

UW Dept. Colloquium 1999
Friday, November 5

The Privilege of Teaching and Exhortations for Good Teaching

Professor Bassam Z. Shakhashiri
Department of Chemistry
UW-Madison



Chemistry 901 - The Teaching of Chemistry

CHEM TIPS

Chemical of the Week

course and curriculum development

pre lab videotapes

post exam options

retake exams

special group projects

cooperative learning groups

learning communities

TA training

audio tutorial lessons

workbooks

study questions

Bull sessions

**UW-Madison Committee on Undergraduate
Education**

**UW System Undergraduate Teaching
Improvement Council**

Institute for Chemical Education

Wisconsin Public Radio

Once Upon A Christmas Cheery...

In The Lab of Shakhashiri

newspaper and magazines

*Chemical Demonstrations: A Handbook for
Teachers of Chemistry, Vol. 1, 2, 3, 4*

www.scifun.chem.wisc.edu

NSF Science and Engineering Education

White House

US Congress

National Governors Association

mobilizing professional societies

Systemic Reform

program assessment and evaluation

elementary school

middle school

high school

undergraduate programs

Calculus Initiative

Engineering coalitions

Physics curriculum

Project Kaleidoscope

graduate fellowship and traineeships

women in science

minorities in science

informal science education

museums

science centers

National Public Radio

NOVA

ENVIRONMENT

nurturing

supportive

collegial

promotes

integrity

scholarship

respect

PRIVILEGE:

**A SPECIAL ADVANTAGE
OR IMMUNITY
OR RIGHT
OR BENEFIT
NOT ENJOYED BY ALL**

TEACHING

RESEARCH

SERVICE

THE WISCONSIN IDEA

NATIONAL CHEMISTRY WEEK

The Briggs-Rauscher Oscillating Reaction

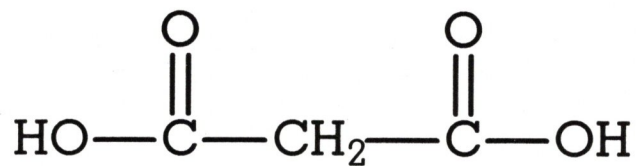
The reactants:

A 4.0 M H_2O_2

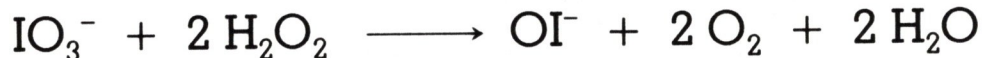
B 0.20 M KIO_3
0.080 M H_2SO_4

C 0.15 M malonic acid
0.020 M MnSO_4
starch

malonic acid

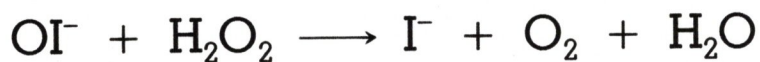
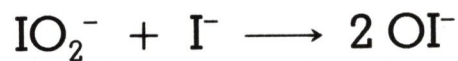


Overall reaction:

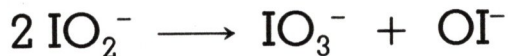
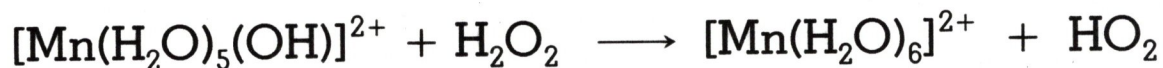
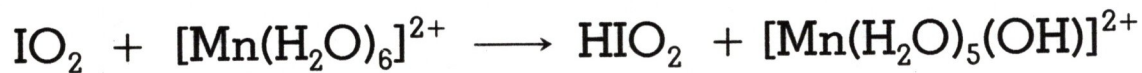


Two competing mechanisms:

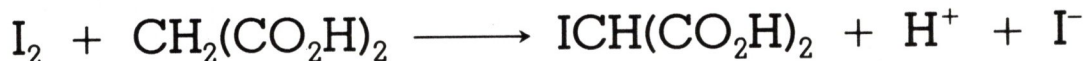
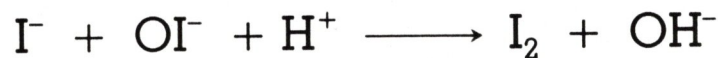
Mechanism A



Mechanism B

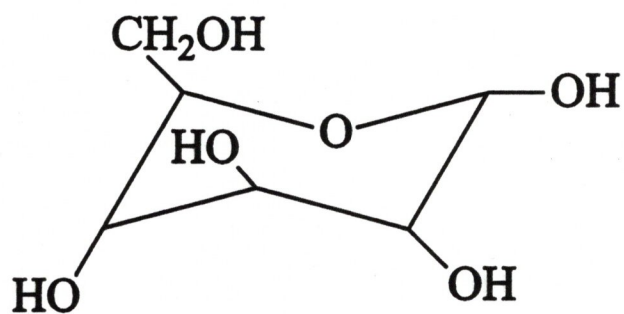


Color changes:

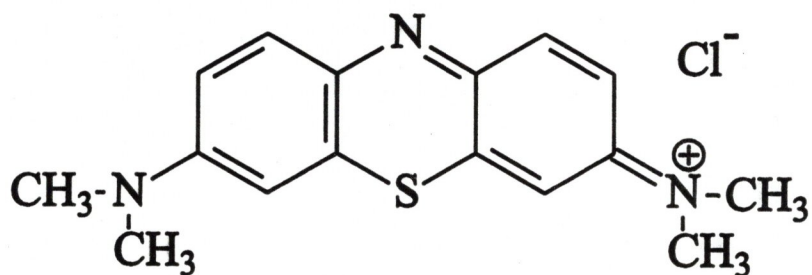


The Blue Bottle Experiment

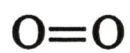
Dextrose



Methylene Blue



Oxygen



“Science is a hexagonal mountain with six faces.... The three beautiful faces of science are science as subversion of authority, science as an art form, and science as an international club... Science is presented to our young people as a rigid and authoritarian discipline, tied to mercenary and utilitarian ends, and tainted by its association with weapons of mass murder.... The way to attract young people into science is to show them all six faces and give them freedom to explore the beautiful and ugly as they please.”

Freeman Dyson
From *Eros to Gaia*, 1997

“A failure of science to produce benefits for the poor in recent decades is due to two factors working in combination: the pure scientists have become more detached from the mundane needs of humanity, and the applied scientists have become more attached to immediate profitability.”

**Freeman Dyson
Imagined Worlds, 1997**

CLARITY OF PURPOSE

THE PURPOSE OF EDUCATION:

**TO ENABLE INDIVIDUALS TO FULFILL THEIR
HUMAN POTENTIAL.**

THE PURPOSE OF RESEARCH:

TO ADVANCE KNOWLEDGE.

THE PURPOSE OF TECHNOLOGY:

TO ADVANCE THE HUMAN CONDITION.

COMMUNICATING CHEMISTRY

Formal

classroom

journals

books

professional meetings

Informal

radio

TV

the Web

print media

schools

shopping malls

museums and science centers

political conventions

State government

Halls of Congress

Set Expectations

State Accomplishment Levels

Monitor Progress

Reward Achievement

problem-solving skills

***GOOD* judgement**

Good Teachers are:

Competent in their disciplines

Committed to their disciplines and to the
profession of teaching

Comfortable with the methods and techniques
they use

Compassionate with students (and colleagues)

Chemical Epistemology

Chemical Skills

Chemical Models & Theories

Chemical Facts & Phenomena

Attitude & Motivation

DESIRABLE OUTCOME

EXPECTATIONS

STRATEGIES

ATTRIBUTES

ACHIEVEMENTS

CONSEQUENCES

ENCOURAGEMENT

REWARDS

OTHER

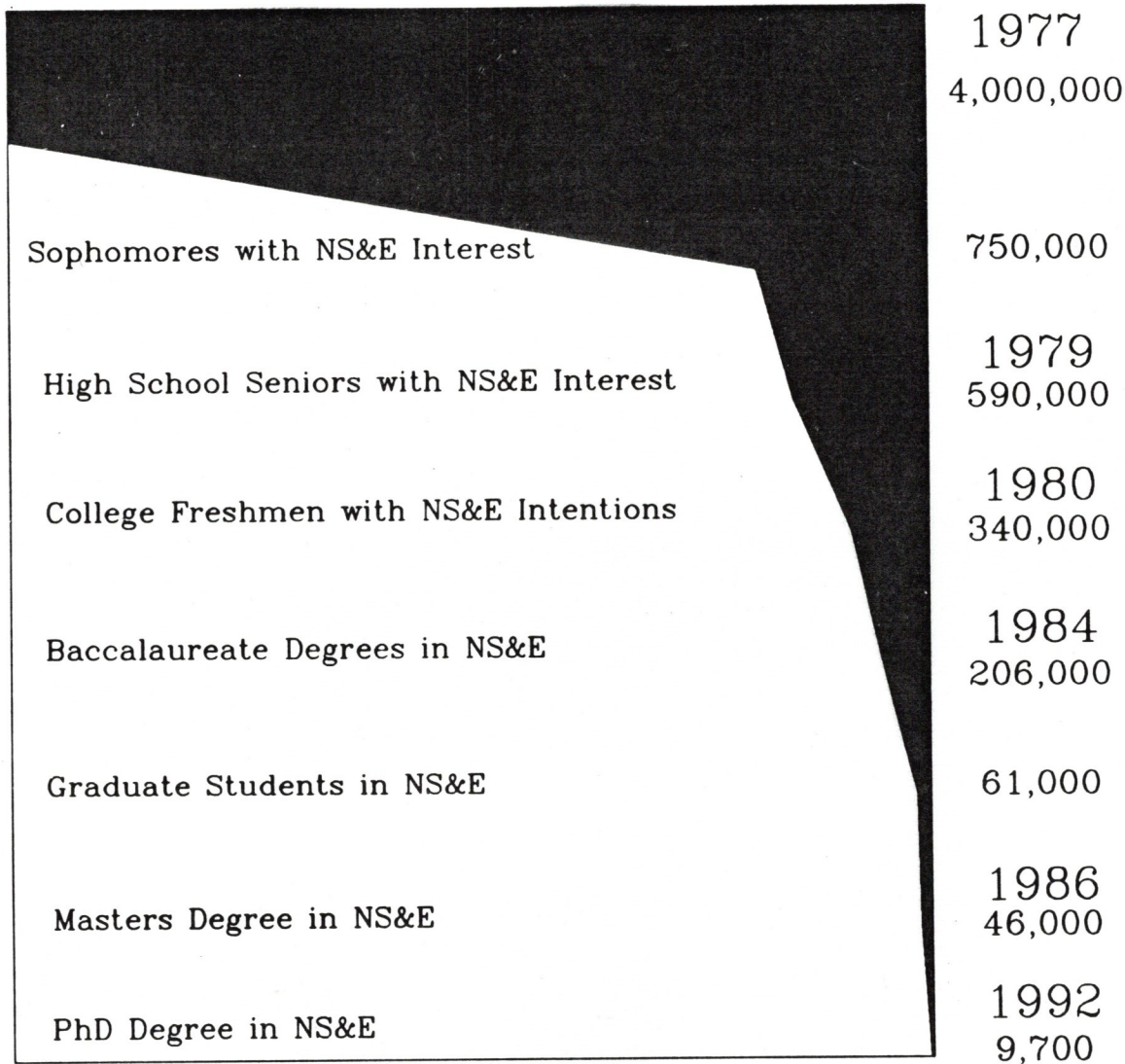
LEARNER'S PERSPECTIVE

Effective Use of Technology

Rewards of Teaching

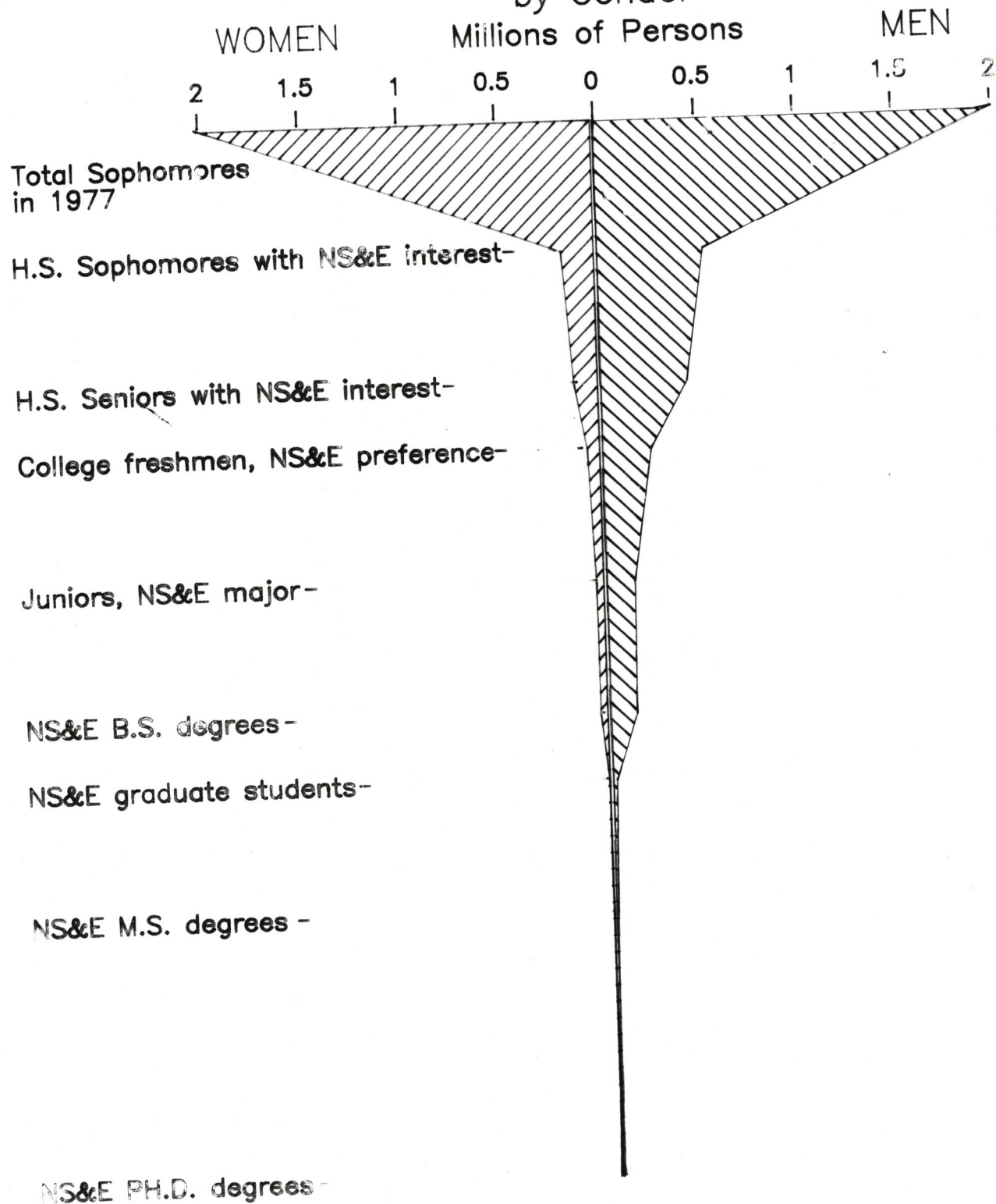
Persistence of NS&E Interest from High School through PhD Degree

← All High School Sophomores →



(The Pipeline)

Persistence of Natural Science & Engineering Interest by Gender



Participation in Natural Science & Engineering Interest by Ethnic Group

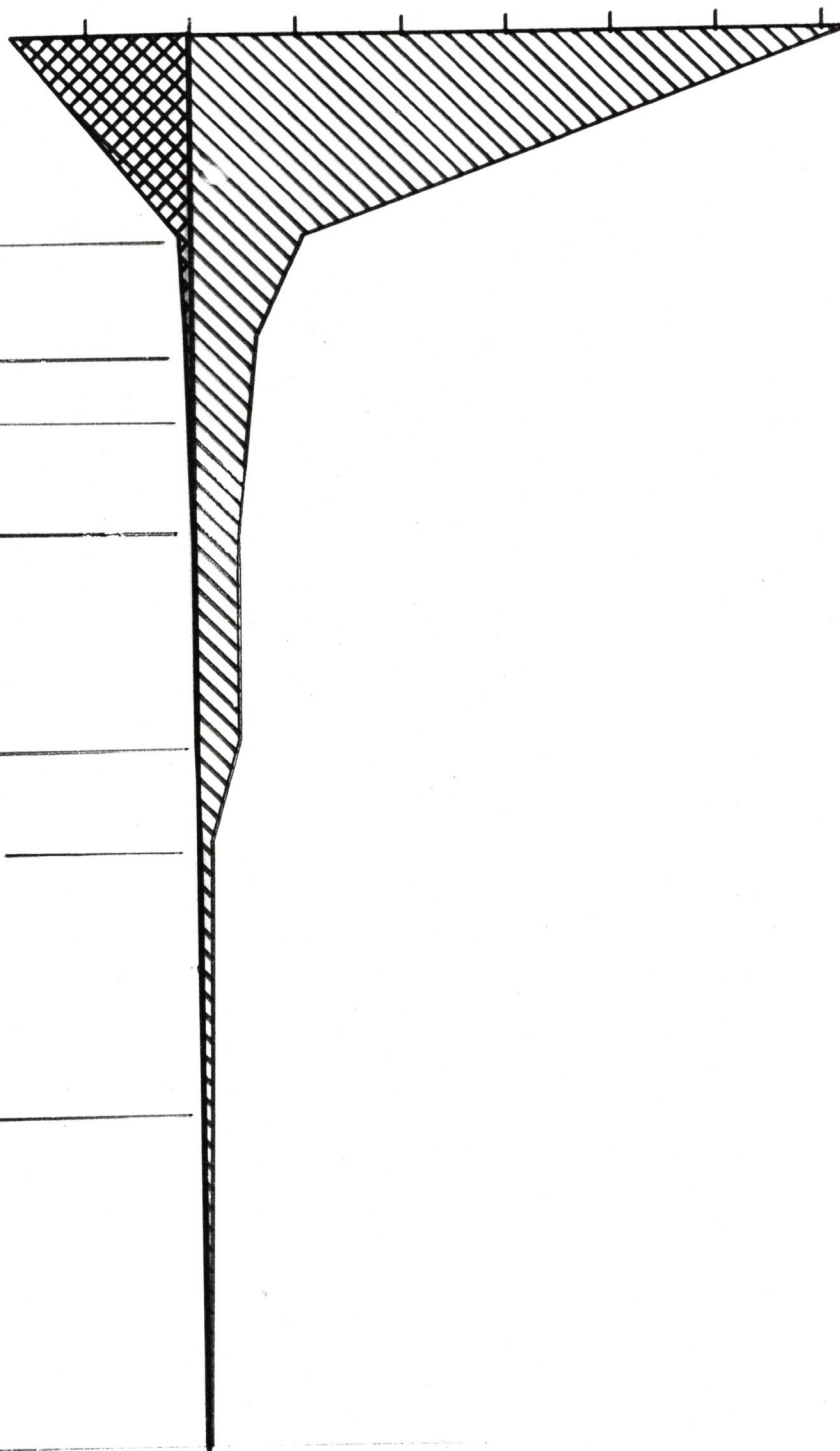
Underrepresented Minorities

Majorities

Millions of Persons

1 0 1 2 3

Total Sophomores
in 1977: 856,000



H.S. Sophomores with
NS&E interest
(86,000 estimated)

H.S. Seniors with
NS&E interest (65,000)

College freshmen,
NS&E preference (40,000)

Juniors, NS&E major
(14,000)

NS&E B.S. degrees
(13,000)

NS&E graduate students
(2,500)

NS&E M.S. degrees
(2,000)

NS&E Ph.D. degrees -
(under 450)

ACHIEVING SCIENCE LITERACY

from
UNDERSTANDING

to
APPRECIATION

to
FULFILLMENT

Biological Sciences, Psychology Doctorate Awards Maintain Pace

FIELD OF STUDY	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	% Change from 1988	% Change from 1996
Science and engineering, total	20,932	21,732	22,868	24,023	24,675	25,443	26,205	26,535	27,230	26,847	28.3%	-1.4%
Engineering, total	4,187	4,543	4,894	5,214	5,438	5,698	5,822	6,008	6,305	6,052	44.5%	-4.0%
Sciences, total	16,745	17,189	17,974	18,809	19,237	19,745	20,383	20,527	20,925	20,795	24.2%	-0.6%
Physical sciences, total	3,350	3,261	3,524	3,626	3,781	3,699	3,977	3,841	3,838	3,711	10.8%	-3.3%
Astronomy	130	113	128	125	134	145	144	173	192	197	51.5%	2.6%
Chemistry	2,015	1,970	2,100	2,194	2,214	2,137	2,257	2,162	2,148	2,115	5.0%	-1.5%
Physics	1,172	1,161	1,265	1,286	1,403	1,399	1,548	1,479	1,485	1,379	17.7%	-7.1%
Other physical sciences	33	17	31	21	30	18	28	27	13	20	-39.4%	53.8%
Earth, atmospheric, and ocean sciences	695	723	738	815	794	771	824	780	794	862	24.0%	8.6%
Mathematics	749	859	892	1,039	1,058	1,146	1,118	1,190	1,122	1,112	48.5%	-0.9%
Computer sciences	515	612	705	800	869	880	903	997	921	889	72.6%	-3.5%
<i>Biological sciences</i>	4,111	4,116	4,328	4,650	4,799	5,092	5,203	5,376	5,723	5,717	39.1%	-0.1%
Agricultural sciences	1,015	1,086	1,174	1,073	1,063	968	1,078	1,036	1,037	966	-4.8%	-6.8%
Psychology	3,074	3,208	3,281	3,250	3,263	3,420	3,379	3,429	3,491	3,489	13.5%	-0.1%
Social sciences	3,236	3,324	3,332	3,556	3,610	3,769	3,901	3,878	3,999	4,049	25.1%	1.3%
Non-S&E, total	12,568	12,595	13,199	13,511	14,215	14,358	14,829	15,208	15,185	15,858	26.2%	4.4%
Grand total, all fields	33,500	34,327	36,067	37,534	38,890	39,801	41,034	41,743	42,415	42,705	27.5%	0.7%

Although doctorate awards in some disciplines in science and engineering have declined or leveled off in recent years, Ph.D. awards in biological sciences and psychology have remained stable, according to the National Science Foundation (NSF) Division of Science Resources. Engineering doctorates dropped 4 percent from 6,305 degrees in 1996 to 6,052 degrees in 1997. Doctorates in physical sciences declined 3.3 percent during the same period, from 3,838 in 1996 to 3,711 in 1997. Doctorates in biological sci-

ences, however, remained basically level, slipping only 0.1 percent from 5,723 degrees in 1996 to 5,717 in 1997. Astronomy, environmental sciences, and social sciences experienced growth in doctorate awards during the one-year period. However, NSF analysts say one year is too short a time to determine a trend in either declines or increases. The figures in the table above represent all Ph.D.s awarded by the approximately 350 U.S. institutions accredited for the degree. Medical and law degrees are not included.

PHYSICAL SCIENCES Total	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	% Change From 1988	% Change From 1996
ASTRONOMY	130	113	128	125	134	145	144	173	192	197	51.5%	2.6%
CHEMISTRY	2,015	1,970	2,100	2,194	2,214	2,137	2,257	2,162	2,148	2,115	5.0%	-1.5%
PHYSICS	1,172	1,161	1,265	1,286	1,403	1,399	1,548	1,479	1,485	1,379	17.7%	-7.1%
Other Physical Sciences	33	17	31	21	30	18	28	27	13	20	-39.4%	53.8%

A SPECIAL REPORT

Scholarship Reconsidered

PRIORITIES OF THE PROFESSORiate

ERNEST L. BOYER



THE CARNEGIE FOUNDATION
FOR THE ADVANCEMENT OF TEACHING

5 IVY LANE, PRINCETON, NEW JERSEY 08540

For an activity to be designated as scholarship, it should manifest at least three key characteristics: It should be public, susceptible to critical review and evaluation, and accessible for exchange and use by other members of one's scholarly community.

These three characteristics are generally absent with respect to teaching. Teaching tends to be a private act (limited to a teacher and the particular students with whom the teacher is engaged). Teaching is rarely evaluated by professional peers. And those who engage in innovative acts of teaching rarely build upon the work of others as they would in their more conventional scholarly work. Through the scholarship of teaching, therefore, we seek to render teaching public, subject to critical evaluation, and usable by others in the community.

Like any other form of investigation, teaching has outcomes. The outcomes of teaching are acts and products of the students learning. An account of teaching without reference to learning is like a research report with no results. It lacks its most essential ingredient.

Lee Shulman, President, The Carnegie
Foundation for the Advancement of Teaching

PEER REVIEW of TEACHING

University of Wisconsin-Madison

www.wisc.edu/MOO/

**THE INTEGRATION OF RESEARCH
AND EDUCATION**

CROSSING THE DIVIDE

**"Nobody cares about your
teaching.**

**You're paid to publish
research"**

Leon Kamin, Northeastern University

**“Doctoral programs typically
overemphasize research and
underemphasize teaching and service”**

**Jerry Gaff, vice president of the Association of
American Colleges and Universities (AACU)**

PhD thesis to include:

chapter on educational experiment:

K-21

museum or science center

public media

chapter explaining the research to:

family members

friends

civic groups

newspaper reporters

state legislators

members of Congress

Integrity

Responsibility

Trust

Accountability

Community

Loyalty

Professorial Duty

Institutional Commitment

Leadership

Behavior

Former Head of Virginia Tech Research Center Indicted for Misusing State Funds

A grand jury indicted the former director of a Virginia Tech research center Tuesday on charges of misappropriating state funds and obtaining money under false pretenses. Craig A. Rogers, who is now dean of the University of South Carolina's College of Engineering, is accused of putting an undisclosed amount of state funds into a personal account and using it for airline tickets, among other things.

by Danielle Stanfield

“Hypocrisy is the most difficult and nerve-racking vice that any man can pursue; it needs an unceasing vigilance and a rare detachment of spirit. It cannot, like adultery or gluttony, be practised at spare moments; it is a whole-time job.”

*Somerset Maugham
Cakes and Ale, 1930*

“The essence of lying is in deception, not in words; a lie may be told by silence, by equivocation, by the accent on a syllable, by a glance of the eyes attaching a peculiar significance to a sentence; and all these kinds of lies are worse and baser by many degrees than a lie plainly worded.”

John Ruskin
Modern Painters, IX, 1872

UW Board of Regents “Sifting and Winnowing” statement

“ whatever may be the limitations which trammel inquiry elsewhere, we believe that the great state University of Wisconsin should ever encourage that continual and fearless sifting and winnowing by which alone the truth can be found.”

**DESIRABLE QUALIFICATIONS OF
FACULTY MEMBERS**

THE FIRST IS INTEGRITY OF CHARACTER

THE SECOND IS SCHOLARSHIP

**BOTH MUST BE PRESENT IF THE FACULTY
MEMBER IS TO BE USEFUL TO THE
UNIVERSITY. OTHER QUALITIES WILL
ENHANCE THAT USEFULNESS.**

Mark H. Ingraham

Dean of the College of Letters and Science, 1949

Faculty owe it to themselves to teach what they love. In so doing, they nourish their students. They owe it to themselves to show their students who they are. To do this, they need to know what they love, and who they are — not a simple task, but surely the anchor without which they'll drift.

Diane Chapman Walsh, President of Wellesley College

Great professors are the ones who weave webs of life-affirming connection for their students. Proficiency with technology, tightly framed learning outcomes, even multicultural awareness are secondary to the passion professors bring to their subject matter, the compassion, awe, and joy they embody and communicate. Great teaching comes from spirit, not from technique.

Diane Chapman Walsh, President of Wellesley College