

# FUTURE IMPACT OF DENTAL SCIENCE ON DENTAL EDUCATION

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R. R. RANNEY

*The University of Alabama at Birmingham, Birmingham, Alabama 35294*

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My purpose in this brief paper is to assess the future impact of scientific advances, such as those described by others in this symposium, on dental education. A disclaimer is usually in order at this point, something about the risks of being wrong about the future, but, not being particularly cautious, I'll state unequivocally that I think that there will be four major impacts. The disclaimers that I *will* make are two-fold: First, the impacts of new scientific advances are inextricably bound and confounded by other major changes affecting dental education. In particular, these are changes in dental disease patterns, related to past scientific achievement, and demographic changes which constitute a more independent variable. It is impossible to isolate totally the impact of scientific advances from the impact of such other variables. Second, the rate of change in scientific information and, thankfully, its unpredictability limit my forecasts to the relatively short-range future. This is tempered by the general slowness of institutional change, so my forecast is for something like the next five to ten years, beginning immediately.

Having disposed of disclaimers, I will state the four major impacts that I see, and then make a brief elaboration on each:

1. Dental schools will make a choice, consciously or unconsciously, whether or not to achieve a better integration with their parent University or Health Sciences Center.
2. Major shifts in allocation of curricular time will occur.
3. The formal education of a dentist will be expanded in time.
4. Most schools will require an internal restructuring in order to support and sustain these changes.

The first of these relates to the traditional and accepted role of Universities as the repositories for knowledge and the generators of new knowledge, and to the fact that the current and future rate of change guarantees that isolation means stagnation. With the complexities and extent of modern science, dental schools in and of themselves will not be able to develop the manpower and facilities to keep abreast

of and capture for their programs those advances in knowledge that facilitate advances in oral health care. If we don't participate, however, someone else will do it without us. Thus, the choices made by dental schools will have major consequences for the development of the profession and the delivery of health care. Being an optimist, I think that most schools will make a conscious choice to foster the integration, but this will take effort. For some, who reside in parent institutions that may not have appropriate understanding of the value of dentistry and dental research to their research and service missions, initiative and hard work from the dental school will be required. For those schools, to fail to take those initiatives and make those efforts will amount to a choice not to achieve improved integration. For some others, who may be pushed or pulled by the parent institution toward better integration, to resist will be a choice against it. For yet others, the effort may be to preserve and protect the integration they already enjoy, so as not to lose it.

Obviously, my bias is that we should choose integration rather than separation or internal isolation. This must be a true integration, and there are inescapable consequences for our internal function. We cannot expect integration without being subject to the expectations of the larger institution. We must share in their respective missions. We must provide traditional University scholarship, and this has implications for our appointment, tenure, and promotion systems. It is unlikely that many dental schools can survive in future symbiosis with Universities without the scholarship which is demanded of a University faculty. Dental schools must be willing to adjust their self-conceived missions to a wider scope, including service of the mission of the University. Those in urban Universities will have a different slant, derived from University-guided mission, than do those in the traditional University setting of a smaller community and state- or nation-wide primary constituencies. Those Universities that view themselves as comprehensive, research Universities will demand comprehensive research programs from their components, including Schools of Dentistry. These demands are not easily met. Importantly for our future, they put substantial strain on the training base that exists for

future dental faculties. This vision of the future demands that we improve quantitatively the training network for future faculties, and that network must have a research emphasis. I believe that the alternative to pursuing closer ties with the University is nothing less than a choice for a subdivision of our profession. Those who achieve or maintain integration with the University will form the base in education and research for continuance of the right to full professional and academic status, while those who opt out through choice or neglect will form the base for a redefined technological health care delivery arm which will have to struggle for the right to maintain independent professional status. I know these are not new thoughts, but ones that have been argued before, perhaps to the extent that some may view them as "crying wolf". However, I believe that the rate of acquisition of new knowledge in the health sciences has made them more cogent, and demands more serious attention than ever before.

The second major impact, that on curriculum, relates not only to content for a DMD or DDS degree program, but also to extended results of the closer tie to the parent University. As we find it necessary to introduce new material into curricula, we will also find it advantageous to open what has been a closed system. Namely, we will move toward making our expertise more widely available to students of different types in the University. It will no longer be strange to have students of engineering, anthropology, or materials sciences, for example, registered in courses that used to be reserved for dental students only. The point of control for dental schools in determining output of dentists will move from admission to *any* dental courses to admission to clinical courses involving the treatment of human patients. With respect to the core curriculum to be required for the award of the DDS or DMD, schools will attempt to incorporate the new health science knowledge through shifts in curricular time. With the necessity to include more information about new diagnostic approaches, the use of information systems, new materials, molecular genetics and its constantly emerging applications to the health sciences, clinical human genetics, and so on, in the context of the apparently declining quantitative need for the traditional focus on restorative and prosthetic procedures, time will be shifted away from these latter areas so that new curricular offerings can be made. In addition, the basic science departments, which are concentrating increasingly on cell and molecular biology, will find it increasingly difficult to maintain such teaching faculty as the traditional anatomist or physiologist, because such individuals have increasing difficulty competing for grants with those versed in the newer biological technologies. These forces will create the necessity for an increased commitment by clinical faculty to such things as surgical anatomy, clinical microbiology, and clinical pharmacology. This puts additional strain on the time avail-

able within the traditional curricular construct for the clinical sciences.

Thus, the third major impact is that of expansion in time of the formal education for dentists. As we reduce time in traditional areas, expand time in new areas, and take over clinically relevant aspects of the basic sciences, we will realize that the experience base of the graduate has become too shallow because of the necessity to increase breadth. This realization will come too soon for the recent reductions in national dental class size to have had their effect on perceptions of manpower excess, even though some years from now the relative underproduction will become apparent and applicant:enrollee ratios will increase. But for the immediate future, expansion of curricular time prior to the award of a dental degree will be unattractive because of a probable detrimental effect on the applicant pool. A much more attractive option will be mandatory post-doctoral clinical training prior to eligibility for licensure, a step taken many years ago by our medical colleagues. As the new frontiers of science, coupled with changes in disease patterns and demographics, make additional education and training time a necessity, this seems the most probable direction for the future. In my view, because such a change has many complexities—including changing the licensure laws of nearly all of the states—we would do well to move in this direction with a united front among dental educators. As with any change, there will be opposition, and the opposition will have the powerful force of inertia on its side. We should make it clear—through loud proclamation that mandatory post-doctoral education is necessary to ensure quality of general dental care in a future that has generalists assuming more functions formerly in the realm of specialists, and through guidelines for educational programs that reinforce that concept—that such a step is needed to preserve the status of the profession.

Finally, most dental schools will find it necessary to restructure internally in order to support these new directions. With the reduction in time for the teaching of technics prior to the degree, the restorative disciplines will be unable to sustain the luxury of subdivision, finding new strength in a coalition of disciplines which address different aspects of restoring or replacing teeth. Separate departments which address parts of this restoration or replacement will become rarities. Improvements in adhesive materials through science will hasten this end, since it diminishes the need for traditional principles of preparation of teeth for resistance and retention—principles which have been with us nearly unchanged for more than three-quarters of a century.

More powerful administrative units will have to be devised in order to move into the new frontiers of serological, microbiological, and molecular genetic diagnostic innovations relative to oral conditions, as well as to move forcefully to take advantage of new

imaging technologies for dental diagnostics before they are lost to us forever through ingression of the burgeoning surplus of medical doctors. In this vision, oral radiology cannot survive as a discipline without incorporating non-radiological imaging technics or enhancements, oral medicine must not limit itself to oral manifestation of systemic abnormality or disease, and oral diagnosticians must realize that diagnosis by dentists cannot be limited to what can be seen in the oral cavity or traditional radiographs. The most likely survival strategy, again, will be one of amalgamation.

Other changes in conventional administrative units internal to dental schools will also be made as the existent specialty disciplines become less useful for the division of effort in an environment which places a premium on integrative efficiency because of information overload. These changes are more likely to have variation among institutions than those in restorative and diagnostic areas, as they respond to the individualized settings and University missions of the various schools.

Far-reaching implications for change also exist with respect to the structure within which the basic sciences relate to dental schools. The new frontiers of science have driven the independent scientist and his private laboratory into near extinction. The demands and opportunities of modern science require large teams with diversities of knowledge and skills. Dental schools can't, and probably won't be able to, afford such units by themselves. Carried to its logical conclusion, this means the demise of independent basic science departments within schools of dentistry. I believe that schools with that kind of structure should carefully assess whether they should attempt to maintain such units, since all forces seem

to conspire toward wider and deeper expertise than such small units can provide. I know the argument that says relevance is best preserved by basic science departments contained within the dental school, but, as referred to earlier, clinical relevance will be better served by transferral of this area to the well-educated clinician. To the best of my knowledge, there are only three dental schools which enjoy access to and participation of health-sciences-wide basic science departments without, at least on paper, structural disadvantage to access and control. In some cases, I know, the structural barriers are surmountable by force of individual strength from dental school faculty or administration. However, I think that the future is best preserved and served for us if we are able to do away with structural boundaries between the dental school and basic science departments which include the entire health science center in their scope. If this means some apparent loss of control, we had better opt for that loss if we can exchange it for a share of control of, and unbiased access to, units which are capable of maintaining pace with the new frontiers of science.

To recapitulate, the future will see closer integration of dental schools with universities, or a subdivision of our profession as we now know it. Assuming that the former is more desirable and will be attained, we will see drastic shifts in the pre-doctoral curriculum, away from technical restorative procedures toward a diversity of new material as well as broader clinical scope. This will create a need for compensatory time which will be provided by mandatory post-doctoral training, and extensive internal restructuring of dental schools will occur to support these changes.