

Scientific Integrity and the University

Introduction

Good evening.

I'm pleased to be with you tonight,
to once again have a chance to speak
at the annual Sigma Xi lecture series.

This year I would like to address the subject of
"Scientific Integrity and the University."

Actually, during the past couple of years
I have had a crash course in the subject.

For you see, in my role as chairman of the National Science
Board,

I am in the strange position of having
the Inspector General of the NSF
...and all of the apparatus for the investigation and
adjudication of scientific misconduct
report directly to me...

However, this evening I am definitely NOT going to
talk to you wearing my hat as chair of the NSB
...for to do so would probably drag me
deeply into the muck of controversy surrounding
federal policy in this complex area.

Rather I would like to talk to you,
as president of the University
but even more as scientist to scientist...

Public Perceptions

Of course the press...

...and many members of Congress
are of the opinion that scientific integrity is an oxymoron

...that scientific misconduct is rampant
...that things are out of control.

And to be sure, several cases certainly
have dominated the headlines

...the charges surrounding Nobel Laureate David
Baltimore,

that eventually led to him withdrawing as
president of Rockefeller University

...the investigations of the AIDS research of Robert Gallo,
which continue to go back and forth

(most recently “forth” with last month’s ORI report)

Indeed, we’ve had some visible activity
even here at Michigan.

Unfortunately we are living in a time,
if we look at the last few years,
when scientific misconduct is contributing
to the general public cynicism toward
higher education.

It is worth noting that over the past few years,
according to the National Academy of Sciences,
more than 200 allegations of misconduct in science
were reported to U.S. government offices,
and of that number, about 30 cases have resulted
in confirmed findings of misconduct in science.

Of course, some would view that number
as relatively low compared to the 26,000 research grants
supported each year by the National Institutes of Health,
and relatively low when you consider
how many scientists are active in the field today.

Yet even this small number of cases has caused serious damage

to public trust and confidence in the research enterprise.

And what about the situation right here at home?

According to the Office of the Vice President for Research, the University of Michigan has an average of two cases of misconduct in progress at any one time.

That does not mean two new cases every year.

It means that of all of the research performed by 3,300 faculty members at the University of Michigan, there is a consistent average of two cases of scientific misconduct being investigated or adjudicated.

Unfortunately, when such cases first began to receive attention by government bodies and draw the attention as well by the media, the initial reaction both by the scientific community and academic institutions was defensive.

We tended to retreat behind our fortress walls, insisting that such cases were rare, and that they could be well-handled within the normal process of scientific inquiry.

Yet, the attention of public officials, recent studies by scientific organizations, the interest of the media all make it clear that the problem of misconduct in science is real and it is not going away.

Indeed, as science plays an increasingly critical role in political, economic, and social decisions,

and as the federal government's support of basic research grows to billions of dollars, it is understandable that society is demanding a higher level of accountability.

The federal government is now deeply involved in regulating the practices of laboratory researchers and trying to define the limits of unacceptable behavior.

The Seriousness

Scientific misconduct is a serious threat to the intellectual integrity

on which the advancement of knowledge depends.

It can taint the reputation of the University and of its honest scholars and researchers, disrupting their lives, and destroying their futures as scholars.

It can compromise the position of collaborators, research assistants, and research directors.

It can lead other investigators down fruitless paths of inquiry at enormous costs of knowledge, morale, careers, time, and money.

Crimes against science are like crimes against mankind; even one incident is too many.

Yet it is the rare cases of misconduct that have a disproportionately large impact on us. Besides damaging the reputations of the individuals and the institutions involved, they contribute, along with indirect cost scandals, for example, to a negative public perception

of both researchers and the academic community.
As you can imagine,
the costs involved with such cases are enormous.
Investigations consume staff time;
there are legal and administrative fees;
cases end up in court.
Those of you who have, as faculty members,
spent time assisting with investigations
know that the process can sometimes take years.
It can be a very stressful experience all in all.
Hence scientific misconduct is indeed a matter
to be taken very seriously by all.
Indeed, while much of the scientific community has
been initially resistant to the intrusion of
government oversight, we now are coming to
understand and accept that we have to make our
code clearer and enforce it...or others will do it
for us.

What is it?

Part of the problem is one of definition.
Scientific integrity is sometimes considered so fundamental
a part of the scientific process, that both defining it
and including it in education and training
is taken for granted.
As Frank Press, president of NAS, says,
“It is a largely tacit code of professional conduct
that guards the integrity of the scientific enterprise.”
Of course there are many forms of misconduct...
...fraud, falsification, fabrication (the Three Fs)

- ...ownership, plagiarism, falsely claiming credit
- ...the mistreatment of students, assistants, colleagues
- ...violation of safety and human subjects regulations
- ...contractual violations
- ...conflict of interest

The Office of Research Integrity of the PHS defines:

“Misconduct or misconduct in science means fabrication, falsification, plagiarism, or other practices that seriously deviate from those that are commonly accepted within the scientific community for proposing, conducting, or reporting research. It does not include honest error or honest differences in interpretations or judgments of data.”

Recently, there have been efforts to distinguish between scientific misconduct and professional misconduct.

The National Academy of Sciences and others have sought to narrow this definition to the three great scientific sins: falsification, fabrication, and plagiarism.

They would then classify other forms of misconduct such as non-collegiality, sloppy notebooks, nastiness, not sharing resources, not helping younger colleagues, as nonprofessional behavior... but NOT as scientific misconduct.

Indeed, the ORI itself has recently proposed a new term, “research misconduct”, that would substitute the phrase “deliberate falsification...or other deliberate misrepresentation

in proposing, conducting, reporting, or reviewing research.”

In this scheme, deliberate falsification of research would fall in the sanction category.

On the other hand, failing to credit the technical services of a graduate student would fall in the improper category...

My remarks will focus primarily on FRAUD...

although the other forms of abuse are regarded as scientific misconduct by some agencies such as NSF (although on this campus they are dealt with by other policies such as Sexual Harassment, Human Subjects, Conflict of Interest...)

Here it is important to distinguish between scientific fraud and honest mistakes or sloppy research.

Fraud is a deliberate misstatement,

...made with an intention to deceive others.

It involves a deliberate effort to deceive and includes

...plagiarism

...fabrication of data

...misrepresentation of historical sources

...tampering with evidence

...selective suppression of unwanted or unacceptable results

...theft of ideas

It is important that the distinction between fraud and negligence be observed.

Since once a question of fraud exists,

it must be investigated under established procedures

If it becomes clear that fraud is not involved,
then the investigation should cease,
regardless of the degree of carelessness
found in the work under scrutiny

How rare or prevalent is scientific misconduct?

Scientific misconduct has a lengthy history.

Some of the big names in science,
we have since discovered,
were involved in some questionable practices,
if not outright fabrication or plagiarism.

You may already know about Ptolemy,
otherwise known as the greatest astronomer of antiquity.
He supposedly plagiarized the work of a Greek
astronomer.

Galileo, Newton, Bernoulli, Dalton, Mendel,
Darwin, and the list goes on.

Today, actual numbers are unknown.

We do not know how many cases go unreported.

But with the media staying right on top of this issue,
a single case becomes widely known to the public.

The media reports that cases of fraud have increased,
but sometimes fails to mention
that the amount of research has been
growing exponentially at the same time.

It is fair to say that the *reporting* of such cases
has increased over the last decade,
especially as the definition of fraudulent behavior
or misconduct begins to gel,
and as protection for the accuser and the accused

is improving.

Greater Pressures Today

Where is it all coming from?

Some have even tried to argue that science attracts a type of person who hopes for great recognition, and often does not care what it takes to achieve this.

And Billy Graham once said that

“Everybody has a little bit of Watergate in him.”

But there are many contributing factors.

Quoting from an editorial in the May 29, 1992 issue of Science:

“Humans respond to the pressures, intellectual climate, and rewards systems to which they are exposed. The pressures at universities have tended to emphasize mere numbers of publications and the amounts of grant money brought in. Skilled lectures to undergraduates have counted for little. The poor performance of a few universities in dealing with serious cases of fabricated data and delays in addressing allegations of misconduct have tarnished the images of all universities.”

Competition for grants and recognition has intensified.

Many young scientists feel that the pressure to publish may be a contributing factor to colleagues' misconduct.

Respondents to an AAAS survey on scientific misconduct cited their own personal views of its causes:

- “The ‘rat race’ to publish findings first;
- Unearned or ‘honorary’ authorship;
- University reliance on ‘quantitative measures

of academic/scientific performance' (more is better);
- Competition for grants and recognition."

Congressional/Agency Reactions and Overreactions

Certainly, politicians have been one factor in the higher visibility

given to scientific misconduct.

It makes good copy for the media...

portraying the investigator as stamping out
scandal and crime...

Indeed, some have built their reputations on such cases...

...and are well-known as receptive to whistleblowers...

...whether legitimate or contrived.

So too, some in elected positions have become true masters

of manipulating the media and public opinion

trampling over confidentiality and occasionally truth

to capture a headline...to gain political support.

In part out of fear of Congress and the press

...and in part out of concern for the scientific enterprise
itself,

federal agencies have responded by building

large administrative structures to investigate

scientific misconduct cases.

For example, the Office of Scientific Integrity

of the Public Health Service, has a couple of dozen staff

handling almost 100 cases per year (including

highly visible cases such as the Gallo investigation)

The NSF established its Office of Inspector General,

with a budget of \$3 million per year,

reporting directly to the National Science Board.

So, How Do We Handle Scientific Misconduct?

So, how DO we handle cases of
possible scientific misconduct.

In theory, research should be predicated on
mutual trust and honesty,
since scientific research attempts to seek truth...

As Harry Truman noted,

“A person who is fundamentally honest
doesn’t need a code of ethics.

The Ten Commandments and the Sermon on the Mount
are all the ethical codes anybody needs.”

Yet unquestioned trust can also leave the door open for abuse.

It is also clear that the self-correcting mechanisms of science
are not always adequate to ensure
the integrity of the scientific process.

One lesson well-learned is that ad hoc procedures
do not work well...they do not allow institutions
to respond well to charges of academic fraud.

Specific procedures must be developed in advance
to handle these cases
and reduce the risks to everyone involved.

At the University of Michigan, we have seen
the evolution of a variety of policies and procedures
over the years.

The key policies in place at the University are
...Academic Integrity Policy for Faculty (1986)
...Academic Integrity Policy for Graduate Studies (1985)
...Guidelines for Responsible Conduct of Research,
Medical School (1989)

These policies set out both our expectations for scholarly behavior, along with a process to investigate and adjudicate cases of possible misconduct.

Because of the potential jeopardy to the reputation and rights of the accused, great care is taken to handle both informal and formal investigations in a way that preserves confidentiality.

The policies and procedures are designed with safeguards for both the accused and the accuser and recognize the interest of the community in academic integrity.

How Do Federal Agencies Handle Such Cases?

Despite the need for effective mechanisms for establishing whether misconduct in science has occurred, considerable controversy has arisen over which are the right mechanisms.

Two government agencies,
...the Public Health Service (NIH)
...and the National Science Foundation
have both had substantial experience
in dealing with misconduct in science cases.

Both agencies generally assign primary responsibility for conducting the investigation to the host institution, a practice called “deferral”.

However, both have very different approaches...

PHS uses the “scientific dialogue” model which emulates the peer review process by assembling a panel of scientists who both investigate allegations and reach a consensus

as to whether misconduct has occurred.

NSF's procedure are instead derived from well-established administration, criminal, and civil methods of investigation and adjudication.

NSF believes that such methods are more appropriate where the issue posed is one of culpability for misconduct in research, rather than an evaluation of whether scientific ideas or results are suitable for publication.

Peer review of articles necessarily relies on the truthfulness of the authors.

When the central issue to be resolved is whether an individual is deserving of such trust, the peer review process lacks the appropriate investigative, adjudicatory, and due process mechanisms.

The NSF's Office of Inspector General conducts a nonadversarial investigation for the purpose of gathering information.

By calling on staff scientists, trained investigators, and lawyers, during an investigation, the OIG brings to bear a balance of scientific and legal expertise that can provide the efficient and confidential acquisition of information essential to both the protection of the whistleblower and a resolution of the case that is fair to the accused.

If the OIG recommends to NSF a finding of misconduct in science,

the subject is entitled to an adjudication by the Deputy Director

which provides full due process rights.

NSF believes that this clear separation of

the investigative and adjudicatory stages

is essential to providing efficiency, confidentiality,

and fairness in a misconduct in science case.

Although scientific experts play key roles in the process

Lawyers also play an essential role in NSF investigations,

by ensuring that constitutional, statutory,

and regulatory provisions are complied with.

Further trained investigators with special skills in the

art and psychodynamics of interviewing are used...

Note that Fifth Amendment due process rights are NOT

required during the investigation phase.

The subject of the investigation does not have the right to know

the identify of the complainants or other witnesses

to be present during the investigation

or to cross examine the witnesses.

Howe ver full due process protections are given to the accused

at the adjudicatory stage, after it is determined

that a misconduct in science has occurred.

What Are the University Responsibilities?

Some of our responsibilities spring to mind

more easily than others.

We have a responsibility to have policies and procedures

in place to address cases, and to firmly adhere

to those policies and procedures.

We must reveal known or suspected cases of misconduct.

Not doing so constitutes misconduct as well.

We must protect the rights and reputations
of both the accuser and the accused.

Finally, responsibility for human life and the human condition
when we consider our choices of research direction
and make decisions on publication.

Is it the case of the lesser of two evils?

The universities may be newer at
the investigating/adjudicating game,
and they may be slow because faculty and staff
have other, primary responsibilities,
but they live in the research world.

Other Approaches

And then there is a different focus: prevention.

Suggestions for preventative changes

and improvements are such things as:

- Ethics training
- Mentoring (helping junior faculty,
who are probably feeling more pressure
than senior faculty, to find their niche)
- Increased collaboration
- Looking at quality rather than quantity of research
- Limiting the number of publications considered
for promotions or funding
- Place more weight on excellence in teaching
- Restructure faculty roles to decrease stress
- Establish burnout prevention
and faculty development programs.

Cargo Cult Science

Bear with me for a moment,
while I set aside my hat as a bureaucrat,
and chat with you, scientist-to-scientist.

Whenever I consider the subject of scientific integrity,
I always remember a commencement address
Richard Feynmann delivered many years ago at Caltech
on the rather bizarre subject of "Cargo Cult" Science...

It happens that on certain South Sea islands following WWII
a strange religion developed among primitive peoples
known as "the Cargo Cult".

During the war these natives saw Allied airplanes land
carrying lots of good things...
but after the war, the planes left

The natives wanted to make the planes return,
so they arranged to make things like runways
to make a wooden hut for a man to sit in
with two wooden pieces on his head like headphones
and bars of bamboo sticking out like antennas.

And they wait for the planes to return
...except, of course, they never do.

To the natives, they are doing everything right
It looks just as before.
The form is perfect.
But it doesn't work.
Something is missing.

The same is true with certain forms of pseudo science
...ESP
...

...cold fusion???
...the form is right
...it looks like science
...but it isn't...
...it doesn't work.

What is missing in these “cargo cult” sciences?

It's a kind of scientific integrity,

...a principle of scientific thought
that corresponds to a kind of utter honesty
...a kind of leaning over backwards

For example, if you're doing an experiment,

you are obligated to report everything you think
might make it invalid--not only what you think is right
about it,

but other causes that could possibly explain your results.

Details that could throw doubt on your results must be given,
if you know them.

You must do the best you can--

if you know anything at all wrong or possibly wrong,
to explain it.

In summary, the idea is to try to give ALL of the information
to help others judge the value of your contributions,
not just the information that leads to judgment
in one particular direction or another.

Of course, in the end, truth will win out.

Others will repeat your efforts
and find out if you were wrong or right.

It is this type of integrity,

this kind of care not to fool yourself

that is missing to a large extent in cargo cult science.
Unfortunately, this sense of utter scientific integrity
is something we rarely include in our training
of future scholars.

The first principle is that you must not fool yourself--
and you are generally the easiest person to fool.
You have to be very careful about that.

After you've not fooled yourself,
it's easy not to fool other scientists.

You just have to be honest in a conventional way.
Note it is also essential that you not fool the layman
when you're talking as an expert.

A Related Concern

Let me mention a related concern.

The approach to truth of science,
that of absolute integrity...
of the responsibility to reveal all
both those facts that support your case
and those that undermine it

Stands in sharp contrast to the legal approach,
which relies on a one-sided presentation of facts
and then a carefully structured adversarial process
to determine truth.

Both the legal and the scientific approach
are powerful models of discovery and proof.
Yet they are each quite different in theory,
values, and process.

So different, in fact, that they may well conflict
and undermine one another if used together

in a given investigation.

And, yet, many of our procedures for investigating and adjudicating scientific misconduct attempt to blend these two quite different approaches together.

It may be best to allow the scholarly examination of facts to proceed without the intrusion of another system for establishing truth.

The investigative procedure should probably retain a non-legalistic character.

Once lawyers are involved, the proceedings shift in tone, from scholarly inquiry to legalistic battles.

Evidence will be considered not in light of scientific criteria, but in the terms of the courtroom.

There is potential for intimidation of scholars who must be able to make judgments on scientific grounds.

The possibility of eventual appeal to the courts will always remain

(through suits for defamation of character, violation of employment contracts, etc.)

This possibility both preserves important rights of the accused found in the investigative process to have been fraudulent in research and provides additional incentive for the relevant committees to proceed with care.

Conclusion

So where do we go from here?

We are concerned, as are other research institutions, about the current climate surrounding scientific integrity.

Clearly, no matter how well Michigan handles
its own cases of misconduct
and the prevention of misconduct,
we need to do more.

Any policy, any procedure, must continually evolve
to face new challenges.

For example, information technology has opened up
an entirely new realm of concerns
...from the privacy of E-mail
...to the complex task of determining ownership of
software

We must aim for a system
that is a complex mix of professional,
institutional, and public ethics.

And aim as well for a community
that is deeply respectful of individuals.

I look forward to hearing
what you may be thinking about
what we can do here at Michigan.

This is an important issue,
and we need to have everyone thinking about it.

Feynman's Final Wish:

Let me return for a moment to
Feynmann's commencement address on Cargo Cult
Science

In typical Feynmann fashion,
he concluded with just one simple wish
for the Caltech graduates before him...

The good luck to be somewhere

where you are free to maintain the kind of integrity
the academic honest
where you do not feel forced by a need
to maintain your position in the organization
or financial support, or so on
to lose your integrity.

May you have that freedom.

And may Michigan be such a place!