretical.

Biedert recommends during the first two months 200 grams a day for each kilogram,of a mixture consisting of one part of cow's milk, three parts barley-water and four grams of sugar. This mixture gives for each liter 9 grams of proteid, 9 grams fat, and 50 grams carbohydrates,--in all about 326 calories.

Heubner adds to two volumes of milk one volume of thin wheat or oatmeal gruel, made by adding a coffee-spoonful of flour to 250 c.c. of water. Of this mixture an infant is given: the first months 600 c.c.(daily); fourth to eighth week, 800 c.c. daily; After the eighth week 900 c.c.; after three months 1000 c.c. daily.

Heubner's mixture furnishes 595 calories to the liter. This gives the infant 100 calories per kilogram a day instead of 40 calories, or more than double that which the adult receives. The infant loses daily 96 calories per kilogram, while the adult loses only 42 calories.

Should a sick mother nurse her infant? No, if any other provision can be made; if the infant does not gain in weight; if it has green diarrhea; Yes, in cases of slight fever if the mother and child do not suffer too much or only momentarily.

At the end of the seventh month the child may take zwieback, concentrated milk, milk porridges, bread puddings, toasted bread with a little fresh butter or yolk of egg. He may also take powdered biscuit, baked potato, yolks of eggs, boiled eggs, eggs stirred into milk.

Maurel has shown that a child should have per kilogram 75 calories during the first four months. This would amount to 102 grams of cow's milk per kilogram of the infant's weight each day.

The following table is according to Variot:

Daily of pure milk.

1st. week	240 grams	Dilute the milk with one-third boiled water.
2nd. week	360	
3rd. week	415	
4th. week.	545	
6th. week	672	Dilute this milk with one-fourth boiled water.
2nd. month	758	
3rd. month	960	

4th. month	1080
5th. month	1280
7th. month	1440
9th. to 12th. month	1600

Give the nursing bottle every two hours during the first weeks; every three and one-half hours the second to the fourth months; then every three hours.

Gautier says that while milk is the nourishment of the infant during the first two or three years of its life, meat must be given, cooked or raw, from the middle of the second year, although in very moderate quantity.

DIET FROM THE SECOND TO THE FIFTEENTH YEAR.

In giving the diet for children of this age, Gautier mentions among other things fruits,--fresh ripe.

The exclusive use of milk produces fat infants, but feeble, of little resistance, with enlarged lymph glands.

Game and meats which have been kept until they have a high flavor, should be avoided. Also avoid salt meats, fat fish, dried fish, salted or smoked fish, oysters, cabbage, mushrooms. The child should not be given wine sauces, vinegar, spices, raw fruits, dried fruits, very acid or unripe fruits; neither should he receive fermented juice, alcoholic liquors or tea.

From the second to the sixteenth year the child should gradually take to the ordinary normal food. Spices, candies, wine, liquors and coffee should be forbidden.

Milk, eggs, roasted meat, purees of peas and beans, and bread should constitute the chief nourishment.

From six to fifteen years the infant should have per kilogram of weight twice as much proteids as an adult of the same weight.

The elimination of nitrogen is .74 grams daily in a child of two years; .61 grams in a child of three or four; 0.40 grams in a child of five to seven years; while it is only 0.23 in the adult.

Infants should use more fat than adults because they require more, since they chill more easily, and lose heat more rapidly.

The following table shows the amount of food required for children of various ages, calculated for twenty-four hours for subjects of average weight:

Gautier page 466.

Age.	Proteids Grams	Fats Grams	Carbohydrates Grams	Total Calories
6 to 15 years (Voit)	79	37	250	1639
5 to 16 years (Camerer)	70	40	236	1627
Boy of 10.5 years, 55 lbs. (Uffelmann)	65	46	206	1539

From the seventh to the twelfth year it is best to avoid the more exciting dishes, heating dishes, dishes too high in proteid, or too highly spiced; neither should strongly alcoholic liquors nor coffee be given.

In the growing child certain ~~m~~ineral salts, especially the salts of potash and lime and organic phosphorus, are especially necessary. Bread, flour of cereals, milk, ~~brx~~ brain, fish, peas, beans and lentils furnish these mineral materials in ample quantity. It is necessary not to lose sight of the fact that from its birth to one year of age the child must fix in his body 600 grams of mineral matter in his bones, and 120 to 150 grams each year after that. It is necessary to furnish the infant during the first ~~year nearly five grams of chalk daily~~ year more than 0.5 grams of chalk daily.

DIET IN ADOLESCENCE AND PUBERTY.

Highly spiced foods should be avoided. They have an effect to hasten the development of the reproductive function.

The best excitant of the appetite is fatigue for young men, and moderate exercise, especially walking, in the open air for girls.

From sixteen to eighteen years of age the boy eats as much as a man and sometimes more. He requires an excess of proteids. The young man should be able to satisfy his appetite. This is not always possible in boarding schools.

The adult woman requires five-sixths as much food as a man.

Women should avoid exciting dishes,--oysters, spices, coffee, etc., at the time of the catamenia.

DIET IN PREGNANCY.

The pregnant woman requires especially bread, eggs, legumes, bread, milk. Fat and carbohydrates must be used in moderation on account of the tendency of the liver and the heartto be invaded by fat.

"Since flesh foods oblige the congested liver to add to its normal work that of eliminating the toxins found in the flesh of animals, meat should be entirely suppressed whenever there is the slightest trace of albumin in the urine. If there are any threatenings of eclampsia, a milk diet should be strictly adhered to."

"The idea entertained by Prochnovnik and other accoucheurs, that the infant will be less well developed if the mother is deprived of flesh, is an error. Generally the mother alone suffers, and the development of the infant is the same as if the mother had not been deprived of usual food."

Pregnant women should avoid acid and indigestible foods, condiments, spices, salt foods, coffee and tea, especially at the end of the sixth to the eighth month. These foods favor miscarriage.

Immediately after delivery the diet should consist of milk, eggs and biscuits. The following days she may be fed with bread, milk and meat in small quantity. She should avoid all indigestible dishes, as cabbage, and during the two or three first weeks, legumes, especially beans.

DIET FOR NURSING WOMEN.

Mothers who are wet nurses may take potatoes, bread, rice, legumes, green and dried peas, lentils, etc. These foods excite the secretion of milk. They should avoid dried haricot beans. Legumes (with the exclusion of cabbage, water-cress, leeks, garlic, onions, mushrooms, salads, sorrel), ripe fruits and cooked fruits may render excellent service.

Avoid also spices, meats, salt meats, strong cheeses, salt fish, oysters, clams.

The amount of food required by a nursing mother should be

Proteids	150 grams
Fat	100 grams
Carbohydrate	450 to 600 grams.

This would be an average ration.

OTHER SPECIAL DONDITIONS GOVERNING DIET.

DIET OF THE MENOPAUSE.--The diet should consist of easily digestible food. Avoid highly seasoned dishes, spices, excessive use of meats and condiments.

DIET IN OLD AGE.-- Old persons require less food than adults. The diet should be reduced, though less than it would appear from their diminished activity.

(Prepare a new table for old persons,and consult the one in Gautier, page 471).

Old persons should avoid too much bread, potatoes, vegetables, -- bulky and indigestible foods.

IDIOSYNCRASIES.-- After the siege of Paris many persons found it difficult to return to their former diet which they found excessive in quantity.

In certain families eggs always produce indigestion with choleriform movements. A certain French officer suffered from suffocation and indigestion whenever he took a yolk of egg, even in small quantity or mixed with other foods. He had suffered this way from infancy (Fonssagrives).

Some persons are unable to eat parsnips, others fish, others pears, cheese, truffles, strawberries. These peculiarities are sometimes hereditary in families.

INSUFFICIENT DIETS.

Gautier's minimum ration is as follows:

Proteids	80 grams	328 calories.
Fats	55 grams	511 calories
Carbohydrates	400 grams	1640 calories. (2479)

On an insufficient diet there is at first loss of fat. When the fats are used up the tissue proteids are burned. The muscles waste rapidly and the bones are rarefied. All the tissues perish.

After starving a warm-blooded animal for three or four weeks, according to Chossat, the temperature falls rapidly, having previously stood at 0.5^{o} below normal.

Death occurs when the temperature of the blood reaches 77 to 79^{o} F. The temperature generally falls when the animal has lost one-fourth to one-third of its weight, sometimes not until the loss is 40 to 50 percent.

In man after twelve to fifteen days of starvation, vomiting occurs, and diarrhea. The stomach secretes mucus and loses power to make gastric juice. There is danger in feeding such patients,--it may produce intractable diarrhea. Other symptoms:- loss of sensibility, feeble heart, mental disturbance, loss of muscular power, hemorrhage from slight wounds as the blood does not readily coagulate, the blood cells are reduced to less than 10% of the blood-volume(The normal is 35 to 40% by weight). There also occurs edema of the trunk and the brain, finally convulsions, coma and death. Water takes the place of fat.

Fat subjects lose albumin less rapidly in fasting than do others. The fat protects the muscles.

The following table shows the rate at which some famous fasters lost weight:

I. Breithaupt.	Body weight.	Proteid loss.	Loss in fats.
First day	59.5 kg.	63 grams	162 grams.

Second day	56.8 kg.	62 grams.	160 grams.
Sixth day	56.4	60	160
II. Cetti.			
First day	56.5	95	170
Fifth day	52.6	87	166
Tenth day	50.6	60	165
III. Succi.			
First day	62.4	104	...
Tenth day	56.7	51	170
Twentieth day	52.8	33	170
Twenty-ninth day	50.2	31	169

In fasting men the urinary chlorides diminish rapidly. Sodium chloride falls to two grams per day and remains at that point.

The amount of lime lost is normal.

Urea, which is 20 grams at the beginning of the fast,becomes 13 on the tenth day, and 8 to 10 grams on the twentieth day, remaining at this point until death. Water drinking increases the amount of urea two or three grams a day. Urea increases just before death.

CO_2 fiminishes until the fourth or fifth day and then remains constant.

Heat loss is proportionately greater for small animals. The same is true of the consumption of oxygen and the loss of fat.

With a diet lacking in carbohydrates (well suited to combat obesity), the fats and proteids disappear at the same time.

When all food is withheld the heat of the body is supported by the combustion of 15% of proteids and 85% of fats.

On a half normal ration, the body loses 2 to 2.5 kilograms the first week. Edema may hide the loss of flesh.

SUPERALIMENTATION.

Consequences of overeating nearly always obesity and the uric acid diathesis.

We systematically overeat. It is a habit. Cooks sharpen our appetites by variety of highly seasoned dishes, by exciting foods, and by fully satisfying the appetite.

Just as one who takes a little alcohol every day finally becomes inebriate, so a person who takes a little excess of food each day finally becomes an arthritic or an over-fat person.

The appetite is not always reliable. It may be decreased or diminished at will. With the majority of people the appetite is large a matter of habit. This is particularly true with flesh foods. The more one eats, the more acid gastric juice the stomach secretes, and the more the stomach secretes the more one is inclined to eat ~~xxxx~~ in order to appease the impressions made by the large amount of acid in the stomach.

The following diseases are especially due to excessive eating, particularly to the excessive use of meat:- Atony of the stomach, gastric derangements, intestinal troubles, dyspepsias, gastric colic, pyrosis, flashes of heat in the face, hepatic and cerebral congestion, arthritis, gout, gravel; sometimes albuminuria, vascular hypertension, arteriosclerosis, neurasthenia, etc.

An excess of the individual principles of food acts differently on the different organs.

Too much meat is always detrimental by introducing into the blood and the tissues an excess of proteids, and especially toxic substances, uric acid and allied purin substances, pyrimidic substances, creatin, neurinic bases, extractives, etc. These poisons exhaust the body, leading to congestion of the brain, the liver and the kidneys, and the heart, and also are the most active agents in the production of arteriosclerosis.

An excess of flesh tends to slightly increase the muscles but only when accompanied by fat and regular exercise. The exercise should stop short of great fatigue.

Adipose tissue increases with rest, especially if the diet is rich in fat and still more if the diet is rich in carbohydrates. Lean meats contribute somewhat to fat formation.

Glycogen may be formed from lean meat, as shown by Claude Bernard.

Carbohydrate may be converted into fat in the body by losing CO_2.

Fats are more difficult to absorb and assimilate than sugar or starch.

Fats sometimes must be increased.

Excess of hydrocarbons or proteids acts only feebly on the reserves. Excess of proteid does not increase the albuminoid tissues, only under certain circumstances:

(1) When a person takes moderately fatiguing exercise daily;

(2) When the subject is young and growing;

(3) When the patient is convalescent or starving.

In starvation, after hemorrhage and in consumptives, superalimentation produces other effects. In these cases any excess whatever of proteids contributes to cover the deficit without any portion being used for the formation of fat. This is often observed in convalescents. In all cases in which superalimentation becomes necessary, it is very efficacious. Meat 150 grams to 250 grams per day, roasted meat or better raw scraped meat, is an average and convenient addition to the ordinary ration. Raw meat pulp swallowed without chewing in the form of boluses weighing 25 grams each, is better supported by feeble stomachs than in any other form.

Fresh and slightly cooked eggs and milk (three or four pints daily) may partially replace the meat. It is better in general to employ, when one can, natural foods rather than dried or peptonized meats of which the origin and composition are often doubtful.

These preparations are not always antiseptic. The same is true of meals and powders of various sorts.

If an excess of fat is to bee taken, give rich cream or butter(80 to 90 grams,--930 calories), potatoes, sugar, vegetables, vegetable soups, etc.

Gautier gives a ration intended for cases where forced feeding is desirable, comprising of proteids 156 grams, fats 130 grams, and carbohydrates 367 grams. The corresponding number of calories is of proteids 640, fats 1209, carbohydrates 1504, a total of 3353 calories.

According to Hirchfeld and Krug an addition of fifty percent to the ordinary ration increases the weight of the body from 3.5 to 5 kilograms in twenty days. This is an average of more than half a pound a day. After beginning, the weight increases more than the weight of the food elements, because of the addition of water. Later the increase of weight is less than that of the fats and proteids taken.

There is danger in forced feeding. It produces rapidly an excess of fat about the liver, the heart and the kidneys, interfering with their normal work.

A diet too rich in flesh burdens the system with waste matters and toxins. It congests the liver and the kidneys. It excites and exhausts the heart by increasing blood-pressure. It saturates the tissues with residues, the elimination of which is difficult because they decrease the alkalinity of the blood and thus diminish oxidation.

Pages 155 to 166 ~~and~~ are left for the discussion of the vegetarian regime, to be translated entire. Get from Mr. Ashley.

MILK DIET.

The principal object is to reduce to a minimum extractives and toxic matters which are derived ~~from~~ almost exclusively from the metabolism of flesh foods,--puric bodies, leukomains, complex amides, extractive proteid matters, etc., substances which congest the liver, irritate the nervous centers, exhaust and congest the kidneys. These noxious compounds are derived from flesh and not from starch, sugar or bread. It is then neither logical nor good to deprive the subject of Bright's disease or hepatic disorder of starch, sugar or bread. It is well to add to the milk diet bread and herbaceous vegetables, also cheese but without salt. This gives a large variety of food-stuffs and does not introduce into the system the toxic residues of meat. It serves also to combat constipation which often results from a strictly milk diet.

Two quarts of milk, two ounces of sugar to the quart, and 150 grams of biscuit or zwieback, give the patient:

Proteid	90 grams	or	369 calories
Fat	75 grams		697
Carbohydrate	270 grams		1107
		Total	2173 calories.

Bread and biscuit may be replaced by rice, mushes, etc., but not with sugar. ~~and milk~~ Add powdered casein, green vegetables, etc., also koumys.

We daily excrete 10 to 12 grams of common salt. The above diet furnishes 1.3 grams of salt as follows:

For 2000 c.c. of milk		1.20 grams salt.
For 120 grams of sugar		0.00
For 150 grams ordinary bread		0.12
	Total	1.32 sodium chloride.

It is necessary to add 7 or 8 grams of chloride of sodium.

According to the observations of F. Widal and Lemierre, and especially those of F. Widal and Javal (Soc. med. des hopitaux, 12 June, 1903, and Presse medicale, 27 June, 1903, p.469) in patients affected with parenchymatous or epithelial nephritis the addition of salt to the ordinary diet or to a milk diet increases the albumin and produces edema. The withdrawal of salt from the diet, even when composed of meat and bread, causes the edema and the albumin to diminish, and disappear; While the symptoms named reappear when salt is added in sufficient quantity to a milk diet. In cases of Bright's disease and edema it is necessary not only to withhold salt from the milk but to withdraw the salt as much as possible from the other foods.

It appears, according to Widal and Javal, that when the salt is withdrawn the milk diet may be replaced by an ordinary diet of meat, bread, etc.

Experience has not yet shown us how long a patient can support a diet from which salt has been entirely or almost entirely removed.

The milk is more digestible if sterilized. If the taste is disagreeable, flavors may be added, as vanilla, citron, etc., or an emulsion of sweet almonds may take the place of a part of the milk.

If there is diarrhea, reduce the dose, add rice water or a little subnitrate of bismuth; if there is constipation add barley or oatmeal water or laxative fruits, such as prunes. Later vegetables, eggs, biscuit and bread may be taken. The milk should be taken very slowly and in small morsels,--(in other words; IT MUST BE FLETCHERIZED).

Milk taken alone diminishes the weight because of the deficiency of carbohydrates. It acts as a slight diuretic. It has an antiseptic action on the intestine.

MEAT DIET.

Some persons find it a necessity to live almost entirely on meat and fish.

Two conditions are necessary: (1) that the meat must be accompanied by its fat; (2) the individuals following this diet must live a very active life in the open air.

According to Darwin the gauchos live for months at a time on fat beef. The esquimo can eat daily 5 or 6 pounds of seal-meat, but this diet becomes insupportable if the meat is lean.

A dog weighing 20 kilograms required 15000 grams of lean meat to maintain its weight, when only 400grams and 200 grams of milk;or 100 grams of meat, 100 grams of milk and 300 grams of bread were sufficient, to obtain the same result. The same is true of men.

To obtain the 280 grams of carbon necessary each day, the average man would need 1600 grams of meat(without fat). This quantity will introduce four times as much proteid as he uses. This is a condition unfavorable both from hygienic and economic points of view.

It should not be supposed that the patient's strength may be increased by the addition of flesh to the diet beyond the needs of the system for proteids. Although the meat diet elevates the nitrogen coefficient of the urine more than does a vegetable regimen, the meat diet diminishes the alkalinity of the blood and thus lessens oxidation. It charges the fluids of the body with an excess of proteid wastes, especially with uric acid. It increases the urinary alkaloids, congests the liver, induces obstinate constipation, causes dyspepsia, gastric obstruction and enteritis. It produces psoriasis, eczema, etc. It develops and predisposes to rheumatism, the arthritic, gouty and neurotic states.

A diet containing an excess of flesh could not be long supported. It produces arterial hypertension, fatigue of the heart and becomes one of the most active predisposing causes of arteriosclerosis (Huchard).

Houssaye has shown that in birds xxx a flesh diet substituted for a granivorous diet produces infecundity, arrest of development, and an excessive proportion of males.

The excessive use of meat, then, is not favorable from any point of view. We have called attention to the fact that it renders the individual more aggresive, more wilful, and the intelligence less active. Ne sacrifions pas au culte de la viande!

The wealthy classes are only too carnivorous. Said Herbert Spencer, 'There exists a marked contrast between the children of the classes of which the diet is often animalized, and those of the classes in which the diet is composed of bread and potatoes. In a double relation of physical and intellectual activity, the child of the peasant is much inferior to the son of the gentleman."

In relation to health and physical force it appears that it is the contrary that is true; as to intellectual activity of the child of the wealthier classes, this results from heredity, from the selection of the parents, and especially from education.

The diet the exaggeration of which is the origin of so many physiologic and morbid disorders, can not be favorable to the good development of the family or race. (Gautier)

DIET IN DISEASE.

Says Gautier, "Diet and rest contribute as much and more than medicinal drugs to aid the recovery of the sick. To aid the vis medicatrix naturae to recover the normal state with shocks and by means of natural measures, avoiding as much as possible artificial excitations, exhaustion, the high temperatures of fevers and dangerous chilliness; to repair the losses of the organism by an appropriate regime; to introduce into the body neither indigestible substances nor an excess of materials which are indigestible, nor useless drugs; to give to the patient foods which meet the triple indication to ~~give to the patient~~ increase energy, to produce the minimum of toxins, to anable the organs to cooperate in relieving themselces from the products of abnormal activity,--this is certainly not abandoning the patient to his fate. It is to act prudently and wisely as possible. It is to avoid violent disturbances of the complex and delicate internal vital work, and the result in general will be the return to health."

"What is best to be done in the majority of those acute maladies, the eruptive fevers, typhoid, pheumonia, etc., in which no specific medication is available, and still more in many chronic maladies in which the pernicious habit of abnormal alimentation, whether a personal or a family peculiarity or a race characteristic, constitutes often the most direct factor of the acquired personal or hereditary defect from which the patient suffers and the effects of which it is necessary to attenuate or remove?"

Two general remarks:

First, the food must be prepared with care, of good quality, pleasing and odorous and acceptable to the taste.

Second, the appetite should be a guide, but account must be taken of the artificial stimulations by which the appetite is abnormally modified.

"An obese person who requires a diet consisting largely of fat, a gouty person or a rheumatic person who eats more than he burns and eliminates, a patient suffering with arteriosclerosis who eats to the satisfaction of his appetite and makes free use of wine, --such persons are comparable to alcoholics and morphinomaniacs who experience an artificial need of alcohol and of morphine. The appetite of the patient being often born of vicious habits, must be controlled by a study of the metabolism and especially in chronic maladies by a study of the daily output of nitrogen and carbon."

A man in repose consumes daily 32 to 38 calories per kilogram; but 24 to 26 (1650) calories per kilogram on the average in twenty-four hours ought to be sufficient when the patient remains in bed.

DIET IN CHRONIC MALADIES.

There are eight classes of chronic maladies:

(1) Obesity, rheumatism, gravel, gout, arteriosclerosis.

(2) Dyspepsias, gastralgias, hyperchlorhydria, hypochlorhydria, gastric dilatation and atony, gastritis, ulcer of the stomach, enteritis, dysentery.

(3) Congestion of the liver, cirrhosis, disease of the pancreas, diabetes, albuminuria, phosphaturia.

(4) Nephritis and affections of the urinary passages.

(5) Plethora, hemorrhages, hemophilia.

(6) Anemia, chlorosis, affections of the heart and lungs, dropsy.

(7) Cachexias, disorders of the skin, cancer, rickets, osteomalacia.

(8) Overwork, neurasthenia, insanity.

ACID DYSCRASIAS.

Called by Bouchard "ralentissement de la nutrition."

Generally due to dietetic disorders.

They have a common tendency to acidify the fluids, and the production of acid compounds,--carbonic, uric, oxalic, etc.

They present many forms according to the organ or tissue attacked, in which there is slowly developed an inequality between the income and the outgo.

The mode of assimilation or dissassimilation is characteristic of each organ of the body and each tissue of the body. Hence the manifestations of this disorder are greatly varied.

The acid dyscrasia may affect especially the connective tissues, adipose tissue, the aponeuroses, the mucous membranes, various glands.

Lack of exercise is the most general cause of slowed nutrition.

These maladies have been called disorders of superalimentation, but in obesity and rheumatism, superalimentation is not always present.

The human machine tends more and more to be replaced by steam and electric machines, leaving to man only the direction of the work which he supervises. His mind works more than his muscles. In former times we traveled on foot or on horseback; today the various means of transportation carry us from place to place without the use of our legs, even without requiring of a single extra breath or heart beat. It is only the peasant in the fiels who takes exercise and yet agricultural machines are being introduced so rapidly that the work of the laborer and the farmer is becoming much less laborious and much more productive. Well-being appears to be increasing. Diet is becoming richer, and more abundant, and more carnivorous, while exercise is diminishing, and with it oxidation and organic disassimilation. Here then is a doubly convergent current which develops and generalizes chronic maladies essentially dietetic in their origin.

OBESITY.

Obesity is really a form of rheumatism. Gout, migraine and dyspeptic states are of the same family. From the point of view of diet it is necessary to distinguish between these forms of slowed nutrition.

Fat is the one element of our bodies which can in our tissues undergo enormous variations. It may oscillate between 5% and 24% of the weight of the body. It accumulates about the heart and the kidneys, in the abdominal cavity, in the subcutaneous tissue. It may invade the tissues of various organs, the liver, muscles, etc.

Obesity begins when the weight exceeds the normal weight more than one-tenth.

Fat is produced by the storing of alimentary fats and by the transformation of starch and sugar into fat. In health a small part only of the albuminoids are converted into fats.

Many obese persons eat little. They are obese perhaps by constitution,--sometimes perhaps by heredity. Oxidation is deficient. It may be due to deficient activity or deficient quantity of the oxidizing enzymes. There are three oxidizing ferments which are produced respectively by the thyroid gland, the testicle or ovary, and the white cells. cold bath,

Obesity may be due to too much food or too little exercise.

Excessive appetite for fats, sugars or starches, may produce temporary obesity.

Hirschfeld observed that ~~mexexthan~~ a woman of 97 kilograms only ate three fourths as much as a man of 91 kilograms.

The principal causes of obesity are: excess of fats or carbohydrates in the diet, alcoholic drinks, inactivity or destruction of the genital glands, living in rooms at too high a temperature, a personal predisposition on the part of the cells of the body to fatty degeneration which is often heredity or related to rheumatism, too much food, too little exercise.

The real obese persons are those who are not able to consume as much fat and proteid as the ordinary person.

Robin (Bulletin de therapeutiquè, Paris, 1897) observed in obese children that the amount of urine was a little more than one third that of the normal child; the total solids of the urine less than half, the total nitrogen one-half, urea the same, phosphoric acid one-fourth, sodium chloride one-half.

Obese subjects are often the subjects of migraine, anemic from infancy, sometimes asthmatic, lymphatic and phlegmatic. They have loss of appetite, difficult digestion; they complain of nervous troubles, muscular and cardiac weakness. They eat moderately but everything they eat turns to fat. The amount of urea may be excessive. They cannot go long without eating. They have a great appetite for albuminoids and fats.

There are other obese persons who are fat because they indulge too freely in the pleasures of the table, taking too little exercise.

In both of these classes the thing necessary is to increase oxidation and to burn up the fats by exercise. In the second class it may be necessary also to diminish the amount of the food.

Banting and Harvey suppress starch and fats, and increase the amount of fatxx meats.

Ebstein suppresses the carbohydrates alone(three to four ounces of bread a day) and reduces the proteid to a minimum. The change is made progressively. He allows fats, especially butter, freely, his idea being that animal and vegetable fats taken in the food are not deposited in the body, but that the fats are formed from carbohydrates exclusively. This idea is disputed. Gautier says that this method produces anemia and dyspepsia.

Gautier recommends the method of A. Robin, based on observations of Voit and also Ranke who shows that the suppression of fats and carbohydrates causes both the fats and the proteids of the body to disappear rapidly.

Robin gives his patients food four times a day,-- two principal meals and two small meals between. He has the patient walk thirty or forty minutes after each meal.. The principal meals are to satisfy the demands of the body and the two smaller meals to occupy, "deceive" the ~~mind~~ stomach, to "amuse" the stomach. The diet is limited to a few articles. Monotony of the diet and the frequency of the meals moderates the appetite. The diet should be about three-fifths of the amount necessary to maintain nutritive balance.

Sample diet of Robin's method:-

8:00 A.M. One egg

One-half ounce bread.

Two-thirds ounce of meat.

10:00 A.M. Two eggs.

One and one-fourth ~~xxxxx~~ drams bread.

Six ounces of a mixture of water and one-third wine.

12:00 M. Six to eight ounces of lean meat.

One and one-fourth ounces of bread.

Six ounces of fresh vegetables.

Six ounces of wine and water mixed.

4:00 P.M. Cup of weak tea without sugar.

7:00 P.M. Nine ounces of meat.

One and one-fourth ounces of bread.

Six ounces of fresh vegetables.

Two-thirds ounce butter.

Such a diet contains 140 grams of albumin, 44 grams of fat, and 82 grams of carbohydrates. There are 1290 calories in all.

Dancel, OErtel, Schweninger, **Baelz** recommend reducing the amount of liquids in obesity. There seems to be no good reason for this. The obesity is not due to an excess of water in the tissues. The cellular isotony regulates the amount of water in the body. This is not increased or diminished, even if the amount of fluids is increased or diminished.

Voit, Bischoff, and Schmiedeberg have shown that water excites oxidation, doubtless by facilitating the circulation of the oxidases. Water is necessary to remove the products of disassimilation, which is always retarded in these patients.

It is better to avoid eggs and to give the patient for each egg nine ounces of some green vegetables, such as spinach, instead; also to give the patient a pint of skimmed milk in place of the wine and water.

In the treatment at Marienbad the patient takes hot drinks, considerable exercise and slight purgation.

The grape-cure in which patients eat from four to eleven pints of grapes a day acts as a laxative. Its effects are uncertain.

Exercise has some disadvantages. It increases the appetite, and is likely to ~~oxidize~~ exhaust the heart which is enfeebled by fatty infiltration so that the exercise must be applied very carefully, and increased slowly and progressively. It is necessary to avoid exhaustive exercises and too much reduction in the ration, also purgations which produce weakness or dilatation of the heart and increase nervous disorders.

Warm baths diminish the appetite and produce sweating, but the results are uncertain, that is, baths from 98.6 to 100.4° F.

Thyroideine accelerates oxidation and produces rapid emaciation. Gautier thinks that this is a violent method, because it is often followed by cardiac troubles in patients with fatty or weakened heart, and these troubles are prolonged after the treatment is discontinued. Sometimes glycosuria appears after the use of thyroideine. Its action is uncertain while the dietetic means are less dangerous and are sure.

The effective treatment of obesity should diminish the weight the first week two kilograms, of which two-fifths to three-fifths should be at the expense of the fat, two-fifths to one-tenth at the expense of the muscles, according as the patient is more or less fat. Later the loss of weight falls to four to six ounces a day, of which one-fourth is at the expense of the muscles, and three-fourths at the expense of the fat.

RHEUMATISMS. GOUT. GRAVEL.

These are disorders characterized by accumulation in the cutaneous tissue, the joints, the fluids and various organs of the body, or urates or oxalates, the deposit of which produces painful sensations either direct or reflex.

It is not an infallible rule that these patients eat too much. The majority of them eat more than is necessary. They cannot oxidize as much as they take in.

Hyperacidity is the rule in these patients. Hence the need of foods which alkalinize the blood, and the restriction of acid dishes with the ~~exeeption of~~ exclusion of vinegar, lemons and ripe fruits. But in gouty cases the uric acid is far from being in excess as a rule. Only a trace is found in the blood except at the crises. On the contrary, during the attacks of gout uric acid is increased, according to Garrod, to 0.17 grams (2.6 grains) per liter of blood. An interesting fact is that at this time uric acid diminishes in the urine until the end of the paroxysm when it is abundantly secreted by the kidneys.

In his lessons upon restricted nutrition, Bouchard recommends to persons threatened with gout hot baths, cold lotions with energetic friction, gymnastics, moderation in the use of meats, in addition to a daily ration which consists of herbaceous foods which lessen the acidity derived from meat and assure better assimilation of proteids. Garrod observed that a vegetable diet substituted hippuric and benzoic acid for uric acid. It is not yet known whether in gouty persons uric acid is produced more abundantly or whether it is simply deposited with greater facility for some unknown reason which interferes with its solubility. In these patients the blood appears not to be appreciably more acid than in the normal state.

For gouty patients beer, liquors, chocolate and spices must be forbiddeng little meat, bread in moderation and a large amount of green vegetables are permitted, also moderate use of fats which are not easily borne and which prevent the disassimilation of proteids. No highly seasoned dishes. No foods which carry with them uric acid or which cause its formation by preventing oxidation. Garrod permits cider provided it is not too acid, water drinks in abundance, more hot than cold.

It is especially important to avoid a sedentary life in a warm atmosphere.

Bouchard thinks the principal causes of rheumatism and gout are as follows: "Uric acid increased by high living, by excess of proteid foods, by acid dyspepsias, by a small amount of liquids, by Champagne and cider, by insufficient or exaggerated muscular exercise, by insufficient cutaneous activity, by cold, by sedentary life, by habitual sojourn in a confined air, nervous atony, sadness, hypochondria."

Articles forbidden for arthritics and gouty patients by Gautier: Flesh foods, especially the flesh of young animals, as follows: veal, pigeons, chicken; and gelatinous meats, as head, feet and skin; smoked meats; brain, eggs;and bread in excess; and gelatin. Also foods containing free oxalic acid as rhubarb, sorrel, spinach, extract of meat.

Eggs are unfavorable to most gouty patients although they produce only a little uric acid. ~~Must~~

Must avoid foods too fat and too sweet.

Milk is good. It is a diuretic and does not increase uric acid. It takes the place of meat.

Use ~~chocolate~~ instead of ordinary coffee, chicory.

Too highly flavored dishes should be avoided, those which excite the appetite. Avoid all condiments and spices with the eception of salt, vinegar and lemon.

Gautier page 509.

All green vegetables are recommended except those which are imperfectly digestible or which contain oxalic acid, such as green peas in the pod, sorrel, spinach, rhubarb.

Must especially avoid chocolate and cacao, although they contain only a little oxalic acid.

It is a mistake to proscribe the tomato when it is well digested. This fruit contains scarcely any oxalates. Its malates and citrates alkalinize the blood.

It has not been demonstrated that asparagus is harmful, although it has often been forbidden.

Cooked onions, and especially raw onions, seem to be favorable in gout.. This vegetable excites the functions of the skin. It is known that respiratory activity increases with the activity of the skin.

Water in abundance excites oxidation and dissolves urates. It is the best drink for the arthritic and gouty.

Ripe fruits are excellent, also fruit juices and stewed fruits. Cherries, raisins, prunes, plums, oranges, apples, pears, lemons, etc., are recommended. The tartrates, malates and citrates which they contain are ~~xxxxfxixinxthe~~ transformed in the body into carbonates which alkalinize the fluids of the body and dissolve uratic deposits.

Bread must be used in moderation. When burned in the body it produces for every hundred grams an excess of 2.39 grams of phosphoric acid. Bread lessens the alkalinity of the blood by the sulphur and the phosphorus of its nucleins, besides purin bodies which it adds to the blood. This amounts to just one grain to the ounce of unsaturated phosphorus besides the nucleins.

Hildebrandt (Bull. Soc. chim., t. XXX, p. 92) made the following experiment with a rabbit. When fed with herbs the urine of the rabbit remained alkaline, even when it was given a half-ounce of sugar for each

pound of body weight daily. When the herbs were replaced by oatmeal or other cereals the urine became acid. When sugar was given a part of it was converted into oxalic acid which poisoned the animal and it died. If carbonate of lime was given with the sugar, this neutralized the oxalic acid, the urine remained alkaline, and the animal lived.

Rjasantzeff has shown that for the same amount of proteid introduced, bread produces more acid in the stomach and more urinary nitrogenous wastes than many other foods,--three times as much as milk.

Bread must be replaced in part by baked potatoes which alkalinize the blood instead of acidifying it.

Gautier testifies to remarkably good results from lessening the amount of bread in these cases.

Moderate exercise aids oxidation. Overwork increases the amount of uric acid.

GRAVEL is a complication of arthritism. It may be uric or oxalic or an alteration of the two.

The amount of uric acid daily excreted is 0.35 to 0.80 grams, and the amount of oxalic acid 0.002 to 0.015 grams.

Foods which contain a large amount of oxalic acid are the following: (The figures given here are those of Esbach, Cipolina and Albahary)

	Amt. of oxalic acid per kilogram of fresh substance.			
Cacao	3.52	to	4.50	grams.
Chocolate	0.724	to	0.90	
Tea (See note)	1.34	to	3.75	
Infusion of tea(5 min.) See note.			2.06	
Pepper			3.25	
Coffee(infusion)			0.13	
Sorrel	2.74	to	3.63	

Spinach	1.91 to	3.17
Rhubarb		2.47
Green beans	0.06 to	0.21
White beans		0.31
Beets		0.39
Broad beans		0.280
White bread	0.020 to	0.130
Brussels sprouts		0.02
Cauliflower		0.00
Beans (fèves)		0.16
Potato-		0.05
Buckwheat flour		0.17
Rye		0.00
Lentils		0.00
Petits pois (small peas)		0.00
Chick peas		0.425
Turnip-cabbage		0.311
Chickory		0.100
Endive		0.02
Corn-salad		0.02
Watercress		traces
Lettuce		0.00
Radish		traces
Cucumber		0.251
Asparagus	0.028 to	0.044
~~Tomatoes~~		~~[illegible]~~
Tomatoes	0.002 to	0.050
Carrots		0.030

Figs (dried)		0.270
Cherries		0.025
Currents		0.13
Prunes		0.12
Plums		0.07
Oranges		0.03
Raspberries		0.06
Lemons		0.03
Strawberries		0.01
Apples		0.01
Grapes		traces
Apricots		traces
Peaches		traces
Pears		traces
Melons		traces
Milk		0.00
Sweet-bread	0.011 to	0.250

Foods which are most free from oxalic acid and may be freely used by persons suffering from gravel, gout or rheumatism, are: Brussel's sprouts, cauliflower, potatoes, barley, lentils, petits pois, endive, lettuce, asparagus, tomatoes, carrots, apples, strawberries, pears, cherries, lemons, oranges, peaches, apricots, melons, milk, plums, raspberries. Most of these contain no oxalic acid at all; others contain only a minute quantity.

A gouty person should drink freely at his meals. When the amount of water is insufficient, uric acid appears in the urine, perhaps because there is not found in the fluids of the body a proper solvent, perhaps because the water increases the activity of the tissue oxidation processes.

Water alkalinizes the blood and excites diuresis. Kefir appears to act in the same way.

All highly seasoned foods, condiments, aromatic dishes,and liquors and brandies should be suppressed.

OXALURIA.------ In a state of health the uric acid found in the blood is destroyed in great part in the body. Only a small quantity escapes through the kidneys. Oxalates are found in small amount (2 to 12 milligramsx per liter in the normal urine) being maintained in semi-solution by the slight acidity of the urine. Oxaluria is often found in dyspeptics, in persons who have hyperchlorhydria and in nervous patients. All the conditions which produce the uric acid diathesis contribute to the development of oxaluria, the oxalic acid being formed at the expense of the albuminoids of the tissues. A meat diet, especially gelatinous meats, increases the formation of uric acid and oxalic acid. Sugar and fat have little influence upon the excretion of these acids.

Obese patients, gouty and dyspeptic persons especially suffer from oxaluria. In such persons the oxalic acid may be increased to 40 milligrams per liter.

Small amounts of sugar and of albumin are also likely to be found. Such cases must avoid foods containing oxalic acid, also foods hard to digest, and those which leave in the intestine a putrescent residue.

Milk lessens the intestinal fermentations and by its lime salts neutralizes the oxalic acid.

Diminished alkalinity of the blood is the result of excess of proteid in the diet, insufficient oxidation, excess of fats and starch, food too highly seasoned, too rich in legumes, excessive use of chocolate, tea, coffee, sorrel, etc.

Oxalic acid in thesecases is made to appear by slight indispositions, chilling, gastrointestinal disturbances, overwork, loss of sleep, exhaustion and prolonged walking. Patients suffering from dyspnea usually have oxaluria. (Benecke)

DIET IN DYSPEPSIA.

The dyspepsias comprise all disorders of digestion whether in the stomach or intestine; whether nervous, mechanical or chemical.

GASTRIC DYSPEPSIAS.

Causes of dyspepsia.-- Excess of foods and drinks; overworking the stomach continuously, particularly daily excess of flesh foods as well as of starches and fats, which prolong digestion and give rise to fermentation and abnormal acid products which are more or less toxic; the use of acrid condiments, strong liquors, so-called aperients, bitter wines, cold drinks (bitters, wine of quinine, vermouth, etc.); the habit of drinking wine and beer between meals; the use of tobacco, coffee and tea; ice taken at meals; too hot foods; aerated waters; excesses of all sorts; irregularity and haste in eating, neglecting to masticate the food; violent and fatiguing exercise; office work immediately after eating; mental overwork; lack of sleep; sedentary life and ennui; various pathologic states, chronic and acute,--anemia, chlorosis, febrile disorders, rheumatism, gout, tuberculosis.

Dyspepsias may be divided into three classes,--nervous, mechanical and chemical.

THE NERVOUS DYSPEPSIAS.

These are cases in which although the gastric juice is normal or only slightly diminished or perhaps a little increased, the stomach is exceedingly subject to cramps and pain, often between meals. Appetite is irregular. Constipation is often present. No disturbance of motility.

Gautier and Robin regard this as "rheumatism of the stomach." Digestion seems slow. Food remains in the stomach too long. There is often a sense of weight, indicating slowness of digestion.

There is often gaseous distention and pain due to the retention of acids formed by fermentations.

These cases are most common among neurasthenics, rheumatics, exhausted persons, subjects of the morphine habit, persons who are mentally overworked.

These cases should avoid fat foods, foods too hot, peas, beans and lentils.

Must eat moderately, not more than one gram of albumin and five grams of fats and carbohydrates to the kilogram of body weight.

Avoid spices, highly seasoned foods, etc., mushrooms, pork, highly seasoned sauces. Must avoid roasts.

Use lemon juice in place of vinegar. Use no condiment except a little salt.

Avoid sweets, chocolate, bouillon and alcohol.

Those who eat little should take but little exercise, sometimes complete rest, especially persons who are anemic, neurasthenic, chlorotic.

Must discard cold drinks, and even cool drinks when the stomach is rheumatic.

Necessary to take only hot drinks sometimes as a means of relieving the pain.

CHEMICAL DYSPEPSIAS.

There are two classes of chemical dyspepsias: hyperchlorhydria, and hypochlorhydria.

Most frequently hyperesthesia of the stomach is maintained by excessive secretion of hydrochloric acid, which irritates its mucous membrane three or four hours after the meal, especially at night, which may continue when the stomach is empty or nearly empty of food. These patients suffer from pyrosis with sharp pain at the epigastrium, exaggerated salivation, sometimes eructations, burning, regurgitations of excessive acidity. There may be vomiting.

A glass of water or water with a little bicarbonate of soda, chalk or magnesia, will calm all these troubles for a few hours.

The attacks are reproduced after each meal, especially after the evening meal. The condition gradually leads to continuous gastric secretion, chronic gastritis and ulceration. In bad cases of hyperchlorhydria there may be found a quart of very acid gastric juice seven or eight hours after a meal.

The diet should be moderate, not more than 1.2 grams of proteids to the kilogram of body weight.

Boas, Penzoldt, Einhorn, Ewald, and others recommend raw or half-cooked meat because this is the most easily digested.

Laying aside these theoretical considerations, Dujardin-Beaumetz, Rosenheim, Flexner, Moritz, Bachmann, and others, recommend legumes and cereal foods, because they excite the gastric secretion.

Meat produces double the amount of hydrochloric acid as is produced by rice and analogous vegetables. It also neutralizes the acid. After a meal of meat the acidity in hydrochloric acid is not more than 22% that of the stomach contents after a meal exclusively vegetable.

The relative effect of the following foodstuffs in stimulating the production of hydrochloric acid is indicated in the order in which they are named, increasing from least to greatest:--milk, bread, potatoes, cereals, eggs, roasted meat (Bachmann).

Milk stimulates the production of hydrochloric acid the least and saturates free hydrochloric acid the best. It should be taken xxxy at from three to four hour intervals, in quantities of half a pint or more, and in very small swallows, two or three minutes apart.

Two to two and a half liters is the proper amount of milk if the patient must be put on an absolute milk diet.

The milk may be taken hot or cold, with or without water, or such fruit juice as the juice of apples, pears. Eggs may be added.

In cases of diarrhea subnitrate of bismuth may be added.

In cases of constipation a little calsium,m agnesium, etc., may be added.

Skimmed milk is preferable in some cases.

Patients on a milk regimen should take very little exercise.

A liter of milk with about three ounces of starch or sugar equals about one thousand calories.

Patients must under this diet take little exercise and keep quiet, and warm.

If milk produces acid regurgitation carbonate of lime and magnesium may be added. Some biscuit may be added to the milk.

"Hyperchlorhydria is often the result of the free use of meat." (Gautier).

Ewald and Boas, as well as Pawlow, have shown that fats and oils greatly lessen the acidity of the gastric secretion. So cream and butter may be employed by these patients, also olive oil.

Foods forbidden these patients are : cabbage, sorrel, chick peas, green beans, spinach, rhubarb.

Cooked fruits are much to be recommended.

Bread must be taken in moderate quantity (5 to 6 ounces daily)

The best drink is water or water with a little cream.

Spices of all kinds must be excluded; also fried foods, gravies containing burned fats, salt meats, game, fat fish, cheese, pork, mushrooms; such starchy foods as potatoes, beans, lentils, sweet dishes, substances which easily ferment in the stomach, also chocolate, cocoa, wine, hard cider and other fermentable liquors and alcoholic drinks, drinks too hot or too cold, and hasty eating.

Alkaline waters or powders must not be taken in connection with the meal for they excite the gastric secretion; but only two and a half or three hours after the meal. In place of bicarbonate of soda ordinarily used it is better to take chalk or mix it with calcium or magnesium and a little water. In rendering alkaline the contents of the stomach, these salts do not indirectly provoke the acid secretion.

Lavage of the stomach may relieve an acute attack; but it does not prevent the return of the attack.

Salicylate and especially the benzoate of soda in powder, three grains at the beginning of an attack and three hours after the beginning of digestion, by substituting for hydrochloric acid which is very corrosive, an acid which is antiseptic and nearly inert, calm the pain and little by little diminish the acidity of the gastric secretion.

Exercise is harmful in these cases. The majority should rest for an hour at least after eating.

GASTRIC ATONY. HYPOCHLORHYDRIA.

This is a condition the opposite and often the result of the preceding.

It is generally observed in anemia, chlorosis, scrofulosis, neurasthenia, febrile diseases and advanced cases of chronic disorders.

Pain, sensation of weight, pyrosis, burning, gastric cramps, commencing with digestion and not three or four hours after as in hyperchlorhydria.

The condition is in great part due to the formation of lactic and butyric acid, etc.

Constipation is the rule.

The acidity of the gastric juice usually is 0.030 to 0.100.

Digestion is chiefly performed in the small intestine.

\- It is necessary to give small amount of of food at a time.

Antisptics should be given as the gastric juice is not sufficient in amount to prevent the microbic fermentation processes in the stomach. Antiseptics do not prevent the action of the gastric ferments. The best antiseptics are those which are insoluble,--~~[illegible]~~ benzonaphthol,--which can be taken indefinitely in ~~[illegible]~~ doses of one-half to three grains after each meal. May also use biniodide of bismuth in doses of 2 to 10 centigrams, oxide of zinc, etc. Benzoates and salicylates must not be taken at the beginning of digestion as they arrest the digestive process.

German physicians recommend the substitution of dilute hydrochloric acid(1:1000 to 4:1000), but experience shows that the use of this solution will render the stomach incapable of making its own hydrochloric acid, so this practice has been abandoned(Du Mesnil, Jaworski, Linnossier).

Martinet has proposed the use twice a day of half a gram to a gram of acid phosphate of soda, with pepsin and pancreatin. Gautier says that this also destroys the power of the stomach to make its own juice.

Gautier says that the treatment of these atonic dyspepsias by pepsins, even the most active, is no better in its results than giving hydrochloric acid.

"The foods suited to hypochlorhydrics are: raw or roasted meats, meats slightly smoked, beef, fowl, pork, lamb, ham, lean fish cooked in water and sprinkled with a little lemon juice, milk if it agrees well, eggs in all forms, and bouillons either with or without fat."

The following vegetables are recommended: cereals, purees of potatoes, tomatoes, vegetables cooked in water without pepper and similar spices; fresh butter, cream-cheese are also allowable.

Cooked fruits if not acid, rice and similar dishes not much sweetened are permitted, also bread, but the latter only in moderate amount.

Foods forbidden are: fat fish, flesh which has been kept for a long time, pork, cabbage, cucumbers, sorrel, fried foods, flours of peas, beans and lentils, especially when diastased, since they ferment very readily in the feeble stomach. It is also necessary to forbid irritating condiments, highly seasoned sauces, and the juices of roasted meats. Avoid radishes.

Eat nothing which has not been well cooked, well divided and well chewed. Avoid foods which are too heavy, too woody, too fat, too indigestible.

Avoid drinking cold liquids or too much liquids.

It would ~~xx~~ seem that the peptones would be useful in these cases. However, commercial peptones generally succeed very badly. They irritate the stomach and intestine. This is especially true of peptones that have a bitter taste. Peptones of Koch or Kemmerich produced by subjecting beef to the action of superheated water, are better born. They contain about 50% of albumin, and extractive matters.

It is not necessary to force the stomach too much, for the intestine can do its work.

In muscular atony of the stomach, stenosis of the pylorus is due chiefly to hyperacidity of the gastric juice, resulting in dilatation which causes stagnation and retention of badly digested products. A hyperacid liquid is secreted by the stomach. The stomach dilates. One meal overlaps another. Fermentations take place. Yeast, bacteria, microbes which produce fatty acids, sulphuretted hydrogen, carbonic acid gas, ammonia, etc., take possession of the stomach.

The indications are

(1) Chemical antisepsis. One third of a grain to one grain of fluoride of ammonium after each meal. One third of a grain to two grains of biniodide of bismuth and cinchonidine. Three to five grains of benzonaphthol after each meal. The first two remedies named were proposed by A. Robin.

(2) Mechanical asepsis, consisting of lavage.

Foods which do not readily ferment and which are readily dissolved, are necessary. The best foods are fowl or roasted meats passed through a mill, eggs, sterilized milk, preparations of casein, lean fish with the skin removed but not fried fish, fresh butter, green vegetables, fruits well cooked and sweetened very little, zwieback in moderate quantity; purees or porridges and legumes (peas, beans, lentils) must be avoided, as they ferment easily.

Drinks recommended are water, barley and rice water, lemon juice, always to be taken in small quantity.

Dishes to be forbidden are all foods which are very starchy, saccharine or fermentable, cabbage, meat that has been long kept, game, fried foods, old cheese, fruits which are very sweet or very starchy, aerated drinks, raw milk, chocolate, beer or wine.

Mustard seems to be sometimes beneficial, accelerating digestion, x and apparently well tolerated by the stomach.

Rosenheim recommends his patients to digest as much as possible in a horizontal position so that the weight of the food will be less fatiguing to the stomach. In cases where there is a tendency to ulceration, whether or not secondary to hyperchlorhydria, milk, buttermilk, raw meat, meat powder rendered aseptic, eggs, light puddings not too hot, seem to be permissible, alone, with a little cold water. At the same time a little subnitrate of bismuth may be given to act locally as an antiseptic and antiulcerative, and to diminisg gastric acidity without preventing digestion.

If there is ulceration with a tendency to hemorrhage the patient may be given sterilized gelatin mixed with bouillon or milk, one-third to two-thirds of an ounce a day.

But it is more certain in these cases to employ nutritive enemas. These enemas should consist chiefly of peptones mixed with water or an emulsion of yolk of egg with the addition of a little dextrin, twenty grams to the quart(2/3 ounce to the quart), and salt about one dram and a half to the quart.

Nothing should be taken into the stomach except broken ice to stop the hemorrhage. The patient may be thus nourished for three weeks without reducing weight.

When there have been no hemorrhages for several days, milk or gruels with purees of green vegetables, rice, and milk, raw meat pulp, purees of potatoes and bread may be carefully taken in small quantities.

Feedings should be every two or three hours.

In CANCER OF THE STOMACH emplgy foods which give little residue, as milk, raw meat, and eggs. Above all use antiseptics such as benzo-naphthol, subnitrate of bismuth, chlorate of soda, and mustard. It should not be omitted for fear it will produce irritation, for nothing irritates the sore more than its own toxins and the acid products,--butyric and lactic,--of the fermentations which are always present.

Acidulated drinks, especially hydrochloric acid, two parts in one thousand, may be very useful in these cases.

GASTRIC VERTIGO.

Often due to hyperchlorhydria. More rarely it is due to hyposthenia. Nearly always in connection with fermentations and production in the stomach of toxic compounds.

These vertigos most often occur two or three hours after meals, when the stomach is empty, frequently in the morning at the moment of rising.

The bitter tonics, quassia, etc., are recommended by Trousseau and Robin, but the dietetic treatment is most useful.

For breakfast, give eggs cooked in the shell, a little bread, some cooked fruit. No drink.

Frin may be taken at the other meals, but only pure water.

The diet should consist of plain puddings or very light beef tea, flesh or fowl roasted or boiled, very thoroughly chewed, legumes cooked with water and the addition of a little butter, eggs in the shell, lean fish cooked without sauces, creams, rice puddings, etc.

Avoid cooked and fried butter, highly seasoned sauces, fried foods, pork, preserves, salads, raw fruits, especially acid fruits.

Immediately after eating take a cup of very hot peppermint or camomile tea.

After breakfast or dinner take with a little water one of the following powders:

Calcined magnesium
Sodium bicarbonate ...... aa 4 grams.

Prepared chalk
Sugar of milk ...... aa 6 grams.

Make into 12 powders.

DIET IN DISORDERS OF THE INTESTINES.

The pathologic states to be considered are:

Chronic constipation

Chronic diarrhea

Acute diarrhea

Dysentery

Typhlitis

Appendicitis

Cancer.

CHRONIC CONSTIPATION

Chronic constipation results from three causes: (1) Intestinal atony, maintained often by a general morbid state, neurasthenia, chlorosis, tuberculosis; (2) deficiency of vegetables; (3) sedentary habits.

Constipation must be combatted by a diet rich in starch, legumes, moderate exercise, intestinal massage.

The weight of the vegetable foods should be six or seven times the weight of the animal foods.

Wheat bread, or better still a rye bread or a mixture of rye and wheat, black bread, boiled vegetables, potatoes, peas, cabbage, cauliflower, salads, asparagus, cooked acid fruits, mayonnaises prepared with butter. As laxatives, Oatmeal mush (?), bread with bran, buttermilk, whey with or without the addition of tamarind, especially acidulated whey, honey, spiced bread, prunes, sugar of milk one third to two-thirds of an ounce taken in the morning in lemonade, two glasses of cold water before breakfast. Also water containing a little bicarbonate of soda.

Foods to be avoided, rice, cacao, all fruits rich in tannin, concentrated bouillon. Some authors require abstinence from the potato. Gautier does not believe in this.

"Too prolonged retention of foods in the intestine, especially those of animal origin, may produce local inflammation and stercoral typhlitis which may involve the appendix."

TYPHLITIS. APPENDICITIS. PERITONITIS.

Too long retention of foods in the intestine, especially foods of animal origin, may lead to local inflammation and stercoral typhlitis, and this inflammation may involve the appendix.

Milk, with the addition of lactose, kefir, whey, vegetables, in the form of light purees, oatmeal (?), etc, are wholesome for these patients, and contribute to reestablish normal movements of the intestine.

When appendicitis is threatened, rest and abstinence from food are indispensable so long as the acute stage persists with nausea.

The same is true with reference to peritonitis.

The stasis of fecal matters, the use of irritating spices,too exciting foods, eating to excess,especially of certain flatulent legumes, may produce the hemorrhoidal state with or without hemorrhages.

In these cases all condiments and excesses in diet must be suppressed. Preparations of milk, purees of potatoes, carrots, rice, light puddings, well ripened fruits are indicated. Vegetables should be such as leave little residue. Hence, cabbage, roots, beans, onions, must be avoided, also coffee and alcohol.

CHRONIC DIARRHEA. INTESTINAL CATARRH.

This condition is often the result of an irrational diet. Unripe fruits, coarse or woody vegetables, lightbread, graham bread, salads, dishes excessively salt, too fat dishes, game, flesh that has been kept too long, badly cooked foods, foods too highly sweetened, foods too watery, too much cold water, chilling of the feet, of chilling of the abdomen.

All objectionable foods should be suppressed immediately. Give albumen water prepared by first beating white of egg; add a pint of water and strain through a cloth; a little lemon juice and sugar may be added.

Sterilized milk or milk mixed with arrow root or sago, meat pulp, mixed with bouillon or not, yolks of eggs cooked in the shell taken with a little lemon juice, may be especially recommended in certain cases. Purees of vegetables cooked in water to which a pinch of carbonate of soda has been added; puddings of meal of rice, wheat (but not those of oatmeal); malted preparations; cooked white of egg; soups with bread; cream with eggs or milk.

Food must be given very carefully to prevent relapse.

Patients pass ten or fifteen percent of their food unabsorbed instead of five percent as in the normal state.

MUCO-MEMBRANOUS ENTERITIS.

This is an intestinal catarrh with a great quantity of mucus, exfoliation of mucous membrane, and intermittent colic. There may be a exfoliation of a pseudomembrane. Patients are most often neuropaths.

They should have four or five light meals a day.

In the morning a little soup with milk; or bouillon with or without the yolk of egg; or puddings of cereals except oatmeal; cream of rice; tapioca, sago.

The second meal should be at ten o'clock. The same as in the morning.

At noon cakes (nouilles), macaroni, grated cheese, potato with a little fresh butter, brains, lean fish, cooked in water, cooked crèmes, stewed fruits; a little pure water.

In the evening, the same meal as at mid-day, adding light pudding, some legumes in puree, eggs cooked in the shell, some cooked fruits, etc. Also use rice water with a little lemon juice added.

DYSENTERY.

In dysentery the hyperemic and ulcerated state of the large intestine makes it necessary to avoid cold drinks which immediately reflexly irritate and congest the colon.

May use rice or barley water, acidulated with a little lemon juice and slightly sweetened. May also use bread water.

Exclude strongly acid lemonade and coffee.

The basis of the diet should be cooked or sterilized milk. Later can add gruels of rice, semolina, casein powders, and the yolks of eggs, zwieback, and if milk is not well borne, mutton pulp taken in small quantities. Gruels of barley, almonds, rice succeed less well.

It is necessary to wash and disinfect the large intestine, throughout its whole length, by one or two quarts of water containing half a gram to a gram (7 - 15 grains) of sulphur. ~~Oxxxxfxth~~ One or two of these lavages is usually sufficient.

In the DIARRHEA OF TUBERCULOSIS the same measures should be taken as above outlined.

GASTRO-INTESTINAL RHEUMATISM.

The walls of the stomach and intestine may be the seat of pain analogous to those which affect muscular aponeuroses, a pathological state which has been termed gastro-intestinal rheumatism. This condition is not yet very well known but it is one which Gautier believes to be the origin of a multitude of so-called nervous symptoms.

The condition is most often unrecognizable, and not easily curable.

This condition is in arthritics often produced by the abuse of cold drinks.

The best treatment in all cases is to abstain from cold drinks and permit only hot water. If necessary, give hot water at meals.

DIET IN DISORDERS OF THE LIVER.

It is the duty of the liver to purify the blood while removing impurities of intestinal origin and the products of disassimilation,--glycocol, taurin, pigments derived from hemoglobin, acid amines and ammoniacal salts which are transformed into urea, etc.

The liver aids digestion through the bile which assists pancreatic digestion and the absorption of fats. The liver acts upon peptone, rendering it assimilable. It arrests sugar and transforms it into glycogen. It modifies intestinal fats.

The liver becomes hypertrophic by reason of the congestion when overworked by excess of proteids, fats, etc. The work of the liver must then be reduced as much as possible.

To undertake to remedy hepatic insufficiency by artificial excitants is to resort to the method of the cab-driver, who by a stroke of the whip extorts from his exhausted beast an additional effort, it is true, but at the expense of exhausting its last resources.

It is not necessary to classify disorders of the liver into hyposthenic and hypersthenic, or enlarged liver or retracted liver; for since the liver is the great transformer of the chyle and the purifier of the venous blood, it is only necessary to see that the diet and the digestion shall not continue to impose upon it work which is above its power to perform.

SIGNS OF HEPATIC INSUFFICIENCY.--A. Robin(Bull. therapeutique, March 23, 1904) gives the following:

(1) Presence of urocrythrin in the urine. Urocrythrin is the rose pigment which reddens the feebly acid urine of certain conditions which furnish a deposit.

(2) A lowering of the nitrogen coefficient (the nitrogen of the

urea divided by the total nitrogen). In hepatic insufficiency this coefficient falls below 0.80.

(3) The lowering of the coefficient of the oxidation of sulphur (sulphur mineral divided by the total sulphur).

2 (4) Decoloration more or less of the stools.

(5) Diminution of the reaction of the liver when submitted to the administration of cholagogues.

Gautier adds that in cases where the liver functionates imperfectly, the toxicity of the urine rises above normal, and the phosphotungstic and the silicotungstic reactions indicate in the renal excretion a relative abundance of nitrogen due to alkaloidal substances.

It is known also that nearly all disorders of the stomach and the intestines disturb the function of the liver;and reciprocally the disorders of nutrition which modify the functions of the liver disturb the digestive organs.

The diet in hepatic disease must then, above all, care for the stomach, relieve digestive disorders, and particularly hyperchlorhydria which suffices in itself to excite and congest the liver. Patients must eat moderately, thus lessening the work of the liver. They must eat moderately of fats and sugars, and especially proteids, and particularly those proteids of animal origin. Felsh foods are those the intestinal digestion of which produces the maximum of proteid wastes, of harmful substances, of ammoniacal salts, and especially the oxamate and the carbamate of ammonia which it is the duty of the liver to eliminate through the bile with other waste matters if it has not been able to transform them into urea.

In all hepatic disorders avoid too much food, and especially too much nitrogen. Gautier says "It is necessary then to avoid in all cases of hepatic disease, no matter of what sort, an excess of food, especially an excess of proteids. The latter, besides introducing substances which cause a hypersecretion of hydrochloric acid, react upon the one hand upon the liver by producing irritation of the ampulla of Vater and on the other by imposing upon the liver proteid wastes resulting from the abnormal excess of intestinal fermentations which increase the depurative work of the skin. It is necessary also to avoid foods too highly flavored, too fat, spices, and whatever tends to produce hyperchlorhydria. The same remarks apply with special force to cases in which jaundice exists with gravel or biliary calculi."

Articles especially to be avoided are the flesh of young animals, especially veal, flesh containing an excess of extractives, such as venison, overworked animals, flesh which has been kept too long, salted meats, crustaceans, fat fish, canned fish. The above are especially to be avoided.

"The vegetable and milk regimen are to be especially recommended. Flesh must be absolutely prohibited in atrophic cirrhosis and all other grave conditions of the liver, where the lacto-vegetarian diet must be exclusively adopted."

"Nencki and Pawlow have established that when in the dog by means of an Eck's fistula an opening is made directly from the portal vein to the inferior vena cava, thus suppressing the circulation of the portal vein, the animal may be nourished almost indefinitely on milk, vegetables, and bread; but when flesh is given to the dog, the animal becomes subject to attacks of biting, becomes savage, is taken with grave nervous disorders and finally dies. Nencki showed that in these cases the liver fails to eliminate the toxins which are formed and especially the carbamate of ammonia which is found in the blood and which reacts by its toxicity upon the nerve centers producing the disorders observed."

Gautier page 536.

Milk contains a superabundance of fat. Skimmed milk has only one third to one half an ounce of butter in it to the quart.

Robin considers the milk regimen rigorously necessary in cases of hypertrophic cirrhosis, the congestive period which precedes the atrophic cirrhosis, and in patients with enlarged liver from Reichmann's disease with gastric dilatation. Matthieu recommends a milk regimen in all these cases, especially in cirrhosis. (Bull. therap., March 9,1904)

Fat faods must also be restricted in quantity; consequently also farinaceous legumes and potatoes, dried peas, beans and lentils, and amylaceous matters ~~of~~ which so easily ~~ferment~~ transform themselves in the liver itself into fatty substances.

Alcohol must be proscribed. It congests the liver and excites the formation of fat by preventing their digestion.

Lancereaux has shown that wines are a special cause of cirrhosis.

Coffee and chocolate must be absolutely prohibited, also all irritating vegetables, as green cabbage, Brussels sprouts, mushrooms, truffles, radishes, pickles.

Replace the bread in part by the potato which alkalinizes the blood.

Pepper directly irritates the liver and tends to produce cirrhosis (Budd; Boix). Dishes containing vinegar should be avoided. Lemon juice can take its place. Vinegar tends to produce cirrhosis of the liver. It has twice the power of alcohol (Boix).

Avoid sorrel, spinach, fat cheese, fat fish.

Foods permitted are green vegetables, tomatoes, cauliflower, petits pois, breen beans. These contain a little cholesterin but it does not do any harm because it is insoluble.

In cases of biliary lithiasis, the same regimen should be followed.

In cases of disease of the pancreas, lessening the quantity of fats and increasing the amount of carbohydrates is indicated. When sugar is present the diabetic diet below outlined should be given.

DIET IN DIABETES MELLITUS.

The cause of diabetes is obscure.

There is an abnormal excretion of glucose and of nitrogen. Glucose in simple cases is from 10 to 100 grams a day with 2000 to 2500 c.c. of urine. Nitrogen increases from 50 to 100% above the normal. In severe cases the sugar may increase to 300 grams, and often a thousand grams or more; the quantity of urine may be increased to from four to ten liters.

In the simple cases withdrawal of starch and sugar causes sugar quickly to disappear. In severe cases nothing changes the excretion of sugar; all the tissues are being converted into sugar, and the patient rapidly succumbs and dies, generally of tuberculosis.

The three principal dietetic indications are:

(1) Suppress as much as possible foods which can produce glucose.

(2) Remedy the loss of nitrogen by proper food.

(3) Adapt the diet as closely as possible to the general pathological conditions present.

Replace the starch and sugar by fat,--the same caloric value. The amount of starch and sugar suppressed from the diet should equal at least the amount which is lost in the urine. Beginning with this amount, more and more of the starch is withdrawn until the sugar disappears from the urine.

Certain sugars and starches are tolerated,--levulose, inulin, inosite.

Special vegetables which may be allowed are: Jerusalem artichoke, artichoke, viper's grass, salsify, green beans, chickory, lettuce, cardoons, onions, garlicks, mushrooms. These contain starch which is not converted into glucose, and so does not increase the output of sugar in the urine.

The following vegetables contain such a small amount of carbohydrates that it may be disregarded:--asparagus, radish, watercress, turnip, spinach, sorrel, cucumbers, green cabbage, turnip cabbage, cauliflower, sour-krout, greens of all kinds, dandelions, beet-tops.

The following fruits may be used:--Peaches, apples, apricots, pears, strawberries, raspberries, oranges, lemons, pomegranate. These fruits contain but little sugar (1 to 6%) and half of this is levulose.

Almonds, walnuts, and olives may be allowed.

Bananas, cherries, chestnuts, and grapes, and other fruits rich in sugar, must be avoided.

Bread contains 45% starch; hence not well adapted.

So-called gluten breads contain 8 to 25% of starch. Breads may be made of inulin, almonds, etc. Aleuronat meal consists of ordinary gluten with the addition of dried and powdered vegetables, of which is made the so-called Ebstein's bread. It contains 8 to 20 parts of hydrates of carbon.

It is better to replace the bread by potatoes. This is much praised by Mossé. For equal weight the potato contains one-half as much starch as bread. If the patient can tolerate two ounces of bread, he can take six ounces of potato.

In place of starch substitute fats,--butter, olive oil, etc.,--mixed with vegetables. Patients may take 200 grams (seven ounces) of fat a day.

Patients must have a little starch,--two ounces of bread or four ounces of potatos.

Patients should have as much proteid as they can digest, especially when acetonuria is observed. (Cream, eggs, koumys, cottage-cheese are especially good; also protose, gluten preparations, casein powders and nuts.--J.H.K.).

Saccharin quickly injures the stomach.

Foods which must be forbidden are preparations of cereals, beans, peas and lentils, rice, tapioca, ordinary bread(except to the extent of two to four ounces daily), all sweet fruits, tapioca, carrots, beets, honey, malt honey, cane-sugar, chocolate, and sweet drinks.

The best drinks are water, and lemonade without sugar.

If there is albumin in the urine, the patient should not take more than two eggs a day.

AZOTURIA. PHOSPHATURIA.

Azoturia,--nitrogen in the urine in excessive quantity.

There is excessive loss of nitrogen in cases of diabetes insipidus.

These cases do not require restriction of the use of carbohydrates. The use of glycerin diminishes the elimination of nitrogen.

Phosphaturia observed in nervous affections, diabetes insipidus, chorea, leukocythemia, chlorosis, dyspepsia, atrophy of the liver, after epileptic attacks, and in pulmonary affections.

The best foods to restore the phosphates are peas, beans, and lentils, bread, and the yolk of eggs.

Phosphaturia exists when the amount of P_2O_5, phosphoric acid, exceeds four to four and a half grams a day, or 18% of the total nitrogen excretion.

Azoturia and phosphaturia may exist at the same time.

Azoturia exists when the amount of nitrogen eliminated in twenty-four hours exceeds 20 to 22 grams, <u>the diet remaining the same</u>.

DIET IN NEPHRITIS.

In nephritis occasioned by certain toxins, as cholera, measles, smallpox, diphtheria, scarlet fever, typhoid fever, tuberculosis, and in those due to all the different poisons,--arsenic, phosphorus, lead, mercury, alcohol, etc.,-- and in those due to reflection to the kidney of functional disorders of the skin produced by cold, burns, and various skin disorders, in parenchymatous nephritis and in interstitial nephritis, the kidney acts like an obstructed filter which allows the waste products of proteid disassimilation to escape too slowly. On the other hand it allows some of the albumin to escape from the blood.

The proteids of the food may excape from the kidney normally when one takes too much or when the kidneys are congested by violent exercise.

The degree of permeability of the kidney may be measured by the time required for the elimination of methylene blue which has been swallowed. It may also be determined by the amount of ~~xxxxxxx~~ delay in the removal of waste matters when the amount of proteids is suddenly increased. In such cases the amount of nitrogen eliminated increases rapidly when the amount of proteid is increased, falls to normal again in two or three days after the excess is no longer taken in. When the kidneys are diseased the rise in the amount of nitrogen excreted is less rapid, it does not go so high, and remains at the same level for several days after the excessive intake ceases. The renal insufficiency is also more perfectly still indicated if after the injection or absorption of eight to ten grams of salt, the same is imperfectly eliminated during the following days, and especially when the excess of chloride of sodium does not appear after twelve to twenty hours after it is introduced, and if its elimination continues during several days. Iodide or bromide of potash may be used instead, noting especially the time of first appearance.

There is generally loss of albumin to the amount of .5 to 3.5 grams per day. The urine is reduced in quantity to 800 and sometimes 500 c.c.

The patient is generally dyspeptic, hasloss of appetite, and diarrhea. Assimilation is not good. There is sometimes azoturia.

Since the kidney cannot readily purify the blood from toxins, and other offensive products, it is necessary to reduce these to the minimum by diminishing to the greatest possible degree the consumption of the substances from which they originate, at the same time sustaining the patient whose assimilative powers are enfeebled.

Forbidden foods:--Fish, shell fish, game, sweet breads, kidneys, liver, gelatinous meats, bouillon, beef juice, cheese, salted foods, spiced foods, beer, coffee, tea, brandy, and wine, onions, garlic, radishes, cabbage asparagus, truffles, mushrooms.

Milk diet and rest are the chief factors in remedying chronic nephritis. (Chrestien and Semmola). Skimmed milk is better than whole milk. Some disadvantages of the milk diet: fatigue of the heart, anemia, excess of liquid.

Mixed diet is better in the majority of cases. (Von Noorden, Senator, etc). Bread puddings, gruels, farinaceous soups, purees of peas, beans, lentils, potatoes, rice, fresh vegetables with the exception of asparagus and cabbage, all the fruits, may be used in connection with milk. These foods produce little or no urinary toxins. Eggs, well boiled, may be added (Oertel, Ewald).

A patient passing 12 grams of albumin a day,when put on a milk diet passed only 2.5 grams. When given 10 grams of common salt the amount of urine fell to 600 c.c., edema appeared, and the albumin increased to 11 grams. The milk was replaced by 450 grams of meat, 1000 grams of potatoes, 100 grams of sugar, 80 grams of butter, 2500 grams of water, all without the addition of salt. Under this regime the albumin fell to 1 gram, the amount of urine passed was 1500 c.c. to 2000 c.c., and the edema disappeared (P. Prieur, Theses de Paris, 1903).

Bread without salt contains 2/3 of a grain of salt to the pound.

Fruits and vegetables without salt contain 2 grains to the pound.

Peas, beans and lentils 4 grains to the pound.

Milk 8 grains to the pound.

Salted bread 13 grains to the pound.

The average daily food contains in the natural state about 1 gram of salt, but we add 10 to 12 grams which we may avoid if we will.

According to Richer the ordinary ration contains one gram of salt taking the food in its natural state (Traitement par la bromuration et l'hypo-chloruration. Mónde Medical, Feb. 15,1904).

500 grams of bread without salt add 0.14 grams, making 1.14 grams in all.

500 grams of salted bread contain 1.20 grams. Adding this to the ordinary ration makes 2.20 grams of salt.

A milk diet of three liters contains 3.40 grams of salt. A milk diet of three liters with the addition of 500 grams of salted bread give 4.60 grams of salt.

Less salt will be found in the ordinary diet without salt than with a milk diet.

In cases in which there is too much albumin, that is, three or four grams to the liter, and the kidney little permeable, as shown by the slow filtration of salt, frequent subacute attacks of nephritis, edema, signs of uremia and danger of eclampsia, and in all cases of pregnancy with albumin in the urine, even in the smallest amount, a milk diet should be adopted at once, or the ordinary diet with salt excluded. Rice and other cereals including bread may be added, also sweet fruits if salt is excluded. As the patient improves, green vegetables, potatoes, eggs, peas, beans and lentils may be added. Alcoholic liquors, cider, beer, spices and smoked meats must be interdicted. (Use skimmed milk that has been concentrated to one half its volume to avoid the inconvenience of too much liquid).

If the milk produces diarrhea, add a little subnitrate of bismuth, milk of almonds, porridges with casein, kefir, kumys, etc.

- In the dropsy of Bright's disease, employ a milk diet and foods without salt.

CYSTITIS.

In cystitis the same diet as in nephritis may be employed.

Add to milk the yolk of eggs, soups, vegetables, bread, raw and cooked fruits.

Prohibit spices, meat juice and extracts of meats, bouillon, alcohol, coffee, beer and wine.

Use little or no animal food (Gautier).

Veal and fish are prohibited. They irritate the urinary passages and produce eruptions and bleedings. They produce eczematous eruptions and serious oozings which may even bring blood.

These patients should dilute the urine as much as possible by drinking much water. Decoctions of barley, with balsamic teas, milk, creams and soups with milk, almond emulsions; fruits either raw or cooked, or in jellies, mulled eggs, are all permitted. Fruits are especially favorable because they alkalinize the blood.

BLENNORRHAGIA.

In this condition the same diet is indicated as for cystitis.

The prohibition of meats, fish, fowl, shellfish, all the exciting dishes, coffee, spices, wine, beer, salted meats; and the free use of milk, and later purees of peas, beans, lentils, fresh vegetables and eggs, may take the place of milk.

Onions, celery, garlic, mustard, radishes, asparagus must be avoided.

Gautier page 551.

DIET IN DISEASES OF THE HEART AND BLOOD-VESSELS.

Organic diseases of the heart are divided into two classes, according to Huchard,--valvular and arterial.

Valvular disease tends to lower arterial tension.

Arterial disease tends to raise the tension.

Asystole, tachycardia, feebleness of the heart, collapse, are signs of hypotension. It is generally the result of toxins, bacterial in origin, acting on the centers which control the circulation. This condition is found in typhoid fever, broncho-pneumonia, meningitis, eruptive fevers, grippe, tuberculosis, acute poisoning.

Avoid excess of starch when the heart has a tendency to fatty degeneration.

Avoid salt in the food when there is edema.

When arterial tension is low the renal filtration is always bad, and the proteid ration especially flesh food must be diminished as much as possible.

Drinks should be as miderate as possible.

Artificial serum may be injected (salt 8:1000) with great advantage.

In arteriosclerosis, sclerosis and hypertrophy of the heart, arterial disease in acute rheumatism, gout and diabetes, in myocarditis, aortitis, angina with changes in the arteries of the heart or from the action of special toxins,renal or hepatic insufficiency, etc., there is arterial hypertension.

These conditions are most often due to errors in diet. Says Huchard: "I am convinced that excess, and especially errors in diet, by throwing into the system a great quantity of toxic substances such as ptomains not eliminated by the renal filter, which soon becomes impermeable, are a frequent cause of arteriosclerosis. There is in consequence in the entire arterial system a state of spasm more or less permanent, which produces at first hypertension and later arterial sclerosis. Consequently it is necessary to prescribe a regimen from which shall be excluded all foods which contain more or less ptomains and extractive matters." (Huchard, Traité des maladies du coeur et des vaisseaux, 4th edition, p.766).

"The same author has established by twenty years of clinical study that among the causes which produce arteriosclerosis must be especially mentioned alcohol, tobacco, condiments, spices, excesses at the table and particularly a diet too rich in meat, which acidifies the blood, diminishes the oxidations, and tends to form deposits of urates and phosphates. All these waste products, these mineral salts, by diminishing the elasticity of the vessels which they little by little thicken, increase the fatigue of the heart, which is obliged to battle against this passive resistance"(Gautier).

"Intellectual or physical overwork by interfering with nutrition and disassimilation may act in the same way." Gautier.

The diet should contain as little as possible of nitrogenous wastes to avoid acidifying the blood and encumbering the arteries, liver and kidneys. The milk diet is indicated. An absolute milk diet is not convenient because it is necessary to combat hypertension. Hence we may add sugar, vegetables, creak of milk, preparations of casein. The patient may thus be nourished with 1800 grams of milk or less, instead of three liters, without overworking the heart, increasing arterial tension by the absorption of too much liquid, and without forcing the kidney to eliminate too much urine.

Rumpf and Karell are in error in rejecting the milk diet with the idea that it would contribute too much chalk to the arterial tunics. This theroetical objection falls before clinical facts, and also before the fact that chalk is supplied in much greater quantity by vegetable foods which we could not easily dispense with in these cases.

Vegetables which should be avoided are: cabbage, radishes, mushrooms, strawberries, celery, and all highly seasoned dishes.

All substances which excite the heart should be excluded, as coffee, tea, alcoholic liquors, wines, chocolate, vanilla, cinnamon, spices, salted foods, extracts of meat, consommés, meat extracts, highly seasoned and hot dishes, old cheese, pork.

Excess of liquids should be avoided.

In CARDIAC EDEMA discard salts from the food entirely.

In all cardiac cases avoid indigestible dishes, freid foods, fat fish, very coarse vegetables.

Eat very little at night.

If with the hypertension there is plethora, if the heart is large and hypertrophic, pulse strong, if there is palpitation, tendency to cerebral congestion, with some signs of arteriosclerosis, foodshould be reduced to a marked degree, especially the proteids. All condiments and spices should be suppressed. A special cardiac dietary should be strictly followed.

Slight and frequently repeated purgations may be usefully employed.

ARTERIOSCLEROSIS.

Invasion of the arterial walls by the salts of chalk, phosphates, urates, and other residues which diminish their elasticity and their resistance, is a vice of nutrition often met in gouty cases, arthritics, rheumatics, plethoric persons, great drinkers, great eaters, and especially in great eaters of flesh.

Chalk is not the cause of arterial sclerosis. Milk and vegetables, although rich in chalk, do not have the injurious effect in cases of gout and rheumatism, arthritism and arterioscleroris that meats have, although the latter contain very little chalk. The same is true of other substances which contain no chalk which are very injurious in these cases, as coffee, alcoholic liquors, ~~[illegible]~~ wine, beer, spices, condiments, chocolate.

It is especially important to avoid everything which tends to produce puric bodies in the system (uric acid, adenin, xanthin, etc).

HEMORRHAGE.

In all cases of hemorrhage the diet should be employed which is recommended for arteriosclerosis. It is especially necessary to avoid drinks, hot dishes and irritating condiments, tea, coffee, aerated waters, etc.

After intestinal hemorrhage the diet should be of skimmed milk, light porridges, gelatin, rice, barley, and in severe cases the injections of serum and rectal alimentation as recommended in cases of round ulcer.

DIET IN PULMONARY TUBERCULOSIS.

Empiricism has shown that proteids and fats, rich in phosphorus, are the most efficient in bringing the body into a state of resistance to Koch's bacillus. Among these, flesh, fish, brain, milk, fats of animal origin(cod-liver oil is the best example), with exercise in the open air which improves nutrition, are the best means of fortifying the individual against the invasion of the tubercle bacillus.

Cases must be divided into two classes: febrile and non-febrile.

With rest and proper care the fever must be reduced. Then the dietetic treatment may be applied.

The patient needs to eat a large amount, but often he is dyspeptic and cannot digest a large amount. Drowsiness after eating, weight in the stomach, indigestion and diarrhea, are signs of excessive alimentation. Pyrosis, pain in the stomach, especially in the night, flushings of heat in the face, indicate gastric hyperesthenia or hyperchlorhydria.

When the patient has nearly regained the weight he has lost, nothing will gained by going beyond this point.

"The most valuable foods are milk, yolk of eggs, meats, shellfish, fish, brains, peas, beans, lentils, fats, red wine, cocoa and coffee." (Gautier).

(Unfinished).

DIET IN ANEMIA.

Disassimilation of proteids is increased. Hence the patient should not exercise too much. He needs his oxygen to support the internal combustions. This is especially true in cases in which the anemia is due to hemorrhage. Hemorrhage always increases the destruction of proteids. (Breathing exercises with the patient lying in his bed, with abdominal compression, would be good.--J.H.K.).

Diet:--Fresh eggs, purees of cereals, peas, beans, lentils, green vegetables, supply phosphorus, chalk, magnesium and iron.

Avoid too much fat, excess of sugar and starch.

The body requires daily one to one and one-half grains of iron.

Stoklasa has shown that hematogen, a vegetable substance rich in iron, is contained in the nuclei of vegetable cells as well as in the yolk of egg. According to this authority a pound of dried peas contains 6.3 grains of this substance rich in organic iron, especially prepared for assimilation by animal tissues. (This observation of Stoklasa sufficiently emphasizes the importance of the free use of green vegetables, especially those which are easily digestible, in cases of anemia and chlorosis, in which rapid blood-building is of the first importance. (J.H.K.)

Danford, Fraser, Ehrlich and others have recommended the use of fresh, raw bone marrow from the tibia of the calf.

DIET IN LEUKEMIA.

Little can be accomplished by diet in these cases. The body xxxxxxxx seems to have lost its power to make red cells.

The excessive formation of uric acid should be borne in mind. This forbids the use of meats, gelatins, bouillons, etc., and indicates the free use of milk and vegetable products free from uric acid and allied compounds.

DIET IN CHLOROSIS.

Anemia is generally present, also excessive destruction of proteids; hence the indications are the same as in anemia. It is especially important to stimulate the appetite in every way possible.

According to Krause, the alkalinity of the blood is normal in chlorosis (?).

Patients should take little exercise.

Cold air treatment especially indicated.

RICKETS.

In rickets there is a diminished amount of phosphorus in the bones. The percentage of calcium phosphate falls from 57.5% to 14.5%. At the same time organic matter rises from 33.5% to 72%.

Voit (Zeitsch. f. Biolog., Bd.XVI, p.62) showed that animals deprived of salts of lime became rickety.

Rüdel, Uffelmann and Baginsky(Rüdel, Arch. f. Path. u. Pharm., Bd. XXXX XXXIII, p. 90; Uffelmann and Baginsky, Prakt. Beitr. z. Kinderheilk., 1882) showed that rickets occurs in infants who have an abundance of salts of lime, the lime being carried off in the urine.

The exact cause of rickets is probably not yet known. It is probably due to the influence of toxins which produce malnutrition. It may be due to deficiency of hydrochloric acid or to an excessive production of lactic acid in the stomach and intestines from abnormal fermentations. Lactic acid being absorbed prevents the propoer deposit of phosphates (Heitzmann, Hoffmeister and Baginsky).

Avoid foods which readily undergo lactic or butyric acid fermentation; coarse foods difficult of digestion, green fruits, cow's milk.

Foods indicated: Zwieback, purees of peas and lentils, foods rich in phosphates.

Fresh air, sea-baths, salt baths , are also indicated.

OSTEOMALACIA.

Foods indicated in osteomalacia: milk, bread, herbaceous vegetables, foods which contain a large amount of lime.

(Make a table showing the amount of lime contained in ordinary foods, and the amount required of some of the leading foods to furnish the body the amount lost in twenty-four hours.)

DISORDERS OF THE SKIN.

Many skin diseases are caused by the use of flesh, especially veal, game, meat kept for a long time, also by spices, fish and shellfish. This is especially true of urticaria, eczema and impetigo.

Errors in diet always aggravate skin disorders and provoke them in persons predisposed, as in arthritics.

Foods to be avoided are: Cheese, game, pork, veal, chocolate, coffee, beer, spices, highly seasoned foods, concentrated foods, fat dishes, wine, fish and shellfish.

Veal often produces eczema and persistent acne. It irritates the intestinal mucous membrane and the urinary passages.

The vegetarian regimen is recommended.

Strawberries should be avoided in cases subject to urticaria.

Avoid vegetables containing oxalic acid,--sorrel, spinach, rhubarb, leeks, and string beans.

Avoid constipation. Absorption of putrescent matters from the colon is a frequent cause of skin troubles.

Gautier page 570.

SCURVY.

Caused by deficient nutrition either in quantity or in quality, also by mental or physical exhaustion. It is encouraged by salted meats.

Vincent (Soc. de biologie, séance of June 4, 1904) showed that chloride of sodium introduced into the blood or under the skin encourages the invasion of the system by infectious microbes.

The indication is for fresh vegetables, potatoes, which furnish potash salts, lemons especially.

Salted meats often contain amides which are not assimilable, and may even be toxic, the result of the action of ferments naturally contained in meat.

In the absence of fresh vegetables, use a decoction of leaves of trees, common herbs, mosses and lichens.

Apples, prunes, pears, oranges, grapes and lemons are especially helpful.

CANCER

Beneke has shown that the vegetarian diet is especially indicated in these cases, and produces a favorable effect.

Cancerous cachexia is due to the absorption of poisons which are formed by the neoplasm. Hence, it is a logical conclusion that the most appropriate diet is the one which will introduce into the system the least amount of proteid residues, which is naturally a vegetable diet with the addition of milk.

DIET IN NERVOUS AFFECTIONS AND IN INSANITY.

Neuropathic conditions and nervous exhaustion result from habitual overwork, exhausting nervous excitements, lack of sleep, exhausting or exciting exercise, errors in diet, especially the excessive use of flesh food.

Says Gautier: "Physical overwork induces lassitude, and depression, and lack of appetite, but rarely produces neurasthenia. Mental overwork associated with deficient exercise acts differently. If the diet is abundant or even moderate, the income may materially exceed the loss. The organic disassimilations, the oxidations, thus become incomplete. The excretory materials have a high molecular weight, and they are generally offensive, and soon accumulate in the tissues and fluids, and render their functions abnormal."

"Emotional excitement, mental overwork, excessive indulgence of the artistic or literary taste, erotic excitement, lack of sleep, produce the same effects upon nutrition and disassimilation. Whatever disturbances affect the digestive and assimilative functions, increase the proteid losses, as is demonstrated by the increase of urinary toxicity. These toxic substances act upon the nerve centers producing irritation, slowly increasing intoxication."

Indications: Foods easily digestible, sufficiently nutritive, but producing [redacted] the smallest possible quantity of proteid wastes.

Advanced neurasthenics often show but a small amount of nitrogen in the urine. They assimilate but a small part of what they eat; and of the total nitrogen of the urine, an abnormally large proportion is made up of alkaloids.

Gautier recommends the Weir-Mitchell treatment,--milk diet and rest at the beginning.

"These patients should never be allowed highly seasoned food. It is especially necessary to avoid flesh meats which act upon the nerve centers through the irritating proteid substances which they contain, substances which are dangerous especially to those in whom digestion and assimilation are imperfect."

Gautier recommends especially the vegetarian regime with the addition of acid drinks, whey, etc. Preparations of casein may be used with advantage as they do not overwork the liver, and they give proteid residues which are non-toxic in character.

In painful affections of the nerves,--sciatica, facial and visceral neuralgias, the diet has a great influence. Everybody knows that neuralgic pains are often aggravated soon after eating, when the products of digestion have enter the circulation.

Neuralgics and patients who are subjects of hysteralgia, as well as neurasthenics, are especially irritated by foods which are rich in proteids. These foods, if they do not produce gastralgia, maintain it.

The proper diet is green vegetables, vegetable jellies, the vegetarian regimen in general, and milk. Peas, beans and lentils are especially indicated as they are rich in phosphates.

In nervous asthma regulation of the diet sometimes works marvels in the way of results. Flesh should be eliminated, also alcohol. The diet should be confined to foods which are easy of digestion.

INSANITY.

Indication: Substantial nourishing foods, especially purees of peas, beans and lentils, green vegetables, prunes, and other fruits, also eggs.

Meats should be discarded from the dietary.

The influence of diet is well seen in the influence of diet consisting of flesh upon animals. "The bear and the rat fed upon meat became violent and ferocious, while they were gentle and manageable on a vegetable diet." From this fact the favorable influence of a vegetable diet in agitated and dangerous maniacs may be readily inferred.

When it is necessary to use the stomach tube or the nasal tube, we may use casein powder, milk, whites of eggs, mixed with bouillon, purees of peas, beans and other foods which are highly nourishing in small volume. Starchy foods should be used in small quantities.

If fats are employed they should be in a form of an emulsion.

DIET IN FEBRILE DISORDERS.

The diet is essentially the same in all febrile disorders. It should be very simple and such as to hinder as little as possible the efforts of the body toward restoration of health.

"Abstinence of food, more or less complete, is itself advantageous. It spares the digestive tract; it decongests the liver, the lungs and the brain; it diminishes the work of the heart; it favors the absorption of toxins."

This plan has also its inconveniences. The fever consumes the tissues as shown by the elevation of temperature and the large amount of heat lost and the analysis of the excretions. Krauss and Loevy have shown that in febrile cases taking no food, the absorption of oxygen and the elimination of CO_2 are at least equal and sometimes superior to that which occurs in the normal state. It is also established that in acute fevers the destructive metabolism of proteids and consequently the amount of waste matter having this origin, exceed by 8 to 15 grams per day at the beginning and especially at the critical period, the amount of nitrogen furnished by the foods. The febrile patient burns his own tissues, both proteid matters and fats, as is shown by the large amount of proteid materials in the urine. The amount of heat lost by the febrile patient is practically the same as that of a person in health, 2000 to 2400 calories per day.

Fasting produces profound anemia. Dennis has shown for 1000 parts of blood in a young man: before the fasting, red globules in a dry state 154 grams; water 750 grams; after 40 days, red cells 111, and water 800.

It is necessary then that the febrile patient be fed a little. Besides it is known that when abstinence is too prolonged, the mucous membrane of the stomach becomes changed and loses its ability to secrete gastric juice.

Too severe a diet enfeebles the patient and prolongs convalescence.

In former times when abstinence was employed to excess patients sometimes diet from inanition.

Gautier page 580.

Buss and Von Noorden have shown that typhoid fever patients and febrile patients in general, lose less weight, have less fever, and shorter convalescence when they are nourished with proteid foods than when they are subjected to a severe regimen, on condition only that the foods administered must be liquid in form and easy of digestion, such as milk, puddings, light porridges, peptones of good brand, etc.

Piorry (Pneumonies des viellards) observed that in pneumonia cases, those who were fed recovered better and more quickly than those who were not.

The febrile patient digests badly, as does an exhausted man. He has no appetite. His salivary glands secrete little or nothing. His gastric juice is nearly inert, poor in pepsin and hydrochloric acid (Ewald and Klemperer). The function of the liver is suspended ~~fax~~ if the fever is high. The intestinal secretions are in large part suppressed. Too rich food exhausts the stomach rendered hyperesthetic by the fever. It rejects foods which are heavy, too abundant, or too exciting. This is observed in relation to meat, meat juice, fatty substances, wine, etc. Dyspnea and syncope are more likely to occur during digestion.

The best guide is to give as much food as can be eaten without increasing the fever. Except in cases of ulcer of the stomach, typhoid fever, dysentery and cases of dementia, the appetite of the patient may serve as a guide, but there is no absolute rule. In convalescents the appetite is a good sign and should be at least partially satisfied.

In many patients,--tuberculosis, anemics, chlorotics,--there may be no sense of hunger to indicate the needs of the body, and so the appetite is not in these cases a good guide.

A practical rule to follow is that the diet should not increase the fever, nor produce insomnia or intestinal disorders, nor cause the appearance of albumin in the urine.

There is sometimes appetite in fever, especially in young persons and young xx children which is likely to be accompanied by slowing of the pulse and a fall of temperature, an indication that more food is needed. Young children especially must be fed. They are not able to support the withdrawal of foods for a long time. An infant digests, notwithstanding fever.

Very light vegetable or bread soups, cream and jellies should be the basis of the diet for a young fever patient.

It has been demonstrated that foods which fever patients digest the best are hydrates of carbon, those which they thx accept with the greatest difficulty are the fats. Proteid substances are intermediary. It follows that the fever diet should furnish the patient especially with sugars, and starchy substances; milk should always be given in small quantity and as much as possible deprived of its fats. Fats do not find in the intestines the usual solvents and digestants and hence cause repugnance. Cream and milk and even a small amount of butter may be taken in moderate proportion.

Food does not raise the temperature unless the substances contained are badly digested or taken in too large quantity, except in cases in which the intestinal tube itself is affected, as in peritonitis, typhoid fever, gastritis, enteritis.

Proteids must be given, and it has been observed (Bauer and Künstley, Deutsch. Arch. f. klin. Med., Bd. XXIV, Heft 1), that the amount of nitrogen in the urine diminishes with an increase of the amount in the food. With no albuminoids in the food the loss of nitrogen was 14 to 16 grams a day. With 51.7 grams of nitrogenxinxthe proteids in the food, the loss was 6.3 grams.

When the fever is of long duration, milk will not alone suffice. Slightly cooked eggs may be given.

In general fever patients should take only liquid or semi-solid food. It is tiresome to chew the food. Soups, purees, nutritive juices and drinks are the best. The amount of food taken at one time should never be large. The interval between feedings should be three hours. Feedings should be repeated four to six times a day. No food should be given until the previous meal has passed through the stomach.

Give as little food as possible at night. Do not wake the patient to feed him. This rule is not observed when there is a pressing demand for nutrition.

For the average patient twenty-five calories per kilogram of body weigh or 1650 calories per day, is sufficient usually.

It should not be supposed that patients can be fed to any extent with the juice of meat or concentrated bouillon of beef, veal or fowl. These preparations contain only a few grams of proteid matters to the liter. By their use we introduce into the blood of the patient which is already charged with the waste products of the fever, not the essential part of the flesh as was formerly supposed, but an excess of irritating extractive matters the destruction of which is incomplete and which exhausts the stomach, the liver, the kidneys and the heart. Bouillon is a condiment more than a food. The gelatin which it contains in small amount cannot be assimilated by the cells unless previously peptonized. Besides, it is a very incomplete food.

Peptones and powdered casein may be used, lemon juice, yolk of egg, soups, cream of rice, toasted bread, sago and tapioca.

Beef bouillon is often not tolerated by the stomach. Bouillons of legumes may then be used.

Avoid cabbage, carrots, lettuce and potatoes.

Peas, beans and celery may be used.

Milk is not easily digestible especially if the fever is high. Buttermilk or skimmed milk is preferable to ordinary milk. Almond milk, whey, may be also used. Purees of peas, potatoes, carrots, tomatoes, barley gruel and oatmeal gruel are good. Omit cabbage and haricot beans. May also use porridges of barley, oatmeal, wheat, rice, using one part of meal to ten parts of water. This may be used when the fever begins to fall a little. A little later stewed fruits may be used,--plums, prunes, apples, cherries.

Condiments of all sorts must be avoided.

Lemonade is an excellent food. It should be sweetened(try malt honey,--J.H.K.)

Fruit juices of all sorts may be given, taking care to swallow nothing but the juice. It is better to add something to the water to encourage its absorption. If the patient prefers pure water, it is better for him.

Gautier says it is not best to give the patient large quantities of water, as it burdens the stomach and intestines and overworks the kidneys. In place of the ordinary teas, it is better to substitute lemonade, [illegible], cold or hot, prepared with lemons, organges, pomegranates, [illegible] currants, cherries, apples.

Drinks may be given, cool, cold or hot. The cold drinks should be omitted when there is congestion of the lungs, diarrhea, dysentery, or visceral rheumatism. Hot drinks are especially useful when the patient is chilly or when it is desirable to induce perspiration.

DIET IN PNEUMONIA, and OTHER FEBRILE AFFECTIONS.

Bland foods and drinks are necessary toavoid exciting cough in PNEUMONIA. Barley water is especially good. Avoid hot and cold drinks.

Milk often produces intestinal disturbances.

In FEBRILE TUBERCULOSIS Gautier recommends 100 to 120 grams of meat pulp twice a day, taken raw at the end of the meal. If milk is taken, it should be mixed with water. Pure milk increases the fever; also hot drinks: Kefir, kumys and buttermilk are recommended.

If the patient has diarrhea, discontinue cooked meats,milk and eggs. Take only rawx meat, meat juice, albumin water, cream of rice, barley gruel, bouillon with sago. The higher the temperature the greater the amount of nourishment the patient needs, but care must be taken that the food is digested (This diet needs to be reconstructed.--J.H.K.).

DIET IN RHEUMATISM, PERICARDITIS AND ENDOCARDITIS.

In acute rheumatism the milk diet is the only logical diet. It increases diuresis and reduces the toxins to a minmum. For drink, give lemonade.

Care must be taken that the milk is digested well. Otherwise the diet is the same as in other fevers.

In pericarditis and endocarditis the milk diet is best, but the quantity must be reduced to one liter a day at the most.

Fruit juices are more favorable. Later, eggs and purees of vegetables may be taken.

When the arterial tension is low, the renal activity is diminished, and hence foods containing waste products must be avoided.

ACUTE MENINGITIS.

In acute meningitis there is usually nausea, vomiting, constipation and thirst.

During the first days no food, only ice or cold infusions of fruits, as prunes, etc., also lemonades, may be given. Also peppermint water.

Avoid spirits, coffee, tea, bouillon and hot drinks.

When the fever falls, give bread water, fruit jellies, etc.

Later give bread puddings, porridges, milk with considerable water, in addition, also yolks of eggs.

Nutritive enemas are indicated when there is persistent vomiting.

ACUTE AFFECTIONS OF THE DIGESTIVE TRACT.

ACUTE GASTRITIS.

Acid fruits agree well.

When the fever falls, give stewed fruits, eggs cooked in the shell, and easily digestible vegetables.

ACUTE GASTRO-ENTERITIS.

If accompanied by vomiting and diarrhea, especially in young children, suppress all food for twenty-four to forty-eight hours. Give only ice or ice-water. Later give barley water acidulated with a little lemon juice, with the addition of a little sugar or vegetable bouillon, albumin water, toast water.

Later give porridges, and milk and water.

So long as the febrile state exists, no solid food should be given.

Bouillon and milk should be avoided at the beginning of the gastro-enteritis, first because it stimulates contractions of the stomach and intestines and irritates them; and the second (milk) because it is difficult of digestion and increases the diarrhea and nausea.

For persistent vomiting give the stomach complete rest. Nourish the patient by enemas.

DYSENTERY

Skimmed milk, boiled, with the addition of a little lime water or subnitrate of bismuth, is indicated. Give two to two and a half liters a day at intervals,--6 to 8 ounces every three house. It should be swallowed very slowly, and well insalivated.

If milk is not tolerated, vegetable bouillon with the addition of a little rice of starch (avoid oatmeal), rice-water, albumin water, slightly sweetened, mulled egg, skimmed milk diluted with water.

Avoid cold drinks and acid drinks, beef tea and meat extracts, aerated waters and condiments of verious kinds, all of which stimulate peristalsis.

Later when the diarrhea is diminished, add porridges, green peas, and vegetable stews.