MAINTAINING THE INTEGRITY OF SCIENTIFIC RESEARCH

HEARING BEFORE THE
SUBCOMMITTEE ON
INVESTIGATIONS AND OVERSIGHT
OF THE
COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
ONE HUNDRED FIRST CONGRESS
FIRST SESSION
JUNE 28, 1989
[No. 73]

Printed for the use of the
Committee on Science, Space, and Technology
kind of climate to resolve the issues before they ever become the
kind of scandal that Congress is likely to be looking at?
Mr. ANDERSEN. The latter, certainly, from NSF.
Mr. RAUB. Very much so. We need to have the facts.
Mr. WALKER. Okay, that is very helpful.
Thank you, Mr. Chairman.
Mr. HAYES. With no other questions, then I thank you very much
for your time and attention, ask your forgiveness for the interrup-
tions, and proceed to our next panel.
Would the witnesses please stand, and I will ask you to raise
your right hands.
[Witnesses sworn.]
Mr. HAYES. There are some critics of Congress who would suggest
that the oath was taken by the wrong group of people, but I won't
comment upon that. [Laughter.]
Since we are running late, I would ask you, if you could, to sum-
marize your statements, and of course the entire statement, as you
are well aware, will be placed into the record, and once again I
would beg your indulgence for the interruptions this morning,
which are certainly no fault attributable to you, but sometimes we
inhabit those circumstances.
If there is a particular order in which you wish to proceed, please
notify the Chair. Otherwise, let me introduce all of you for
the record.
Dr. Penny Gilmer is an Associate Professor of Chemistry at Flor-
da State University in Tallahassee. Dr. Paul Friedman is a Profes-
sor of Radiology and Associate Dean for Academic Affairs at the
University of California, San Diego School of Medicine in La Jolla,
and Dr. Howard K. Schachman is the President, Federation of
American Societies for Experimental Biology in Bethesda.
I welcome all of you, and if there is no preconceived order among
yourselves, then I will just begin with Dr. Gilmer.

TESTIMONY OF DR. PENNY J. GILMER, ASSOCIATE PROFESSOR
OF CHEMISTRY, FLORIDA STATE UNIVERSITY, TALLAHASSEE, FL

Dr. Gilmer. Thank you, Mr. Chairman.
I am a biochemist and an associate professor in the Chemistry
Department at Florida State University. My research is in the
areas of immunochemistry and biodegradation of toxic waste.
I have been asked to speak to your subcommittee here today on
education and the research environment in the hearing on main-
taining the integrity of scientific research. The following is a sum-
mary of my written statement.
First, I want to give you a short background of how I got inter-
ested in introducing ethics into university science courses, then say
how I actually did it, and finally how it has worked, both for the
students and for the university as a whole.
While I was in graduate school in 1969 at the University of Cali-
ifornia, Berkeley, I audited a nonacademic course called the Social
Responsibility of the Scientist, which was taught by Prof. Joseph
Neiands. It really opened my eyes to the impact that the scientific
and technological enterprise has on a myriad of aspects in our
At the conclusion of the course I made a promise to myself, that
once I was tenured at some university that I would try to teach a
similar course. In the intervening years during my postdoctoral
years at Stanford University and while working towards tenure at
FSU, I continued reading the types of articles that we had read in
the course with Neiands.
After being granted tenure, I applied to the President of FSU,
Dr. Bernard Sliger, for funds for an innovative course I called
Problems in Science and Society. Typically, it is difficult to get a
course like the one I wanted to teach approved for academic credit
from a chemistry department. However, with funding from our un-
iversity president it was easier.
While the first course was being taught, I met FSU's psychology
professor, Michael Rashotte, who also had always wanted to teach
such a course. He and I applied to an intramural funding source to
teach an expanded version of the course, which we called Science,
Technology, and Society.
First, I co-taught the course twice with Rashotte, and then I co-
taught it twice more with biological science professor, Paul Elliott.
I will give you a brief idea of how we currently organize the
course. Basically, we have three major sections in the course. The
two co-instructors give five to seven lectures each in areas within
their expertise. In addition, we invite 10 to 12 FSU faculty to con-
tribute generally one and sometimes two lectures each. We also
invite two or three speakers from other institutions, either from
Tallahassee or from out of town. Each of the speakers gives a dif-
ferent perspective on the particular topic chosen.
Attached to the end of my written statement is a summary of the
syllabus.
We conclude each section or subsection of the course with small
student-led discussion groups. The student-led discussions are one
of the powerful components of the course.
The first section of the course is entitled Facts and Fictions
about Science and Scientists. We give students an overview of the
scientific and technological enterprise, including its dimensions, its
complexity, its composition, and its influence on society. We consid-
ner the varied characterizations of science that are found in the pop-
ular culture and take an insider's look at how science is done.
Topics have included how scientists communicate with each other,
including the peer review process and the changing composition of
the work force and its influence on how science is conducted.
The second section of the course is entitled Societal Influences
on Science. We focus on how the society that we live in influences the
science and technology that takes place. There are many historical
and current examples in which society has imposed controls on sci-
ence. The Church v. Galileo is perhaps the classic case.
In this section we deal with the issue of fraud or misconduct in
science. Society right now is influencing the scientific enterprise by
Congress' insistence that research institutions put policies and pro-
cedures in place to deal with allegations of scientific misconduct.
This past year I chaired the committee on our campus that draft-
ed FSU's proposed policies and procedures for dealing with allega-
tions of scientific misconduct. This final section of the course is
titled Science, Technology, and Society.
In other years we have had outside experts speak on the same topic, including Nobel Laureate Ivar Giaever; New York Times' Science Editor Nicholas Wade; and Rosemary Chalk of the Institute of Medicine here in Washington. I have all those lectures videotaped for use by other educational institutions.

The largest and final section of the course is entitled Dilemmas for Modern Science and Technology. This section typically has four subsections. In the last offering of the course we included subsections: Radiation and Risk Assessment; Science, Ethics and Public Policy in AIDS; the Public Understanding of Science and Technology; and Ethical Issues in Utilizing Human Tissue.

Since your committee is specifically interested in how I have introduced ethics into science courses, I will concentrate on that aspect of the course.

For instance, in the last subsection dealing with the utilization of human tissue, initially we addressed the controversial topic of using fetal tissue to cure human diseases, such as diabetes, Alzheimer's disease, Parkinson's disease, and others. The scientific side of the issue was presented by me, followed by a heart surgeon from Tallahassee, who spoke on the medical and ethical considerations of transplanting human hearts to otherwise terminally ill individuals. The philosophical and ethical side was presented by FSU Professor of Philosophy Alan Mabe. Finally, the students led a class discussion to bring this topic to a close.

Each year we vary some of the topics, as new topics become timely and the speakers become available. I often work with other scientists on campus to bring an outside speaker to campus to speak either jointly to both groups or separately in his or her discipline plus to the students in our group.

I am certain that courses of this type can have a profound effect on students. Often the students will mention in their student evaluations that this type of course should be required because it integrates so much of different types of knowledge and because it deals with today's current issues.

One recent student said, "I would really enjoy more classes in all areas of the curriculum that emphasized self-study of topics rather than exams." And another said, "Need to make it a requirement for liberal studies " " Very important class so people can understand science better."

I also feel that it has been an integrating force within the university as well. Students tend to take this course in their senior year at a time when they are primarily taking courses in their majors. When students take our course, they meet in a situation in which they can really talk in depth about the issues and often from quite different perspectives.

In addition, the faculty who participate interact with each other in a different mode because the topics covered are often very different from what they generally teach.

Teaching this course has had a profound effect upon me and my professional development. I view and sense the complexity of the world and the relationship of science to the world in a very different manner.

It has so influenced me that I have started adding ethics to more...
P.J. Gilmer

Congressional Testimony
Written Deposition

Penny J. Gilmer, Ph.D.
Florida State University

"Education and the Research Environment"

Before the U.S. House of Representatives
Committee on Science, Space and Technology,
Subcommittee on Investigations and Oversight

28 June 1989

I am a biochemist and an associate professor in the Chemistry Department at Florida State University. My research is in the areas of immunochemistry and biodegradation of toxic waste.

I have been asked to speak to your subcommittee here today on "Education and the Environment" in the hearing on "Maintaining the Integrity of Scientific Research."

First, I want to give you a short background of how I got interested in introducing ethics into university science courses, then say how I actually did it, and finally how it has worked, both for the students and for the university as a whole.

While I was in graduate school in 1969 at the University of California, Berkeley, I audited a nonacademic course called "The Social Responsibility of the Scientist," which was taught by Professor Joseph Neilands. It really opened my eyes to the impact that the scientific and technological enterprise has on a myriad of aspects in our world.

One of the speakers from this course had a profound effect on me. He was Nobel laureate in physics, Professor Owen Chamberlin. Chamberlin spoke to us about how it had been one year into his doctoral dissertation research during World War II when it became obvious to him and his advisor that what he was working on was treason. He felt a calling which could contribute to the development of the atomic bomb. He felt a sense of responsibility to contribute to the war effort, but the use of the bomb really bothered him.

At the conclusion of the course, I made a promise to myself that once I was tenured at some university that I would try to teach a similar course. In 1976, I was tenured at Stanford University and the intervening years during my postdoctoral years at Stanford University and the intervening years during my postdoctoral years at Stanford University and the intervening years during my postdoctoral years at Stanford University and the intervening years during my postdoctoral years at Stanford University at the University of California, Berkeley, I continued reading the types of articles that we had read in the course with Neilands.

After being granted tenure, I applied to the President of FSU, Dr. Bernard Sliger, for funds for an innovative course called "Problems in Science and Society." Typically, it is difficult to get a course like the one I wanted to teach approved for academic credit from a chemistry department. However, with the support of the university president it was easier.

While the first course was being taught, I met FSU psychology professor, Michael Rashotte, who also had always wanted to teach such a course. He and I

P.J. Gilmer

applied to an intramural funding source within FSU called the Council for Instruction to teach an expanded version of the course which we called "Science, Technology and Society." This new course had to be approved by the Science Area Committee, and it was given the interdisciplinary science designation within the College of Arts & Sciences. First I co-taught the course twice with Rashotte, and then I co-taught it twice more with Biological Sciences professor, Paul Elliott.

I will give you a brief idea of how we currently organize the course. Basically, we have three major sections in the course. The two co-instructors give 5-7 lectures each, in areas within their expertise. In addition, we invite two or three speakers from other institutions, either from Tallahassee or from out-of-town. Each of the speakers gives a different perspective on the particular topic chosen. Attached to the end of this written statement is a summary of the syllabus.

We conclude each section (or subsection) of the course with small student-led discussion groups. The student-led discussions are one of the powerful components of this course.

The first section of the course is entitled, "Facts and Fictions about Science and Scientists." We give the students an overview of the scientific and technological enterprise, including its dimensions, its complexity, its composition, and its influence on society. We consider the varied characterizations of science that are found in the popular culture and take an "insiders" look at how science is done. Topics have included how scientists communicate with each other, including the peer review process, and the changing composition of the work force and its influence on how science is conducted.

The second section of the course is entitled "Societal Influence on Science." We focus on how the society that we live in influences the science and technology that take place. There are many historical and current examples in which society has imposed controls on science. The Church versus Galileo is, perhaps, the classic case. In this section we deal with the issue of fraud or misconduct in science. Society right now is influencing the scientific enterprise by Congress' insistence that research institutions put policies and procedures in place to deal with allegations of scientific misconduct. This past year I chaired the committee on our campus that drafted FSU's proposed policies and procedures for dealing with allegations of scientific misconduct. Therefore, I could speak to the students of what it really is like to do this. In addition, we have had outside experts speak on the same topic, including Nobel laureate, Ivar Giaever; "New York Times" science editor, Nicholas Wade; and Rosemary Chalk of the Institute for Medicine, here in Washington. I have all those lectures videotaped, for use by other educational institutions.

In the same section of the course our Dean of Arts and Sciences, Dr. Werner Baum, spoke of the stand he took on a sensitive issue involving academic freedom when he was Chancellor at the University of Wisconsin. In 1985, Baun was awarded the AAAS medal in Scientific Freedom & Responsibility for the stand he took on this issue.

The largest and final section of the course is entitled "Dilemmas for Modern Science and Technology." This section typically has four subsections.
In the last offering of the course we included subsections: “Radiation and Risk Assessment”, “Science, Ethics & Public Policy in AIDS”, “The Public Understanding of Science and Technology”, and “Ethical Issues in Utilizing Human Tissue.”

Since your committee is specifically interested in how I have introduced ethics in science courses, I will concentrate on that aspect of the course. For instance, in the last subsection dealing with utilization of human tissue, initially we addressed the controversial topic of using fetal tissue to cure human diseases, such as diabetes, Alzheimer’s disease, Parkinson’s disease, and others. The scientific side of the issue was presented by me, followed by a heart surgeon from Tallahassee who spoke on the medical and ethical considerations of transplanting human hearts to otherwise terminally ill individuals. The philosophical and ethical side was presented by FSU Professor of Philosophy, Alan Mabe. Finally, the students led a class discussion to bring this topic to a close.

Each year we vary some of the topics, as new topics become timely and as speakers become available. I often work with other scientists on campus to bring an outside speaker to campus to speak either jointly to both groups or separately in his or her discipline plus to the students in our course. For instance, this past year I worked closely with the scientific research society, Sigma Xi, and invited noted author, Dorothy Nelkin, to speak jointly at the annual meeting of Tallahassee chapter of Sigma Xi and to the students in our course in the subsection on the public understanding of science and technology.

Typically, 20-25 students take the course each spring, and they are mainly undergraduates. The course does not count towards credit in a science major, but does count towards total credits for graduation. We have to advertise the course so that students know about it.

FSU requires all undergraduates to take a certain number of courses in six areas of study in order to graduate. This is called fulfilling the requirements for liberal studies. In the natural sciences, ten semester hours are required. Currently, I am petitioning to see if our three credit course could count towards meeting liberal studies requirement in the natural sciences. We would have to limit enrollment to no more than 40 students in order to maintain the small class size conducive to class discussion.

I am certain that courses of this type can have a profound effect on students. Often the students will mention in their student evaluations that this type of course should be required because it integrates so much of different types of knowledge and because it deals with today’s current issues. One recent student said, “I would really enjoy more classes, in all areas of the curriculum, that emphasized self study of topics rather than exams” and another said, “Need to make it a requirement for liberal studies... Very important class so people can understand science better.”

I also feel that it has been an integrating force within the university as well. Students tend to take this course in their senior year at a time when they are primarily taking courses in their majors. When students take our course, they meet in a situation in which they can really talk in depth about the issues, and often from quite different perspectives. In addition, the faculty who participate interact with each other in a different mode because the topics covered are often very different than what they generally teach.

Teaching this course has had a profound effect upon me and my professional development. I view and sense the complexity of the world and the relationship of science to the world in a very different manner.

It has so influenced me that I have started to add ethics to more traditional courses as well, including Honors General Chemistry. That has on topics related to chemistry that we course is “Science, Technology and Freshman.” This has worked well, even though the students are just entering.

One group of four freshman women for their group discussion acted out a dramatization in which two of the students portrayed themselves as coworkers in a laboratory in which they suspected another researcher of having faked the data. The suspected coworker talked about how serious an offense faking the data is. Finally, the fourth student portrayed herself as one member of an NIH committee who must evaluate the important issues of the other students in the class. They had discussion.

There is a special bond that I have with the students from this course, really communicated with each other and that this experience truly had a deep impact on them.

I receive modest financial support from the Dean of Arts and Sciences to continue offering this course once a year. Primarily, we utilize those funds to bring in outside speakers.

In order for a university to have such a course, it requires approximately $5,000 – $10,000 per course offering. This is needed to support a teaching assistant, to build and maintain a library of collected articles and books that Association for the Advancement of Sciences (in order to stay abreast of the current issues and to select speakers on the topics relevant to the course), and to pay for the expenses of the outside speakers.

One thing that the Federal government might consider is having a small grants program to fund this sort of effort at many colleges and universities. If the government is serious about this, grant funds speak loudly and clearly that the government considers it a high priority.

I am aware that within the NSF’s Young Scholars Program that there is a new component this summer on teaching ethics for high school students who are interested in science. Two of my colleagues in the Biological Science Department, Paul Elliott and Patricia Hayward, are the co-principal investigators on FSU’s grant. Dr. Mabe and I have helped them organize how to introduce ethics within the context of science to a group of 52 very bright Florida high school juniors in this current summer’s program.
The FSU Summer Science Camp plans to videotape the process of the students learning about ethics, utilizing a competitive board game designed by the camp. Each student will receive a videotape of this project to take home with them. This may be used by other Young Scholar Programs in following summers.

Innovative ways as described here today can be used to bring a consciousness of ethics to students interested in science. This introduction of ethics will influence how science is done in the years ahead as this wave of new students finish their training and become part of the scientific and technological enterprise.

### REVISED SCHEDULE OF SPEAKERS

**Spring Semester 1989: Short-form Syllabus for ISC 3121, "Science, Technology and Society"**

**Florida State University**

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* Denotes student-led group discussions

# Denotes keynote guest lecturers
READINGS FOR HONORS GENERAL CHEMISTRY

Dr. Penny J. Gilmer
Florida State University
Fall 1988

Friday, August 26th, Gilmer-led discussion:

Friday, September 9, Student-led discussion:

Friday, September 23, Student-led discussion:

Friday, October 7, Student-led discussion:


Friday, October 21, Student-led discussion:

Friday, November 4, Student-led discussion:

Friday, December 2, Student-led discussion:
Grants:

"Effect of Tumor Plasma Membrane Vesicles on Cell-mediated Lysis of Tumor Cells," from the Florida branch of the American Cancer Society for a $10,000 starter grant, 1978.

"Histocompatibility Antigens in Defined Membranes," from the National Institutes of Health for $130,500, 1979-81.


"Expression of Histocompatibility Antigens," from the Florida branch of the American Cancer Society for a pilot project grant, $10,000, 1980.

"Modulation of H-2 Recognition in Target Vesicles," from the American Cancer Society for $125,000, 1982-83.

"Non-tumorigenic Variant Cells as Probes for Cellular Recognition and Lysis," from the Committee on Faculty Research Support at Florida State University, $10,000, 1984-85.


"Science, Technology and Society Course Development Project," Council of Arts and Sciences, $8,000, 1986.


"Regulation of Intracellular Carbohydrate Metabolism Influencing Cell-Surface Structures," Research Corporation, $24,000, grant pending review.

Professional Societies:

American Association for the Advancement of Science
American Chemical Society
Association of Women in Science
American Society for Biochemistry & Molecular Biology
Biophysical Society
Sigma Xi
Lambda International
Publications:
Mr. Roe: What is the best way to train scientists to conduct research in an appropriate and ethical manner?

Dr. Gilmer: I believe that the best way to train graduate students in the proper and ethical manner in which to do research is by example from the major professor and the rest of the research group. This is the primary way that has been utilized in American science.

In general, this type of informal method of training works well, but I believe that some graduate students may be short-changed. With the continuing growth of the scientific enterprise and the increasing competitiveness in obtaining research grants, many research group leaders are so busy submitting grant proposals, reviewing others' grant proposals, and preparing manuscripts for publication that they do not have as much time to devote to their graduate students as they used to when science was not as competitive. Many graduate students observe their research mentors so involved with the outward products of science (grants, publications, invited lectures, etc.) that some of the students may not realize that it is the carefully executed experiments done in the laboratory and the analysis of the data that provide the bulwark for these outward products. The experiments and the analysis are really the important part of science. Because of these factors, I feel that formal training in a classroom situation supplements the informal research training with the research advisor and the research group.

Mr. Roe: Why have educational institutions not placed emphasis on this point in the past on ethical training of scientists?

Dr. Gilmer: I think that educational institutions have placed emphasis on the informal training to which I just alluded but have been reluctant to do more formal training for several reasons. The first reason is that so much pure science needs to be taught in the classroom that they do not want to detract from the science content to which the graduate students are exposed by making them take a course involving ethics in science. Secondly, scientists feel that graduate students should have been taught this somewhere else in their education. Thirdly, I think that scientists do not like to admit that they might not give enough attention to their graduate students. Often a postdoctoral fellow might oversee the graduate student on a day to day basis rather than it being done by the research advisor. Although this is good for the postdoctoral fellow to have this experience, the graduate student may or may not get proper training.

Mr. Roe: Is there resistance to the idea of formal ethical instruction for new graduate students and junior faculty?

Dr. Gilmer: I think that there certainly is resistance to formal ethical training for graduate students and, especially for junior faculty. I think that if it were forced upon universities to do this that it would not be effective. It needs to be an option in an open environment in which the course for credit or to audit it. As faculty participate in the course, they might encourage their graduate students to take the course.

In my testimony, I mentioned the idea of the Federal government offering a small grants program to fund efforts at colleges or universities offering funds, encouraging the effort at many universities.

I think that there is less resistance towards offering formal training in ethics in research than there used to be, in light of the numerous recent cases reported of fraud in science and of conflict of interest. Also the Congressional hearings have caught the scientists' eye.

Mr. Roe: How do students react to the discussion of ethical dilemmas in research?

Dr. Gilmer: Students react positively in discussions of ethical dilemmas in science. They start to examine their own behavior as well as think of situations which they have observed or in which they might be involved. I was on topics such as fraud in science and ethical issues in the new reproductive technologies.

Recently I was a judge of a competition of talented high school students who attended a six-week long Summer Science Camp at Florida State University. Four groups of thirteen students each competed to develop a board game that involved at least some questions involving ethical problems in science. I was especially interested to hear the questions involving ethics that they thought up on their own in this competition. Many of the students were very involved and they worked well as a team. The NSF supported this summer camp as part of its Young Scholars Program.

Mr. Roe: How much does undergraduate laboratory education ("cookbook science") contribute to poor laboratory practice in later years?

Dr. Gilmer: "Cookbook science" experiments may contribute to problems later in a scientist's career because of the great emphasis typically placed on easily measurable parameters, such as reaction yield and purity of product in a this point. In particular, to me when we talked about fraud in science. They tempt to "stretch" their data. If more emphasis were put on the learning scientist better. Often discoveries are made after an error is made in an experiment, but the scientists learn from what they observe.

One thing that we do at FSU for our undergraduates is offer them research experience. This type of experience is definitely not "cookbook science". Generally, this is offered to undergraduate students in their junior or senior year for one semester at a time. In addition, for ten years we have offered a...
research experience to undergraduate freshman in the honors program. We give the students an option of doing research with a faculty member who is conducting chemical research or of taking a typical chemistry laboratory course during the second semester of the freshman year. I have seen many students become committed to science during this experience early in their training. It is a large commitment of the faculty member's time to take a student like this into his or her research laboratory. However, sometimes the student chooses to continue working on that project for the rest of his or her undergraduate education, even finishing with an honors thesis.