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Eurovariety 2013: "Smarter teaching – better learning", 3 July 2013

# TEACHING COLLEGE CHEMISTRY: CONTEXT, COLLABORATION AND COMMUNICATION

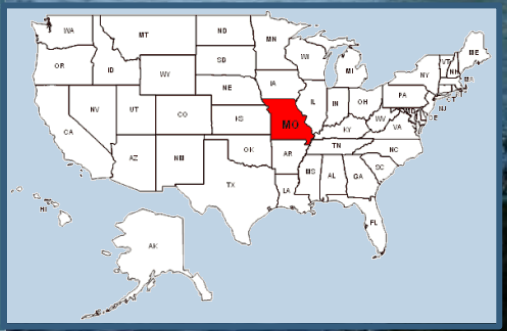
Rainer E. Glaser

Department of Chemistry

University of Missouri, Columbia, MO 65211, USA

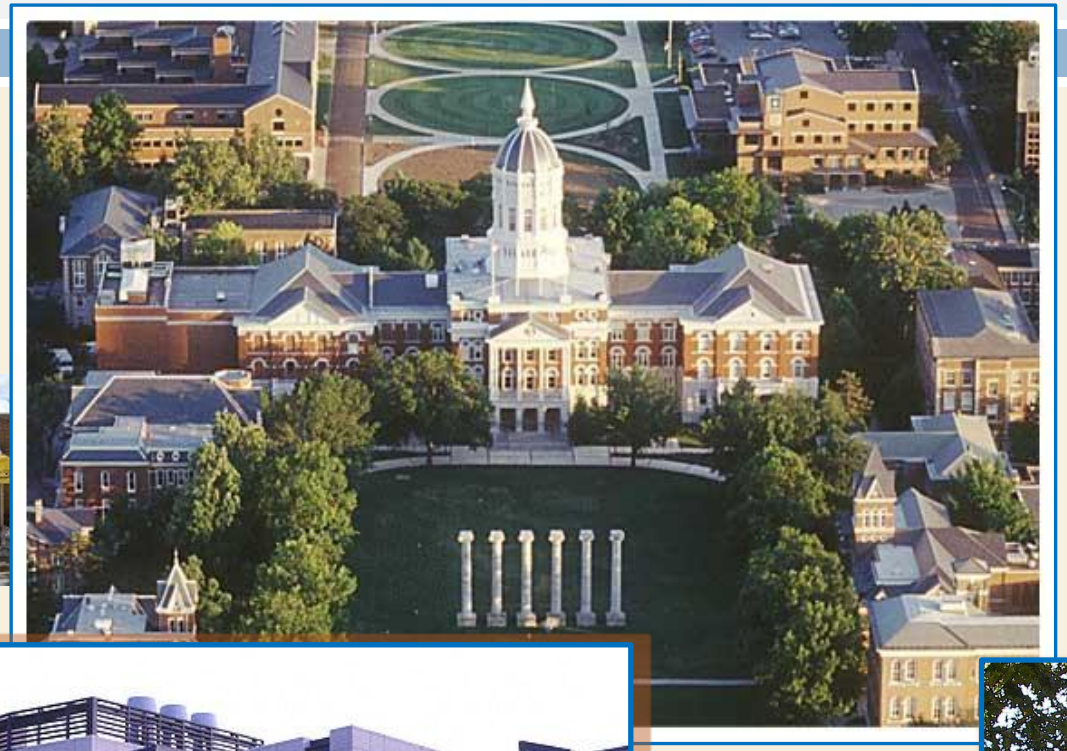
# City of Columbia MISSOURI

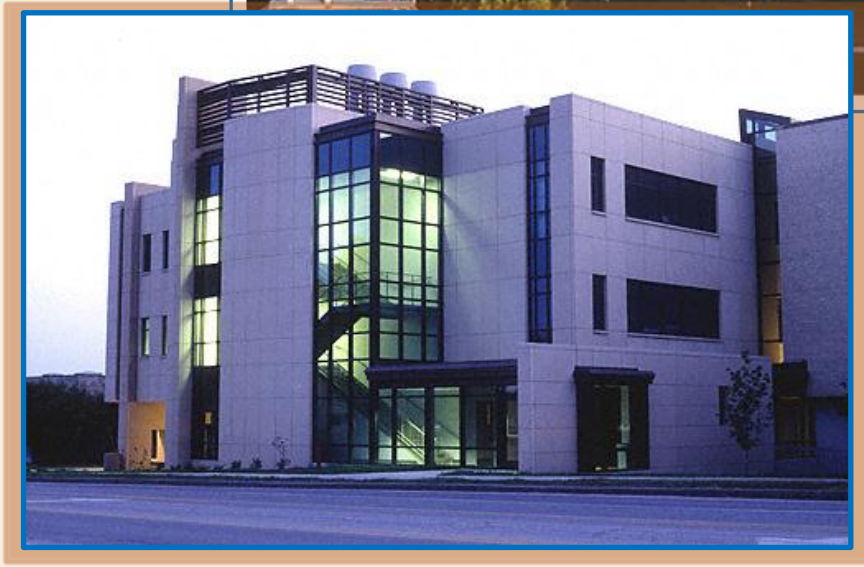




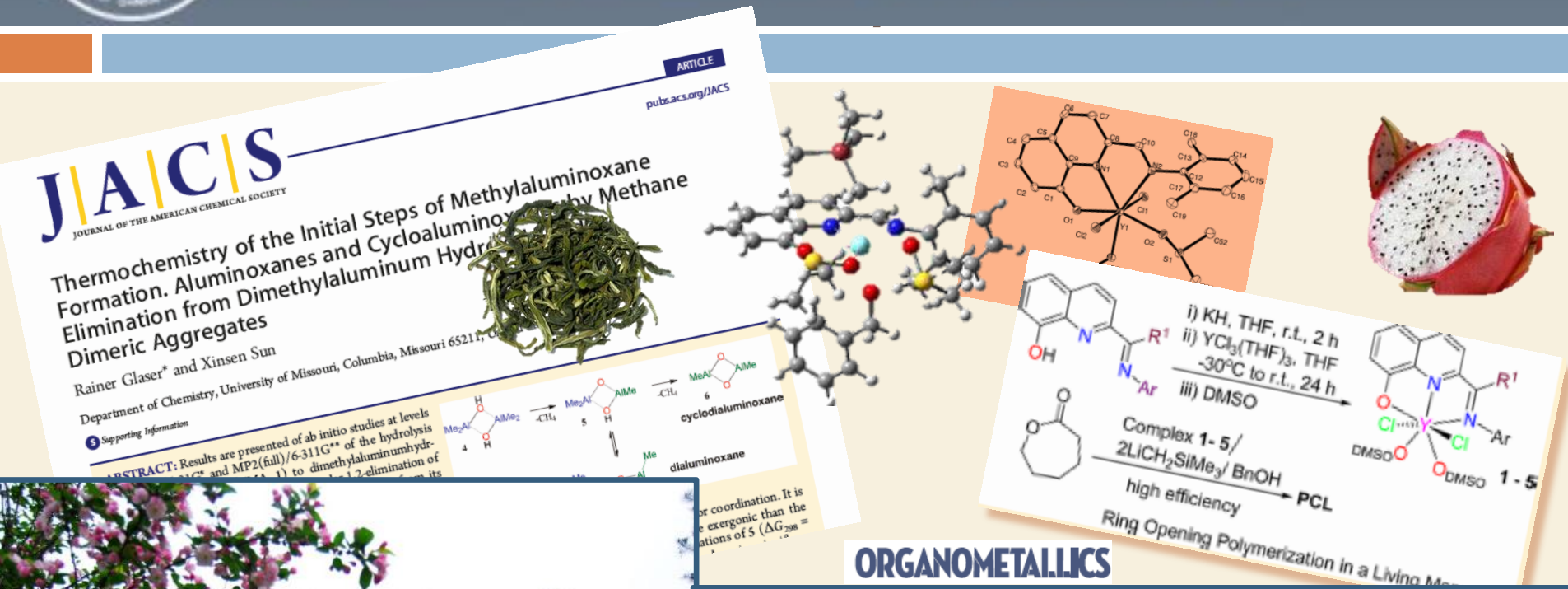
# Mizzou

University of Missouri





# INSTITUTE OF CHEMISTRY
# CHINESE ACADEMY OF SCIENCES




# INSTITUTE OF CHEMISTRY
# CHINESE ACADEMY OF SCIENCES


中国科学院大学
University of Chinese Academy of Sciences

Forktails by Asif Khan

# 写作 科学

Xiězuò Kēxué

中国科学院大学
University of Chinese Academy of Sciences


Enrollment in 2013:

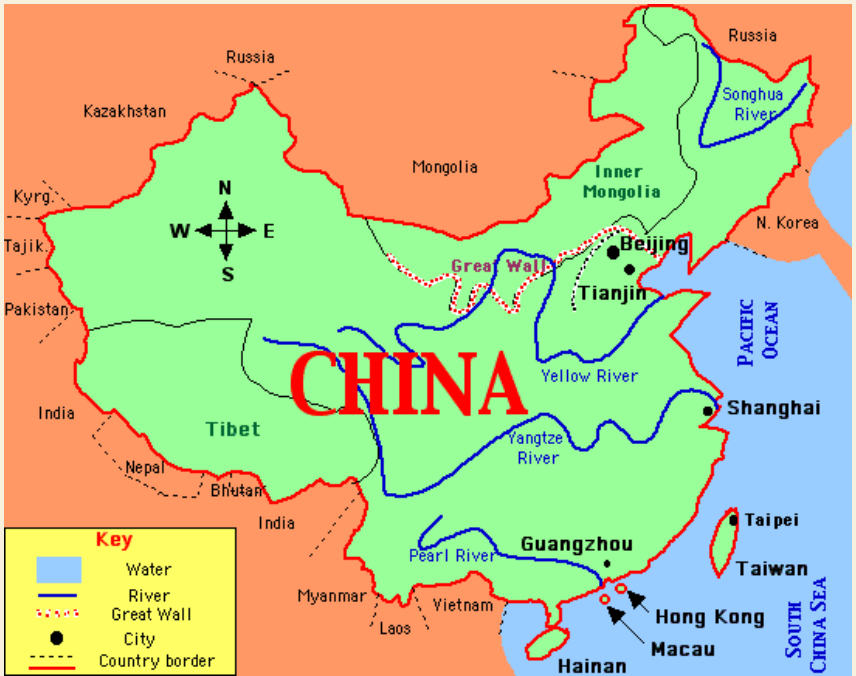
Course #1: 200 grads

Course #2: 103 grads

… and growing

# Zhang Boling – Nankai University

**Zhang Boling** (traditional Chinese: 張伯苓; simplified Chinese: 张伯苓; pinyin: *Zhāng Bóling*; Wade–Giles: **Chang Po-ling**) (April 5, 1876 in Tianjin – Feb. 23, 1951 in Tianjin) was the founder of Nankai University and the Nankai system of schools.




**Zhang Boling** was the founder of **Nankai University and the Nankai system of schools.** He was fortunate to meet a **Confucian scholar** in Tianjin named **Yan Xiu,** a reformer who had been stripped of his high posts by anti-reform Qing court officials. Returning to Tianjin to start a modern school, Yan learned that Zhang Boling had training in **Western knowledge** and wanted to be an educator, so he asked him to join the venture. Thus started an immensely fruitful partnership lasting over three decades.

**Confucius** (551–479 BC)

*"I hear and I forget.*
*I see and I remember.*
*I do and I understand."*

Confucian Temple Gate 6/23/13

# Zhang Boling's Brother & Nephew

**Peng Chun Chang** also **P. C. Chang** (simplified Chinese: 张彭春; traditional Chinese: 張彭春; pinyin: *Zhāng Péngchūn*; Wade–Giles: Chang1 P'eng2-ch'un1) (1892 – 1957) was a Chinese academic, philosopher, playwright, and diplomat. He was born in Tianjin, China, and died at his home in Nutley, New Jersey.

**Chen Chung Chang** also **C. C. Chang** is a mathematician who works in model theory. He obtained his PhD from Berkeley in 1955 with Alfred Tarski. He wrote the standard text Chang & Keisler (1990) on model theory. Chang's conjecture is named after him, and more. He is emeritus professor at the mathematics department of the UCLA.


# Abstract

Interdisciplinarity is rapidly becoming a norm within both the professional and academic worlds, and the ability to **collaborate** and **communicate** is becoming an essential skill for all graduates. We have been interested in the development, implementation and assessment of new curricula to promote cross-disciplinary learning (i.e., in super-disciplinary **contexts**) at all levels of college chemistry education.

We will report on three such efforts, namely, the ***Chemistry Is in the News*** project for lower-division large lecture courses for science majors, an upper-level seminar on ***Scientific Writing in Chemistry*** for chemistry majors, and the ***Mathematics and Life Sciences*** curriculum for the education of gifted STEM majors. **Peer review is essential to science and the students learn about various forms of peer review in these courses**.

Closely following the CCSS (Common Core State Standards), the Next Generation Science Standards (NGSS) are being developed by Achieve, a nonprofit organization, working directly with 26 lead states.

Online: www.nextgenscience.org/next-generation-science-standards
May 17, 2013: Interactive Online Version of NGSS Released
June 13, 2013: APS and ACS Education Divisions Endorse the NGSS

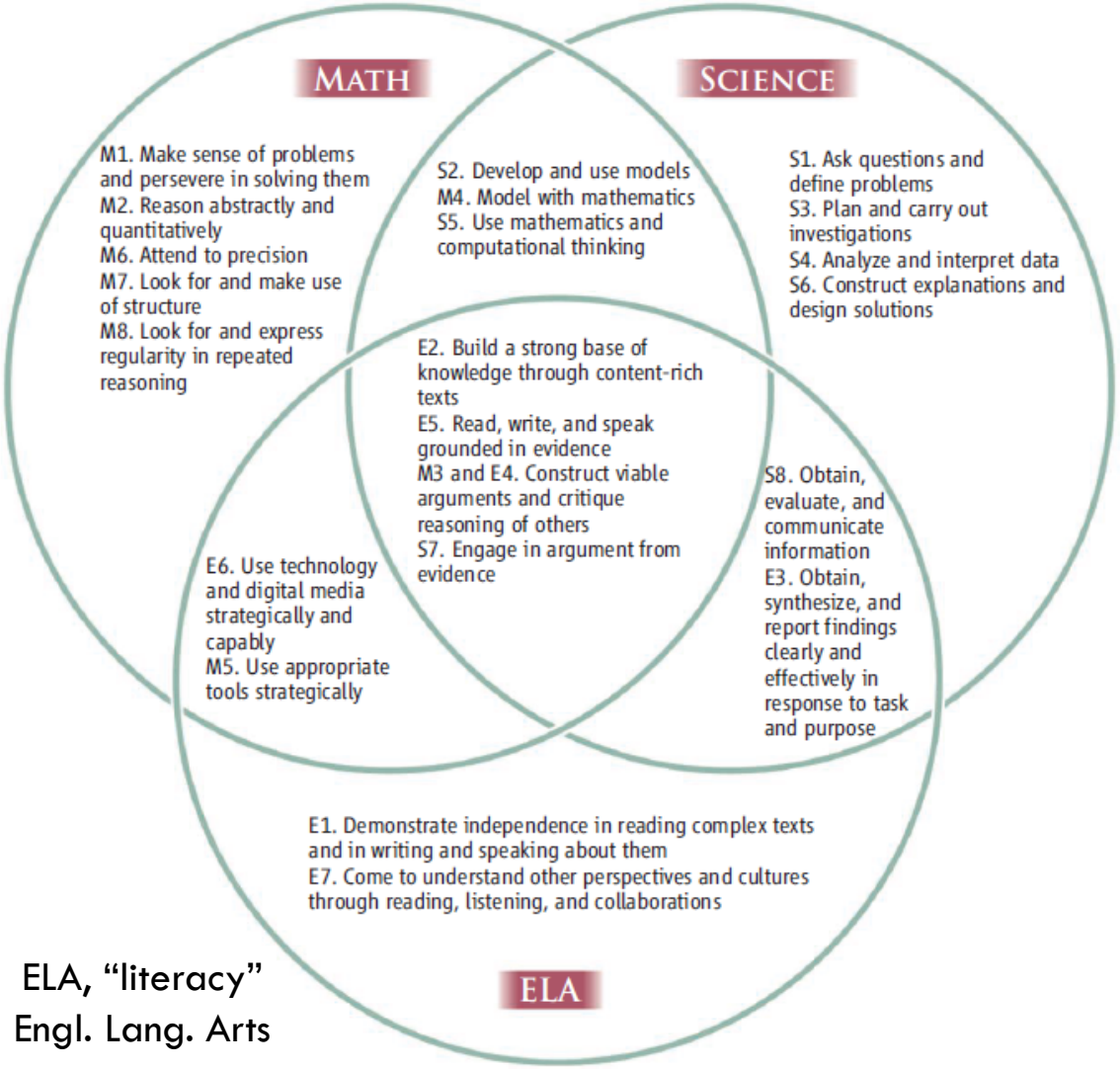
"The Next Generation Science Standards (NGSS) describe what all students should know about science and engineering, and be able to do by the time they leave high school. The NGSS are based on learning progressions of core ideas in the discipline, crosscutting concepts across disciplines, and the practices that will allow students to use their disciplinary knowledge in meaningful ways. As states adopt the NGSS, significant changes will be required in all areas of science education, including the development of new curricula and assessments. Support for both pre- and in-service teachers will be crucial, and perhaps less obviously, so will changes in the way chemistry is taught at the college level." Melanie Cooper, *J. Chem. Educ.* **2013**, *90*, 679-680.

SCIENCE EDUCATION

# Opportunities and Challenges in Next Generation Standards

Goals for literacy, math, and science education may increase citizens' capacity to argue from evidence.

Stage, E. K.; Asturias, H.; Cheuk, T.; Daro, P. A.; Hampton, S. B. *Science* **2013**, *340*, 276-277.




ELA, "literacy"
Engl. Lang. Arts

Past educational standards were developed by prof. organizations and in different subject areas independently, yielding more material than the K–12 system could teach well. Now there is a call for "fewer, clearer, and higher" standards.

**Relations and convergences** in literacy (*3*), math (*4*), and science and engineering (*1*) practices. Adapted from (*12*).

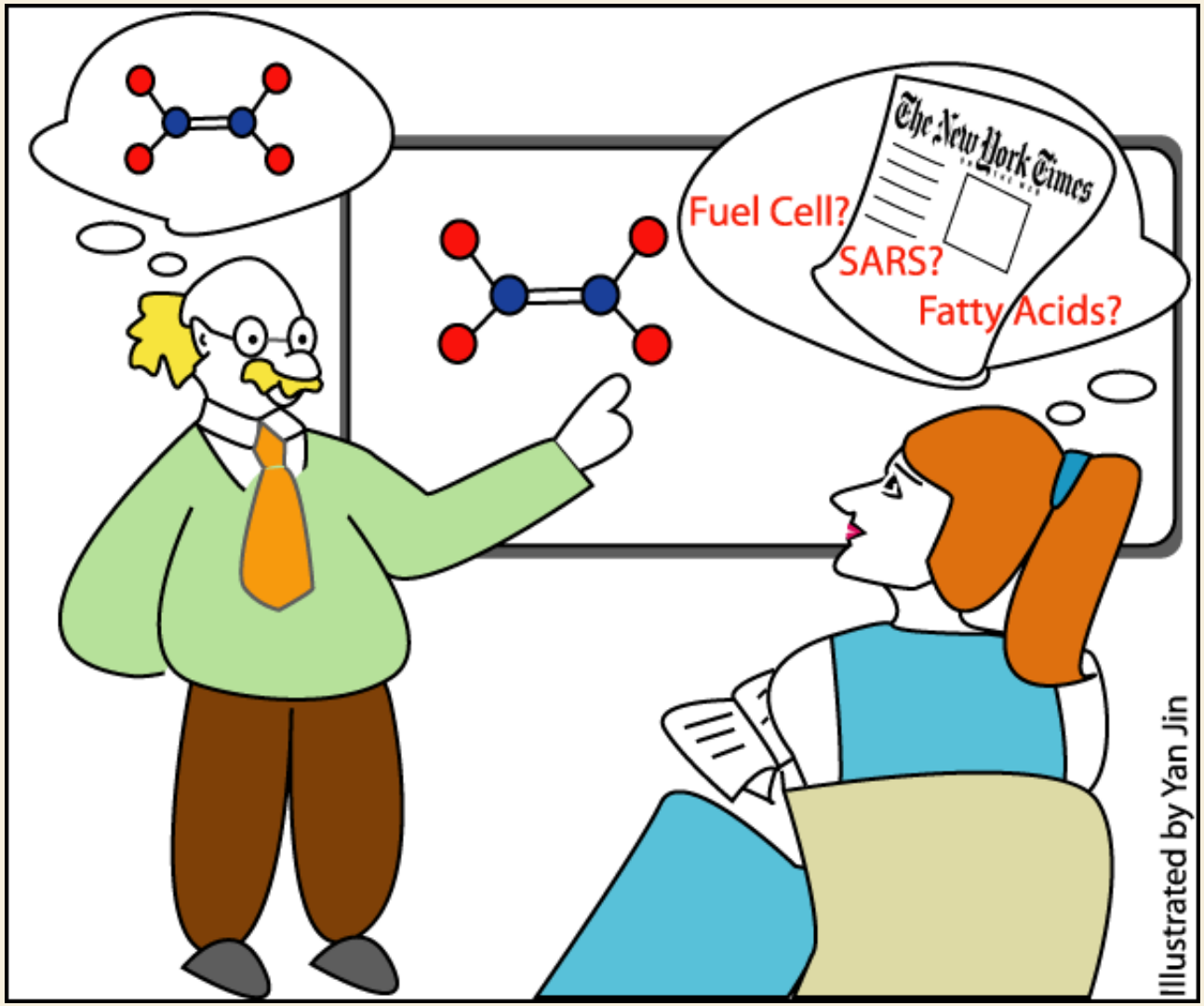
(*12*) T. Cheuk, Comparison of the three content standards: CCSS-ELA, CCSS-Mathematics, and NGSS (2012); http://ell.stanford.edu/content/science.

CHEMISTRY International

The News Magazine of the International Union of Pure and Applied Chemistry (IUPAC)

> CI Home
> IUPAC
> e-news

*Science Communication For All* Glaser, R. *Chem. Int.* **2003**, *25*, 3-6.



# Teaching Dissent and Persuasion

Kathleen M. Carson[1], Brian Hodgen[2], and Rainer E. Glaser[2]

*Educational Research and Reviews* **2006**, *1*, 115-120.

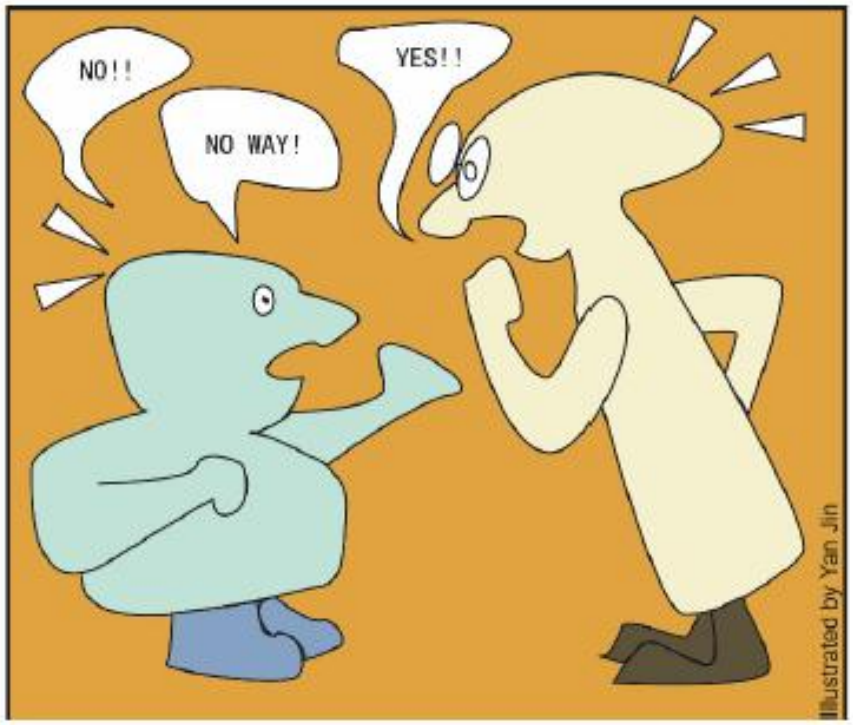



**Figure 1.** Dissent, sometimes presented heatedly and emotionally, is an essential component of science and science education.

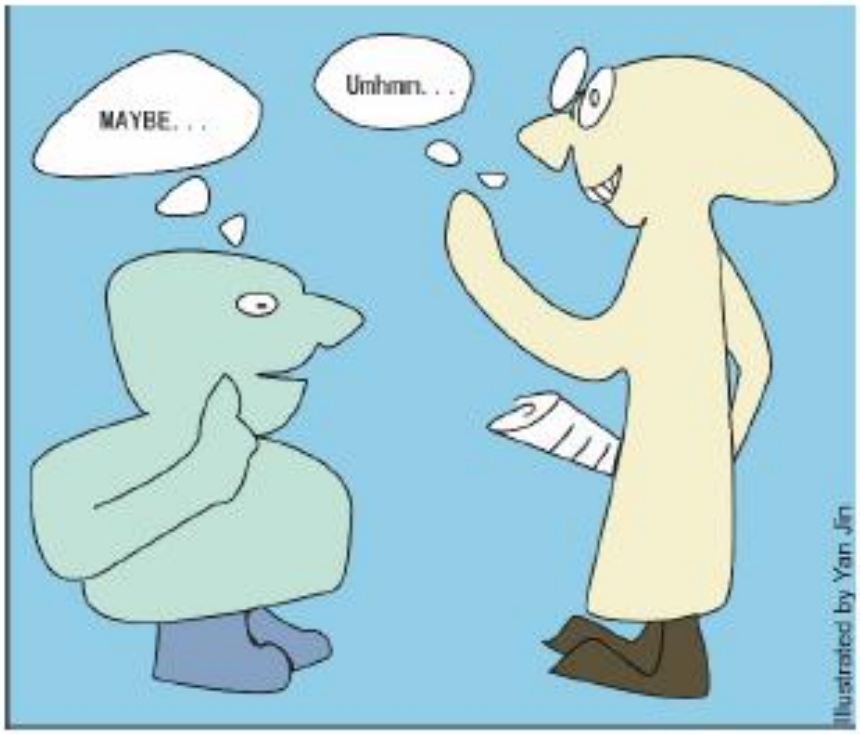



**Figure 2.** Continuous debate and growing understanding of contrary arguments leads to a consensus, which is the desired final stage of he scientific process.

# Teaching Dissent and Persuasion

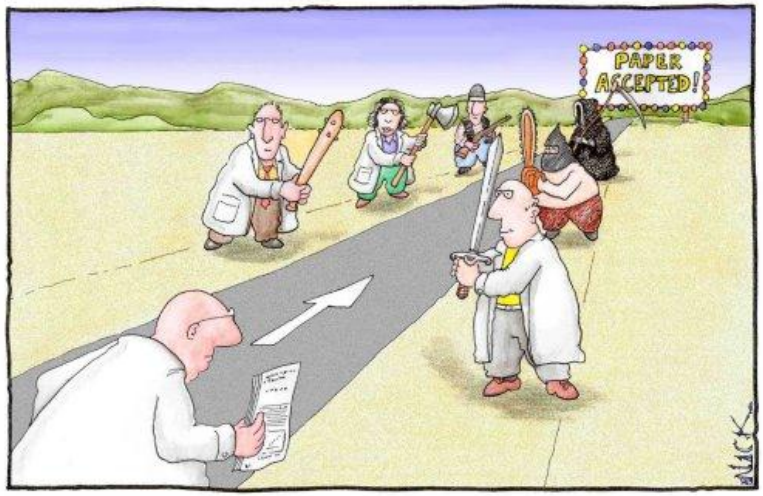
Kathleen M. Carson[1], Brian Hodgen[2], and Rainer E. Glaser[2]

*Educational Research and Reviews* **2006**, *1*, 115-120.

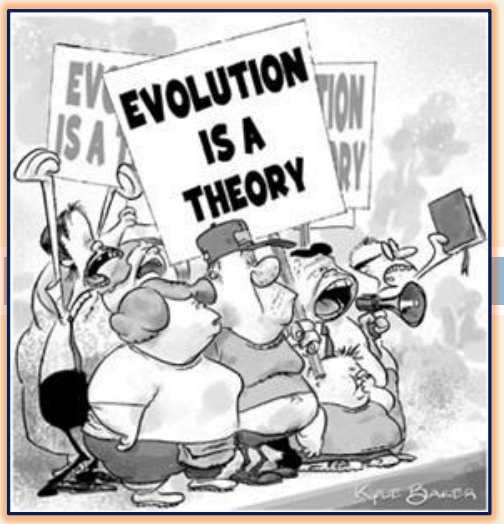
**Teaching philosophy should be based on the desired outcome of the teaching. In the case of science education, the guiding principle for a teaching philosophy should start with the desire to help students understand and use science, regardless of their major or profession. To effectively teach students how to understand science, one must include both the content and the process. Peer review is an integral part of the process of science, however it is generally lacking from science education. One must have something for the students to review in order to implement the process education, and *Chemistry Is in the News* offers such a project in the news portfolios. In-class peer review is useful and common in other disciplines, but there is much to be gained by going outside the walls of the institution. Inter-class, in particular interstate and international, compels faculty and students to use Information and Communication Technologies, exposes students to a diverse student body, and provides an opportunity to engage in faculty development via collaboration on instruction.**

**Key words:** Science Communication, Scientific Literacy, Peer Review, Science Teaching Philosophy, Collaborative Learning, Computer-Assisted Instruction.

http://handygrammar.com/tag/writing/

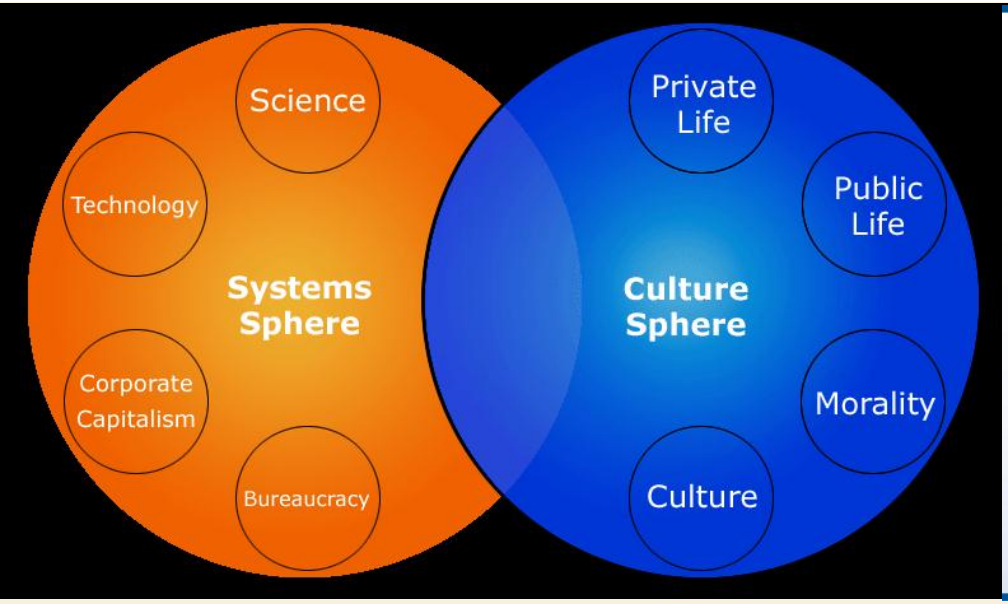


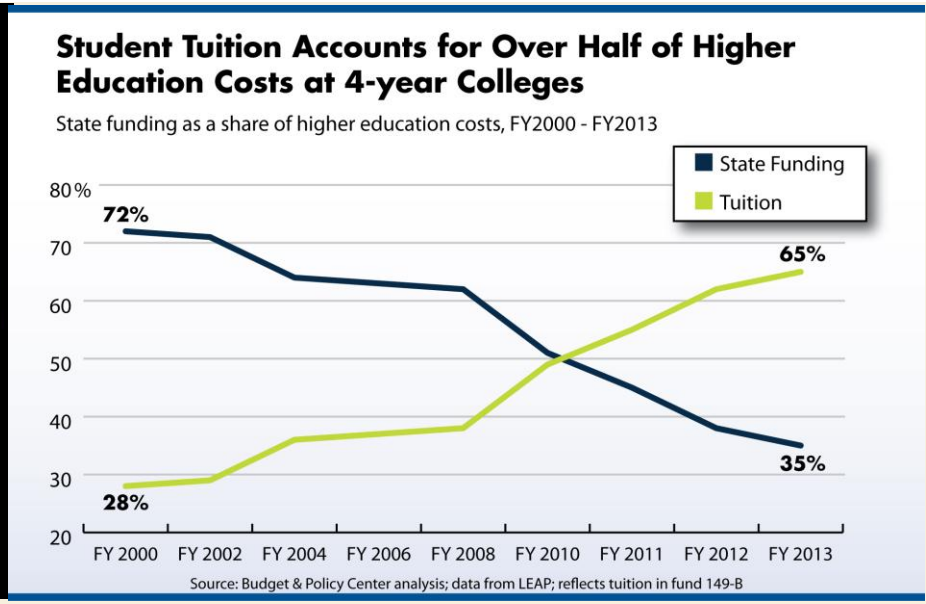
# Science or Ignorance





# Science and the Culture Sphere




**Jürgen Habermas:** Crisis will result from a failure to integrate the culture sphere and the systems sphere. The culture sphere will become *too weak* (emphasis ours) to legitimize the systems sphere.

**Crisis is already happening!** Total student loan debt exceeds 1 trillion US$. Student debt for seniors graduating with loans now exceeds $26,000. Ca. 13% of borrowers owe more than $50,000, and ca. 4% owe more than $100,000.

National Science Foundation
Directorate for Education and Human Resources
Division of Undergraduate Education

# Chemistry is in the News:

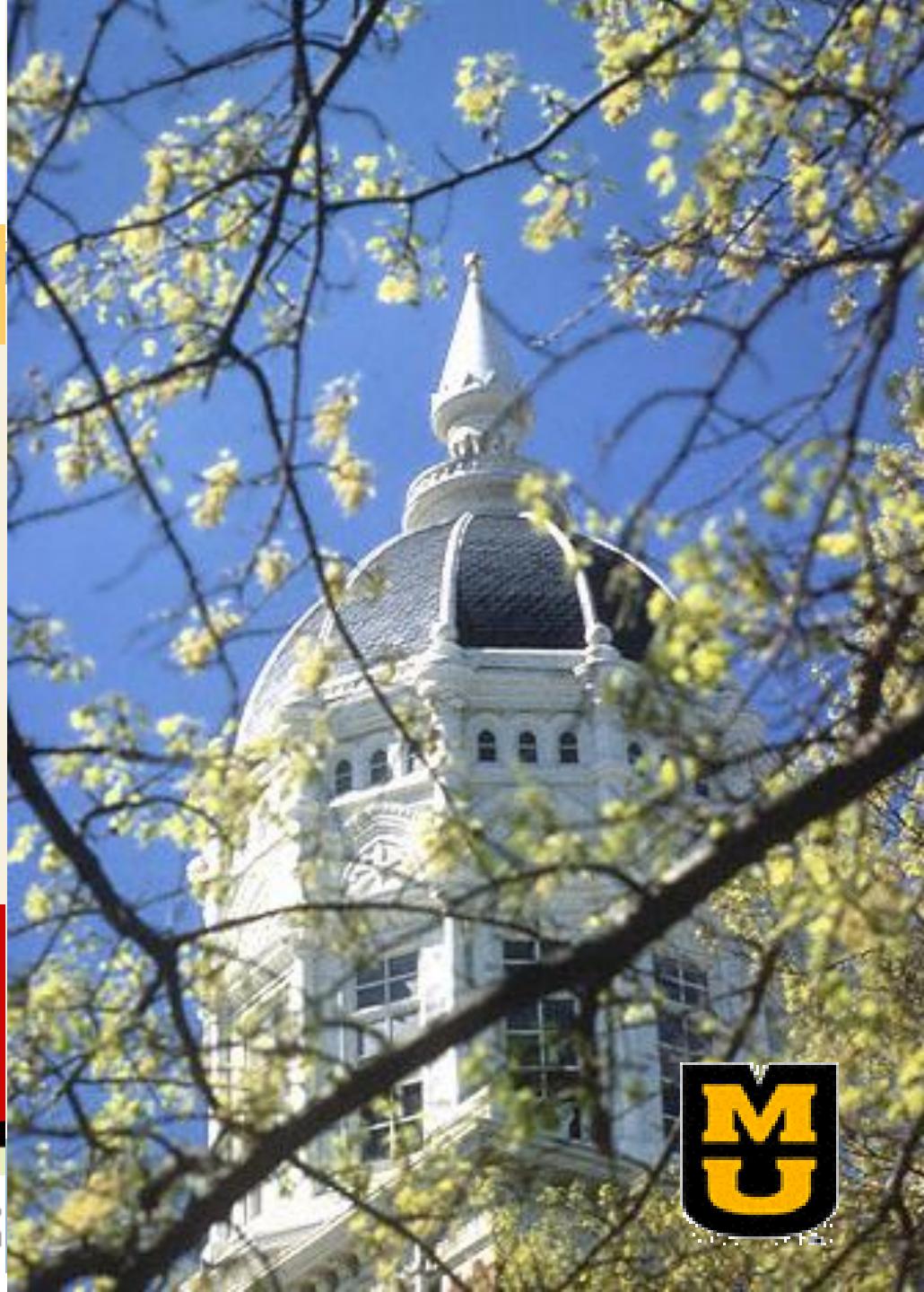
## Preparation for Science Communication

E. K. Mellon Honorary Seminar
on Chemical Education

FSU, January 23, 2004

The Camille & Henry Dreyfus Foundation, Inc.

The New York Times



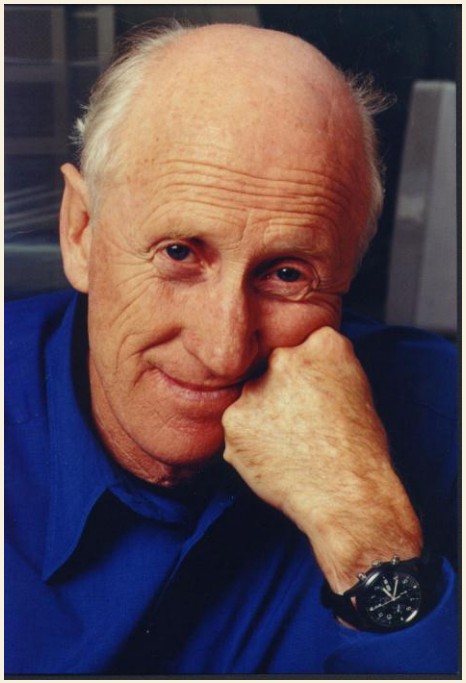
# provocative opinion

**The process of teaching and learning in college or university has conveniently been factored into two functions: a short-range *training* function and a long-range *education* function. In chemistry the simple *training* function comprises student mastery of task… is easily defined in terms of educational objectives... In the long-range *education* function, the important factor seems to be the enthusiasm imparted by the teacher… [it] is almost impossible to measure, but… it is here that the unique college experience is centered.**

**Edward K. Mellon**
Florida State University
Tallahassee, Florida 32306

*J. Chem. Educ.*, **50**, 531 (1973)

# Science is the Only News



STEWART BRAND
Founder of the Whole Earth Catalog, cofounder of the Global Business Network, cofounder and president of the Long Now Foundation.

We now live in a world in which the rate of change is the biggest change. Science has thus become a big story.

"Science is the only news. When you scan through a newspaper or magazine, all the human interest stuff is the same old he-said-she-said, the politics and economics the same sorry cyclic dramas, the fashions a pathetic illusion of newness, and even the technology is predictable if you know the science. Human nature doesn't change much; science does, and the change accrues, altering the world irreversibly."

# *Chemistry Is in the News*: Taxonomy of authentic news media-based learning activities[1]

Rainer E. Glaser* and Kathleen M. Carson

*Intl. J. Sci. Educ.* **2005**, *9*, 1083-1098.

Table 1. Taxonomy of 'authentic news media-based learning activities'

| Level | Activity | Quality review | Resource | Focus |
|---|---|---|---|---|
| 1 | Read News Article | None | Online News Media | Issue Awareness & Interest |
| 2 | Read News Portfolios | None | *Chemistry Is in the News* Online Database | Knowledge & Comprehension |
| 3 | Read & Create News portfolios | Instructor Review | | Application, Analysis & Synthesis |
| 4 | Read, Create & Judge News Portfolios | Intra-Class Peer Review | *Chemistry Is in the News* IITN Software tools | Evaluation Constructive Review |
| 5 | Read, Create & Judge News Portfolios | Inter-Class Peer Review | | Awareness of diversity |
| 6 | Read, Create & Judge News Portfolios | International Peer Review | | Awareness of International Context |

Level 2 Activities all semester. One item per chapter.

# Dr. Glaser's "Chemistry is in the News"

"Newspapers mirror society and newspaper articles allow to construct the important relations between society and chemistry."

Chapter Number in Wade 4/e & Chapter Theme
NEWS ARTICLE TITLE (serves as the link to the news item)
- Reference & Date
- Issues Raised
- Relevant Chemistry Topic

---

Chapter 1. Introduction and Review. Bonding, Acids & Bases.
U.S. FLOATS NEW 'BUBBLE' PROPOSAL
- Asahi News Service, December 11, 1997
- Greenhouse Effect, Atmospheric Chemistry, Environmental Protection
- Lewis Structures, Hybridization, Resources

Chapter 2. Structure and Properties of Organic Molecules.
TANKER BLEEDS OIL IN TOKYO BAY, WORST SPILL IN JAPAN'S HISTORY
- Assoc. Press and Reuters, July 3, 1997
- Oil Spill, Environmental Technology
- Physical Properties, Hydrophobic Effect, Oil Spill Remediation

Chapter 3. Structure and Stereochemistry of Alkanes.
ALTERNATIVES TO INTERNAL COMBUSTION

This news item was adapted by students Kerry Hickox and Shelley Glenn as part of their Chemistry 210 Honors' Project in FS98 under the guidance of Prof. Rainer Glaser.

# Glaser's "Chemistry is in the News"

To Accompany Wade Organic Chemistry 4/e.
Chapter 6. Alkyl Halides: Nucleophilic Substitution and Elimination.

For each of the following questions, please refer to the following article:

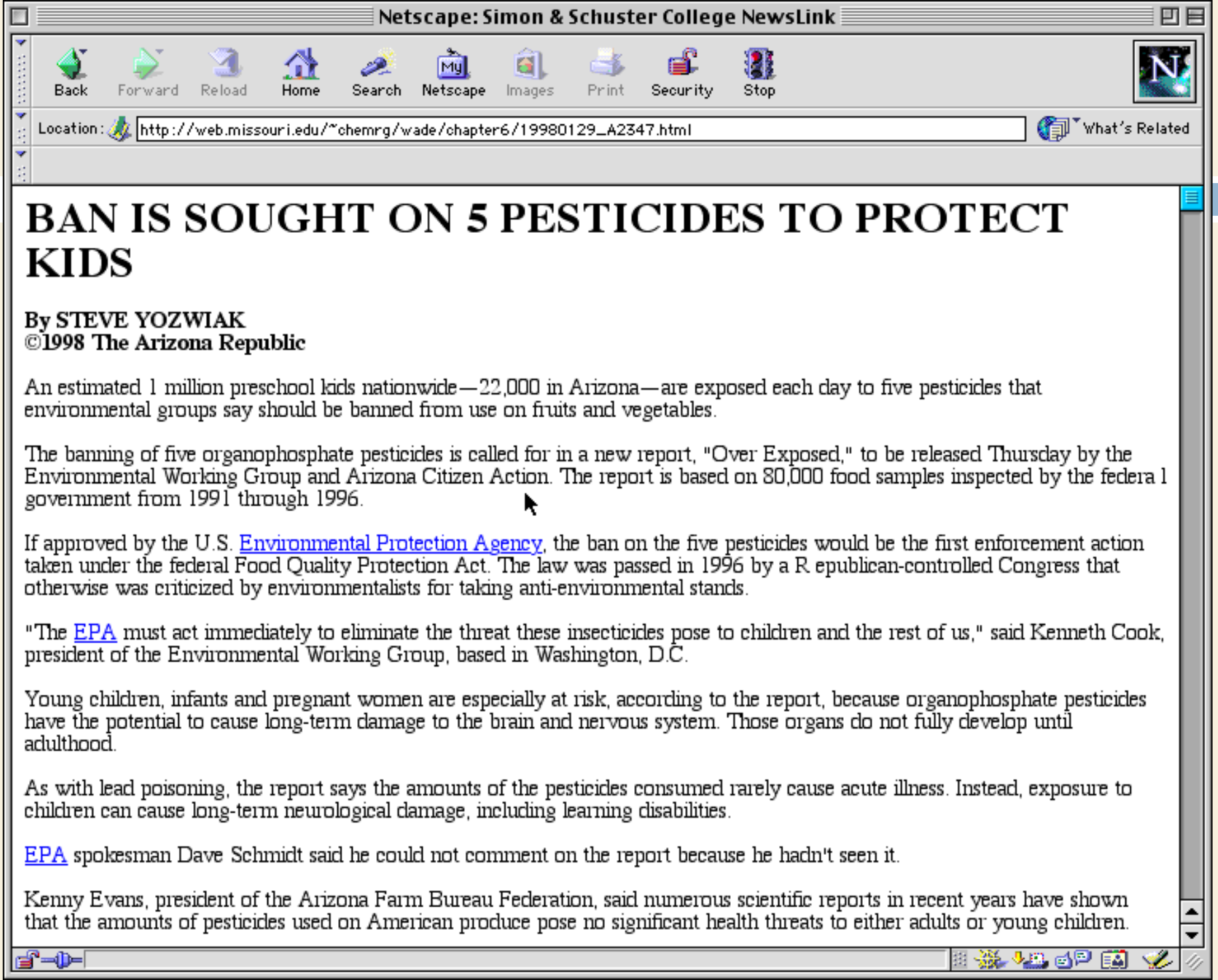
---

*BAN IS SOUGHT ON 5 PESTICIDES TO PROTECT KIDS*
by Steve Yozwiak (*The Arizona Republic* , January 29, 1998)

## Editorial Comments

The discussion of the reactivity of the substrate in the nucleophilic substitution reaction is highly pertinent to biological processes. Obviously, reactions in living organisms have to go at mild temperature. Hence, biological methylating reagents contain methyl groups that are attached to very good leaving groups so that methylation can take place at a reasonable rate. In other words: If a methyl compound Me-X enters the body and X is a very good leaving group, then this compound can alkylate cellular materials and it may cause damage. In fact, many chemicals are toxic just for that reason and highly methylating reagents have to be avoided.

Shortly after I had read Chapter 6, I came across the above article on pesticides. About halfway into the article I read the sentence "The chemicals environmentalists propose banning are methyl parathion, dimethoate, chlorpyrifos, pirimiphos methyl and azinphos methyl". I have a PhD in chemistry but I have no idea what these compounds are. Could these pesticides be bad because they are methylating reagents? Well, to answer that question, I need to know what their structures are. I did a web search for the first compound on the list and easily found a methyl parathion page on the web. I look at page 1 but there is little




# BAN IS SOUGHT ON 5 PESTICIDES TO PROTECT KIDS

**By STEVE YOZWIAK**


An estimated 1 million preschool kids nationwide—22,000 in Arizona—are exposed each day to five pesticides that environmental groups say should be banned from use on fruits and vegetables.

The banning of five organophosphate pesticides is called for in a new report, "Over Exposed," to be released Thursday by the Environmental Working Group and Arizona Citizen Action. The report is based on 80,000 food samples inspected by the federa l government from 1991 through 1996.

If approved by the U.S. Environmental Protection Agency, the ban on the five pesticides would be the first enforcement action taken under the federal Food Quality Protection Act. The law was passed in 1996 by a R epublican-controlled Congress that otherwise was criticized by environmentalists for taking anti-environmental stands.

"The EPA must act immediately to eliminate the threat these insecticides pose to children and the rest of us," said Kenneth Cook, president of the Environmental Working Group, based in Washington, D.C.

Young children, infants and pregnant women are especially at risk, according to the report, because organophosphate pesticides have the potential to cause long-term damage to the brain and nervous system. Those organs do not fully develop until adulthood.

As with lead poisoning, the report says the amounts of the pesticides consumed rarely cause acute illness. Instead, exposure to children can cause long-term neurological damage, including learning disabilities.

EPA spokesman Dave Schmidt said he could not comment on the report because he hadn't seen it.

Kenny Evans, president of the Arizona Farm Bureau Federation, said numerous scientific reports in recent years have shown that the amounts of pesticides used on American produce pose no significant health threats to either adults or young children.

# Editorial Comments

The discussion of the reactivity of the substrate in the nucleophilic substitution reaction is highly pertinent to biological processes. Obviously, reactions in living organisms have to go at mild temperature. Hence, biological methylating reagents contain methyl groups that are attached to very good leaving groups so that methylation can take place at a reasonable rate. In other words: If a methyl compound Me-X enters the body and X is a very good leaving group, then this compound can alkylate cellular materials and it may cause damage. In fact, many chemicals are toxic just for that reason and highly methylating reagents have to be avoided.

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Now that we deciphered the commercial names and were able to recognize the alkylating potential of these compounds, we would have to start looking into whether they actually realize this potential and to what extent. Only lots of testing over the course of many years would fully answer our concerns. In the meantime, should we use the pesticides?

**Pertinent Text References**

Section 6.8 and following on Nucleophilic Substitution.

# Methyl Parathion
<I1003189>

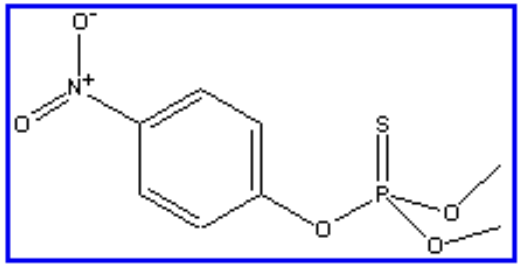
[298-00-0]

**Synonyms:** Parathion-methyl; Phosphorothioic acid O,O-dimethyl O-(4-nitrophenyl) ester; O,O-dimethyl O-p-nitrophenyl phosphorothioate; O,O-dimethyl O-p-nitrophenyl thiophosphate; dimethyl parathion; Metaphos; E 601; Dalf; Folidol-M; Metacide; Penncap-M; Metafos; Dimethyl 4-nitrophenyl phosphorothionate; dimethyl p-nitrophenyl monothiophosphate; O,O-dimethyl O-(p-nitrophenyl) thionophosphate; dimethyl p-nitrophenyl thionophosphate; p-nitrophenyldimethylthionophosphate; Dalif; metron; nitrox 80; bladan m; nitrox; wofatox; bay e-601; folidol-80; Metaphor; parathion methyl homolog; Dimethyl O-p-nitrophenyl thiophosphate

$C_8H_{10}NO_5PS$

263.20





| | | | |
|---|---|---|---|
| ACX Number | I1003189 | CAS RN | 298-00-0 |
| Melting Point (°C) | 36 | Specific Gravity | 1.36 |
| Boiling Point (°C) | 143 at 1.0 mm Hg | Vapor Density | -- |
| Evaporation Rate | -- | Water Solubility | 0.005 g/100 mL |
| Flash Point (°C) | 46.1 | EPA Code | P071 |

Chapter 15.10. $S_N2$ Displacement Reactions of Allylic Halides and Tosylates.

**Follow-Up References**
Sept. 7, 1999: Taking measures on pesticides. Measure puts profits above kids' health. (Methyl parathion)
June 2, 2000: EPA set to ban Dursban for household use.
Dec. 5, 2000: EPA Phasing Out Popular Ant And Roach Poison. (Diazinon)

## Questions

**Question 1:** Use ChemFinder to find out about the structures of the five pesticides mentioned in the article.

**Question 2:** Learn about the mode of action of these organophosphate pesticides in the Introduction to Insecticides by George Ware. What are the structures of cholin and acetylcholin? What is the function of cholinesterase? What is the effect of cholinesterase inhibition?

**Question 3:** Organophosphate insecticides and pesticides permanently inhibit cholinesterase by a reaction of an enzyme-OH group with the organophosphate. Using structural formula, describe this reaction.

**Question 4:** Consider the SN2 reaction of methyl parathion with a nucleophile such as an alkoxide (use ethoxide). Draw the structures of the products of this reaction and write down all the resonance forms of the leaving group that is released in this reaction.

## Chemistry & Society Discussion

In the article, a person named Cook is quoted as saying "We have the right to remain silent about risks in the food supply." Do you think that is an ethical attitude?

# *CIITN* Content Needs to Be Tested

Chemistry 210
"Organic Chemistry I"
Winter Semester 1999
Dr. Rainer Glaser

Examination #2
"Alkyl Halides: Their Synthesis by Halogenation of Alkanes and Their Nucleophilic Substitution and Elimination Reactions."

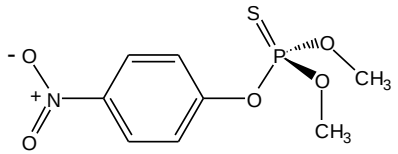
Friday, March 12, 1999, 9:00 - 9:50

| Name: |
|---|
| |

| | | |
|---|---|---|
| Question 1. Radical Chain Halogenations I. | 12 | |
| Question 2. Radical Chain Halogenations II. | 16 | |
| Question 3. Stereochemistry I. (incl. News #5) | 14 | |
| Question 4. Stereochemistry II. | 16 | |
| Question 5. Nucl. Subst. & Elim. I. (incl. News #6) | 12 | |
| Question 6. Nucl. Subst. & Elim. II. | 14 | |
| Question 7. Nucl. Subst. & Elim. III. | 16 | |
| Total | 100 | |
| Multiple Choice Percentage Q2, Q4 and Q7. | | |

**Question 5.** Nucleophilic Substitution and Elimination I. (12 points)

The article "BAN IS SOUGHT ON 5 PESTICIDES TO PROTECT KIDS" (*The Arizona Republic*, Jan. 29, **1998**) talked environmental activism aimed at banning a group of pesticides. One of these is **methyl parathion** and its structure is shown. This compound is suspected to be toxic because of its high methylating power. Methyl parathion contains two methyl groups. If one of these methyl groups is attacked by a nucleophile, then an _____ ($S_N1$, $S_N2$) reaction can occur. This $S_N$ reaction is facilitated by the fact that the nucleofug is a really good leaving group. (1 point)




**(a)** Consider the reaction of the **methyl sulfide** nucleophile, $H_3C\text{-}S^-$, with methyl parathion. Draw the structure of the product of this reaction and draw the structure of the leaving group as well. (5 p.)

**(b)** Using resonance theory, explain why the leaving group in the above reaction is a "good" one. (6 p.)

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| 1 | Read News Article | None | Online News Media | Issue Awareness & Interest |
| 2 | Read News Portfolios | None | *Chemistry Is in the News* Online Database | Knowledge & Comprehension |
| 3 | Read & Create News portfolios | Instructor Review | | Application, Analysis & Synthesis |
| 4 | Read, Create & Judge News Portfolios | Intra-Class Peer Review | *Chemistry Is in the News* IITN Software tools | Evaluation Constructive Review |
| 5 | Read, Create & Judge News Portfolios | Inter-Class Peer Review | | Awareness of diversity |
| 6 | Read, Create & Judge News Portfolios | International Peer Review | | Awareness of International Context |

Level 4 - 5 activities: One group project at end of semester.
Self-selected groups of 5-6 students. Groups from in week #2.

# *Chemistry Is in the News:* Assessment of Student Attitudes toward Authentic News Media-Based Learning Activities

*J. Chem. Educ.* **2006**, *83*, 662-667.

**Deborah L. Hume**
Department of Psychological Sciences

**Kathleen M. Carson**
Department of Educational Leadership and Policy Analysis

**Brian Hodgen and Rainer E. Glaser***
Department of Chemistry

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***CIITN* helps to create**
**-- interest in Organic Chemistry**
**-- better understanding of society**

**Organic Chemistry is still hard.**

**Table 1. Key Questions Asked in the Quantitative Assessment at T1 and T2**

| Item | Question[a] | T1: Expectations Mean | T2: Perceptions Mean |
|---|---|---|---|
| 1 | How interesting do you expect the material in organic chemistry to be? | 3.20 (0.98)[b] | 3.05 (0.88) |
| 2 | How useful do you expect the material in organic chemistry will be in helping you understand issues of concern to our society or the world? | 3.33 (0.92) | 3.28 (0.80)[c] |
| 3 | Do you think seeing how organic chemistry is related to real world issues and problems would make the subject more interesting? | 3.88 (0.85) | 3.46 (0.92)[c] |
| 4 | Do you think seeing how organic chemistry is related to real world issues and problems would make the subject easier to understand and learn? | 3.63 (0.98) | 2.60 (0.87)[c] |

[a]Questions were rephrased at T2 to reflect students' exposure to *CIITN*. [b]Standard deviations are provided in parentheses. [c]The difference between T1 and T2 is statistically significant ($p < 0.05$).

# Assessment

*J. Chem. Educ.* **2006,** *83,* 662-667.

## *CIITN* encourages peer-to-peer learning!

*Collaborative groups help students' learning in this class: 2.90/4*

*Use of collaborative group to otherwise study for this class: 3.86/4*

**Table 3. Additional Questions Asked in the Quantitative Assessment at Time Two**

| Questions about News Portfolios | Mean |
|---|---|
| 1. Did using the news portfolios help you see how organic chemistry is related to societal issues? | 3.56 (1.03) |
| 2. Did creating your own news portfolios help you see how organic chemistry is related to societal issues? | 3.28 (1.11) |
| 3. To what extent did reading and answering questions on the news portfolios help your learning in this class? | 2.65 (0.99) |
| 4. To what extent did creating your own news portfolios and questions help your learning in this class? | 2.55 (1.05) |
| 5. To what extent did working in collaborative groups help your learning in this class? | 2.90 (1.29) |
| **Questions about Collaborative Groups** | |
| 1. How much did you use your collaborative groups to work on the posted news portfolios? (instructor-created news portfolios) | 1.21 (1.29) |
| 2. How much did you use your collaborative groups to create your own news portfolios? (collaborative group projects) | 2.92 (1.13) |
| 3. How much did you use your collaborative groups to work problem sets? | 0.95 (1.22) |
| 4. How much did you use your collaborative groups to use the visualization centers? | 0.21 (0.54) |
| 5. How much did you use your collaborative groups to otherwise study for this class? | 3.86 (1.34) |

NOTE: Responses on this scale were anchored at 0 (not at all), 1 (somewhat), 2 (moderately), 3 (frequently), and 4 (a great deal). Higher numbers in the bottom half of the table indicate more extensive use of groups.

# Assessment of Student Attitudes

*J. Chem. Educ.* **2006**, *83*, 662-667.

One of the most important results of our assessment concerns our finding of a significant correlation between students' expectations at the beginning of the semester and learning outcomes. This finding suggests that if students' expectations are raised at the beginning of the semester, the final learning outcome will also more positive. To that end, there have been several additional changes to the *CIITN* project.

[1] To increase the confidence of both the instructor and the students, two preparatory assignments have been added. These assignments (summary writing, reaction description with diagram) provide for more mandated contact between the students and their collaborative group and this contact takes place over the course of the semester. Students also have a greater opportunity to gain skills required to complete the portfolios prior to the actual construction, making the students more comfortable with the process and resulting in higher quality portfolios.

[2] A constructive peer review step has been added to the assessment of the portfolios. This step alleviates pressure on the students to perform well on the first try on a novel activity, making them more open to this form of assessment.

# *Chemistry Is in the news*: assessing intra-group peer review

Kathleen M. Carson[a]* and Rainer E. Glaser[b]*

*Assessment & Evaluation in Higher Education* **2009**, *34*, 69–81.

*Chemistry Is in the News* (*CIITN*) is a curriculum that aims to teach students this skill by engaging student collaborative groups in a project that ties real world events and topics to the content taught in the classroom. While the collaborative activity has been successful in many ways, the **challenge of maintaining individual accountability within the collaborative activity** has persisted. The need to **balance the tension between promoting collaboration and maintaining individual performance** standards drove the development of an **intra-group peer review system**. In developing this peer review system, four goals guide the design: the desire to promote collaboration, to produce a differentiated score among group members reflecting the contribution each person made, to improve student perception of fairness and accuracy in the assessment process of *CIITN* and to avoid artificially inflating students' grades. The system was assessed in the winter semester of 2004 in a large lecture course at a major Midwestern university via student questionnaires and the *CIITN* scores. Evidence is provided to suggest that the intra-group peer review system has met its core goals.

**Keywords:** science education; interdisciplinarity; group collaboration; peer review; accountability

# *Chemistry Is in the news*: assessing intra-group peer review

Kathleen M. Carson[a]* and Rainer E. Glaser[b]*

*Assessment & Evaluation in Higher Education* **2009**, *34*, 69–81.

During the winter semester 2004, the three *CIITN* projects accounted for 200 points of a total of 850 points or 23.5% of the overall course grade. The first and second assignments were worth 50 points each and the scores were entirely based on the score the TA assigned to the work. The third assignment, the *CIITN* portfolio, was worth 100 points and combined the portfolio score and the intra-group peer review score.

## *CIITN intra-group peer review*

The *CIITN* intra-group peer review system is a hybrid of the two systems designed by Goldfinch and Raeside (1993) and Kruck and Reif (2001). Students are given the rubric at the beginning of the semester when they form groups of three to five students and the intra-group scoring is roughly outlined for the students. It is explained to students in class that rubric categories are some of the things they should consider when choosing group members. For example, if it is important to them that all group members attend all group meetings, it would be better to form a group made of students who have similar schedules as opposed to automatically forming a group with a former lab partner who works at a job 20 hours per week.

**Appendix 1. Intra-group peer review rubric**

| Level of performance | Highly effective | Effective | Moderately effective | Not effective | Inadequate |
|---|---|---|---|---|---|
| | Truly went above and beyond in an effort to improve the group and the group's project | Contributed their share to the group, fulfiling what was required of them and enhancing the group and final project | Attempted to participate but occasionally fell below the level expected of them, overall moved the group forwards | Frequently fell below the level expected or did not attempt the role but was not severely disruptive to the group or the project | Disruptive in their attempt to fulfil the role or their refusal to take on the role, detrimental to group cohesiveness and overall quality of final project |
| Facilitator<br>Proposer<br>Supporter<br>Critic<br>Organiser | Attempted all five roles | Attempted four out of five roles | Attempted three out of five roles | Attempted one–two out of five roles | Attempted no roles |
| Time contribution | Attended all meetings and did significant outside research | Attended all meetings and did some outside research | Attended most meetings and did little outside research | Attended most meetings but did no outside research | Attended few meetings and did no outside research |
| Share of workload | Picked up any 'slack' | Fulfiled expectations completely | Fulfiled most expectations | Fulfiled a minimum amount of expectations | Did not fulfil expectations |
| Project knowledge | Exceptional awareness of project requirements and how to meet them, innovative ideas provided | Aware of project requirements and how to meet them creatively | Mostly aware of project requirements and how to meet them conventionally | Generally aware of the project requirements but is unsure of how to meet some of them | Unaware of most or all of the project requirements and few or no ideas of how to meet them |
| Chemistry knowledge | Exceptional chemistry knowledge provided to the group | Provided group with the knowledge of chemistry needed | Adequate chemistry knowledge shared with group | Inadequate knowledge of chemistry shared with group | Share no chemistry knowledge with group |
| Ability to cooperate | Enhanced cooperation with the group as a whole | Cooperated as expected | Cooperated as needed | Cooperated at times but not on a regular basis | Did not cooperate to any meaningful extent |
| Enthusiasm for group work | Highly enthusiastic | Showed overall enthusiasm | Showed some enthusiasm | Was primarily unenthusiastic | Displayed a negative attitude |
| Similarity of goals for project with group | Complete agreement with group's goals | Primarily in agreement with group – worked towards group's goals | Adequate amount of agreement 0 worked towards most goals | Inadequate amount of agreement – worked towards few goals | Total inadequate amount of agreement – only concerned with personal goals |
| This person's contribution to this project made it | Significantly better | Moderately better | No better or worse | Moderately worse | Significantly worse |

# *Chemistry Is in the news*: assessing intra-group peer review

Kathleen M. Carson[a]* and Rainer E. Glaser[b]*

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Following the final round of peer review of the portfolio, students login to the *CIITN* webtool (Glaser et al. 2004; Wu and Glaser 2004) as an individual and carry out intra-group peer review. Once logged into their individual accounts, the students can access an electronic copy of the rubric. They then access the intra-group peer review form where all group members except for the individual grading are listed with a point value field and a comment field for each. At the bottom there is a 'Points Left' field. **Students must distribute all 100 points between the various fields** and **provide a justification for that value in the comment field for each student.** … Requiring comments encourages students to be thoughtful in their scoring, to provide a reference in the case of grade disputes and, most importantly, to give students more meaningful feedback with regard to their collaborative group work skills (Boud, Cohen, and Sampson 1999).

# *Chemistry Is in the news*: assessing intra-group peer review

Kathleen M. Carson[a]* and Rainer E. Glaser[b]*

*Assessment & Evaluation in Higher Education* **2009**, *34*, 69–81.

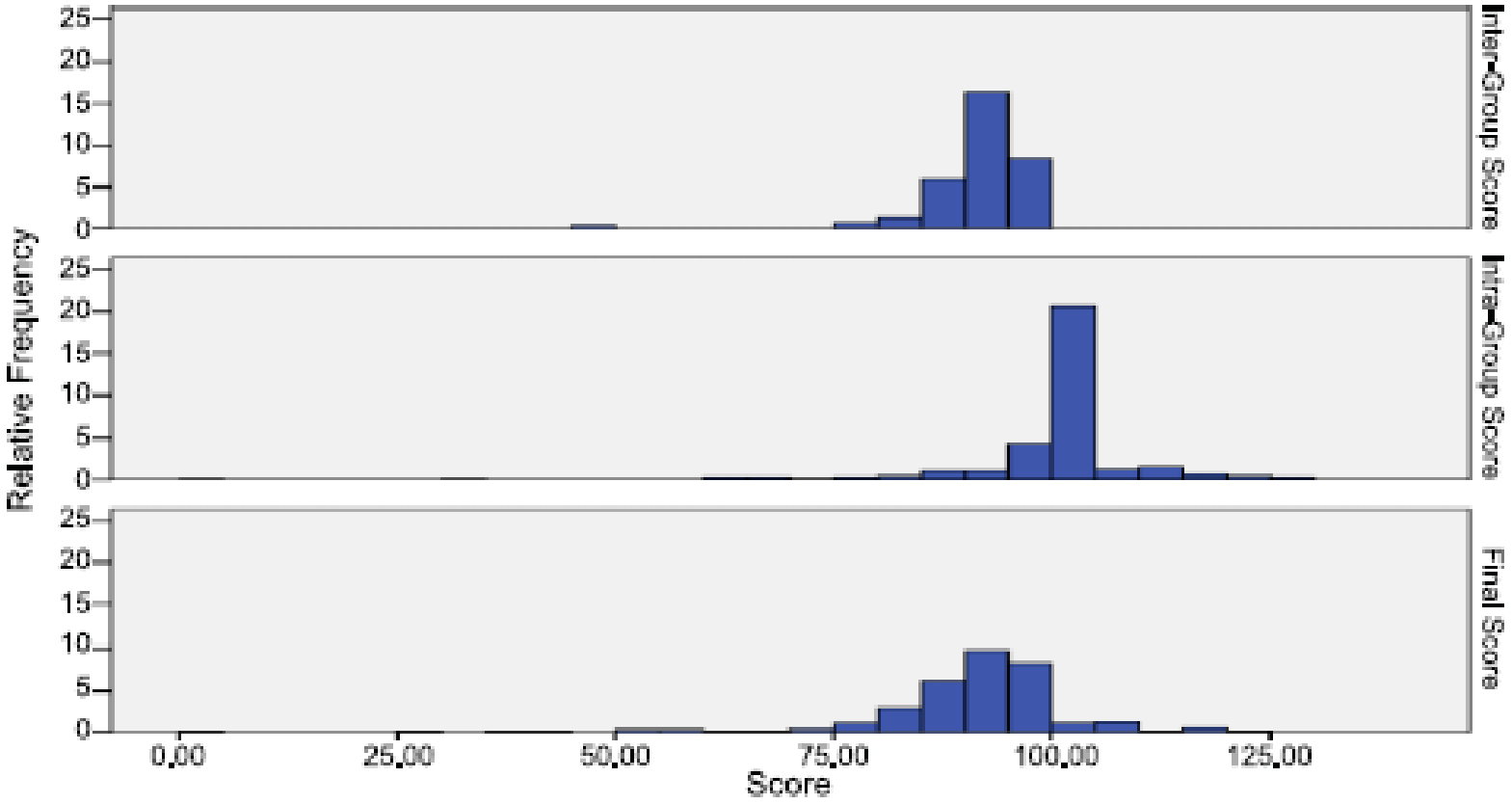



Figure 2. Distribution of *CIITN* Scores. The intra-group peer-review score is converted to a percentage and multiplied by the portfolio's inter-group score to arrive at the final score.

# Scientific Writing in Chemistry

Chem3700: Undergraduate Seminar in Chemistry

SP 2013

# CHEM 3700

"UGS Chemistry"



Inaugural Writing Intensive Teaching Excellence Award 2012, Campus Writing Program
Faculty Development Award AY13/14, Campus Writing Program



## Course Essentials

Syllabus, Schedule, Contact Hours, Honors College and myZou. Classroom Conduct Guidelines, Jan. 2011.
Residence Hall Classroom Information 01/16/13
Emergency Information for Students, Emergency Securing 01/16/13

**Main Entry:** writ.ing. Form of human communication by means of a set of visible marks that are related, by convention, to some particular structural level of language.


We endorse, adopt and implement the Next Generation Science Standards.

Writing Intensive (WI) CHEM 3700 fulfills the WI-requirements of the Campus Writing Program.

Computer and Information Proficiency (CIP) CHEM3700 is a computer and information proficiency course. As part of the requirements for successfully completing this course, students will be asked to use computers in a variety of ways. This experience should help students gain useful skills they can use throughout their academic life and in the workplace after graduation. There are, however, no computing prerequisites for this course.

**Student Feedback** and Teaching Evaluations

SP 2013
CHEM 3700
"UGS Chemistry"


Inaugural Writing Intensive Teaching Excellence Award 2012, Campus Writing Program
Faculty Development Award AY13/14, Campus Writing Program



**Weekly Assignments on "Scientific Writing":**

# Solar Energy and Other Renewables

Assignment #1: Writing Text (01/30/13). Rubric (01/30/13). Sample as PDF, as DOC and as DOCX.
Assignment #2: Creating & Integrating Schemes (01/30/13). Rubric (01/30/13). Sample1 as PDF, as DOC, and as DOCX. Sample2 as PDF, as DOC, and as DOCX.
Assignment #3: Tables, Descriptive Statistics, Histograms & Bell Curves (01/30/13). Data as DOC file and as DOCX file. Rubric (01/30/13). Sample as XLSX, XLS and PDF.
Assignment #4: Functions, Graphs and Regression (01/30/13). Source. N719. Plasmonic NPs. Surface Plasmon Resonance (PDF). Rubric (01/30/13). Sample as XLSX, XLS, DOCX, DOC, and as PDF.
Assignment #5: Searching, Bibliography, and Database (01/31/13). Rubric (01/31/13). Sample as DOCX, DOC and PDF.
Assignment #6: Oral Presentation (01/31/13). Rubric (01/31/13). Presentation Schedule.
Presentation Award Winners (by peer review, PDF format): Gold, Silver, Bronze, Histogram. Honorary Mention for Dazzling Color as PPTX, PPT and PDF.
Assignment #7: Data Mining & Molecular Modeling of Photosystems I and II (02/01/13). Rubric (02/01/13). RCSB Protein Data Bank. Photosystem I and Photosystem II. Photosynthetic Electron Transport and ATP Synthesis (Animation). Reviews 1, 2 and 3. Helpful information: Jmol Help; Jmol; check out "select" under examples. Protein Workshop. How to Take Screen Shots Using Windows. How to Take Screen Shots on Macs. Samples 1, 2, and 3.

SP 2013
CHEM 3700
"UGS Chemistry"


Inaugural Writing Intensive Teaching Excellence Award 2012, Campus Writing Program
Faculty Development Award AY13/14, Campus Writing Program



Presentation Award Winners (by peer review, PDF format): Gold, Silver, Bronze, Histogram. Honorary Mention for Dazzling Color as PPTX, PPT and PDF.
Assignment #7: Data Mining & Molecular Modeling of Photosystems I and II (02/01/13). Rubric (02/01/13). RCSB Protein Data Bank. Photosystem I and Photosystem II. Photosynthetic Electron Transport and ATP Synthesis (Animation). Reviews 1, 2 and 3. Helpful information: Jmol Help; Jmol; check out "select" under examples. Protein Workshop. How to Take Screen Shots Using Windows. How to Take Screen Shots on Macs. Samples 1, 2, and 3.

Assignment #8: Materials, Methods, & Appendix (02/01/13). Rubric (02/01/13). Sample as DOCX, DOC and PDF.
Assignment #9: Manuscript Preparation and Submission (02/01/13, bundled with A08). No rubric for A09; A09 will be peer-reviewed by 3-fold, written, anonymous peer review in A10.
Assignment #10: Written Scientific Peer Review (02/01/13). No rubric for A10; the quality of the peer reviews is not assessed formally.
Assignment #11: Rebuttal Letter, Revision of Manuscript, and Graphical Abstract (02/01/13). Rubric (02/01/13).
Revised Paper Award Winners (by peer review): Gold, Silver, Bronze. Bronze. Histogram A11 PR Scores (05/13/13).

Course Outcomes: Course Histogram (05/13/13). Course Keywords Wordle (04/27/13).

**Scientific Writing & Peer Review: Manuscript Preparation, Review and Revision**
Assignments #9 - #11 constitute a contiguous sequence and the three assignments result in one overall score. The review of A#9 will be Assignment #10 and every submission will be peer reviewed by three groups/individuals. In Assignment #11, the manuscript is revised and resubmitted, along with a rebuttal letter, for a second peer review by the same three referees. This second review will be a rubric-based peer review and the average score is the A11 score.

# Course Design and Organization

| | Week 2 | | | Week 3 | | | Week 4 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mon | Wed | Fri CL | Mon | Wed | Fri CL | Mon | Wed | Fri CL |
| A01 | BG Lect. | Assign Conv. | Comp. Lab | Qs? | Peer Rev. | Return PR | | | |
| A02 | | | | BG Lect. | Assign Conv. | Comp. Lab | | Peer Rev. | Return PR |
| A03 | | | | | | | BG Lect. | Assign Conv. | Comp. Lab |
| … | | | | | | | | | |

**Develop a rhythm. Explain the organization.**
**Stick to the schedule as much as possible! Enforce deadlines!**

SP 2013
# CHEM 3700
"UGS Chemistry"


Inaugural Writing Intensive Teaching Excellence Award 2012, Campus Writing Program
Faculty Development Award AY13/14, Campus Writing Program

Essentials | Notes | Writing Resources | Science Topic Resources
Assignments: SP13 | SP12 | SP11 | SP10

## Schedule, Chemistry 3700, Spring 2013

Posted: January 9, 2013. Last Update: March 7, 2013.

| Week of | Theme | Resource/Software | Assignment | Review |
|---|---|---|---|---|
| Jan. 21 | The Standards (Katz I.1) | | | |
| Jan. 28 | Words & Text (more Katz I.2-3) | Word | Wed., 01/30: A01 | |
| Feb. 4 | Data Presentation: Tables & Schemes (Katz I.4) | ChemDraw, Word | Wed., 02/06: A02 | Wed., 02/06: A01 |
| Feb. 11 | Data Analysis I: Statistics & Graphing (Katz I.4-5) | Excel | Wed., 02/13: A03 | Wed., 02/13: A02 |
| Feb. 18 | Data Analysis II: Statistics & Graphing (Katz I.4-5, other) | Excel | Wed., 02/20: A04 | Wed., 02/20: A03 |
| Feb. 25 | Search & Bibliography (Katz II.2.11-13, App. D) | SciFinder, Word | Wed., 02/27: A05, A06 | Wed., 02/27: A04 |
| March 4 | Citation & Reference Section; Article & Slides | Powerpoint | | Wed., 03/06: A05 |
| March 11 | Oral Presentation Week (No Meeting Mon., 03/11) | All Resources | | All Week: A06 |
| March 18 | Oral Presentation Week 2, Friday: Structure and Modeling | Chem3D, Jmol etc. | | Fri., 03/22: A07 |
| March 25 | **SPRING BREAK** | $H_2O$ & $SiO_2$ | | |

Blizzards! Feb. & March

# Assignments

# Clear & Concise Instructions

Clear Goals
Precise Instructions
Specific Format Requirements
Submission Requirements



**Assignment #1: Writing Text**

For the following skeletal outline, the topic provided and using selected articles (5 – 8) from the literature (and the web sites) posted on the course web site in the section "Science Topic Resources": (a) Open a Word file and create a standard outline for a scientific paper, (b) at the appropriate place, type in the information about the selected, provided sources, (c) read the sources and "pile in ideas", (d) identify temporary theme labels (TTLs), (e) collect additional information if needed (no more than 2 additional sources) and go back to (d), and (f) write two rough paragraphs.

| | |
|---|---|
| (Working Title) | **Solar Energy and Other Renewables** |
| (Heading 1) | Introduction |
| (Heading 2) | A. General Purpose / Uses of Solar Energy (write one paragraph) |
| (Heading 2) | B. General Types of Solar Cells (write one paragraph) |
| (Heading 2) | C. Statement of Need and Outline of Approach |
| (Heading 1) | Materials & Methods |
| (Heading 1) | Results |
| (Heading 1) | Discussion |
| (Heading 1) | Conclusion |
| (Heading 1) | References |

The assignment must be completed with MS WORD (Times New Roman, 12 pt, 1-inch margins, page numbers centered in footer, your name(s) in the header, 18 pt line spacing). Submit one Word file "A01_'your_last_names'.docx". This file should contain two parts, separated by a page break, and the two parts should contain your writings before and after execution of item (f). Part I consists of a list of the (provided & additional) sources, each source followed by lines of statements extracted/abstracted from the source, with TTLs highlighted in red. When Part I is complete, then copy and past all of it, leave the original as is, and turn the copy into Part II. Part II consists of the outline and contains two paragraphs of text and the associated endnotes.

Deadline for electronic submission: Tuesday, 02/05/13, by midnight. Bring one hardcopy (stapled) to class on Wednesday, 02/06/13.

# Assignments

## Theme-Based Res.-Oriented Skill Training

Clarity about Item Type
Clarity about Function
Specific Format Requirements
**A02 Builds on A01**



**Assignment #2: Creating and Integrating Schemes**

It is the goal of this assignment to provide an authentic exercise in the use of chemical structure drawing software. You will learn about the design of schemes, about best practices in scheme creation, and about the integration of schemes and text.

A02 builds on A01, and you are asked to provide three schemes "fully embedded" with your revision of Part II of A01. Each scheme requires a scheme legend and must be cited in the text. Scheme 1 should be appropriate to support the first paragraph of the introduction you wrote in A01, and Schemes 2 & 3 will serve in support of your second paragraph. Use color to focus / enhance the message.

**(a)** Create Scheme 1 to illustrate the five major modes for the application of solar power with a cartoon type graphic.

**(b)** Create Scheme 2 to illustrate the four main types of solar cells (semiconductor solar cells, sensitized inorganic solar cells, organic dye sensitized solar cells, and organic polymer solar cells) using schematic drawings.

**(c)** Create Scheme 3 to show the chemical structures of specific examples of one organic dye used in a DSSC device and of two organic polymers employed in a PSC device.

The assignment must be completed with MS WORD (Times New Roman, 12 pt, 1-inch margins, page numbers centered in footer, your name(s) in the header, 18 pt line spacing) and using ChemOffice's ChemDraw (ACS 1996 settings, insert as figure, reduce to 64% in Word file). Submit one Word file "A02_'your_last_names'.docx".

Deadline for electronic submission: Tuesday, 02/12/13, by midnight. Bring one (stapled) hardcopy to class on Wednesday, 02/13/13.

# Chem3700 **Changing Themes**

**SP10:** Aspirin and Other Painkillers
**SP11:** Dyes, Indicators & Chemical Sensors
**SP12:** Soaps, Detergents and Other Ambiphiles
**SP13:** Solar Energy and Other Renewables
**SP14:** ??

**Crosscutting Concepts**: Structure & Function, Patterns, Cause & Effect, etc.
**Science Practices**: All aspects of actual research.
**Science & Society**: Consequences, Choices, Options.
**Pedagogy**: No Plagiarism! Less "Teacher Fatigue".

# The Campus Writing Program

The University of Missouri

**Design assignments specific to the course that cannot be found elsewhere in reproducible form.**

1. Are your assignments rehashed "topics"? No!

2. Are your assignments unique to your course? Yes!

3. Do they teach critical thinking or merely repeat known information? Yes! Very much so.

4. Do they allow students to actually use citation as not an after thought or a rephrasing of someone else's work, but as a way to build a piece of writing out of ideas? Citations, after all, are the writing itself, not add-ons. Yes! Work with refs. from A01 – A11.

# NRC Operationalizing Inquiry with Practices

**NRC: Operationalizing Inquiry**

The NRC operationalized "inquiry" with eight practices of science and engineering:

**(i)** asking questions & defining problems;

**(ii)** developing & using models;

**(iii)** planning & carrying out investigations;

**(iv)** analyzing & interpreting data;

**(v)** using mathematics & computational thinking;

**(vi)** constructing explanations & designing solutions;

**(vii)** engaging in argument from evidence; and

**(viii)** obtaining, evaluating, & communicating information.

National Academy of Engineering and Committee on Standards for K–12 Engineering Education, NRC, *K-12 Standards for Engineering?* (National Academies Press, Washington, DC, 2010.

**Standard Science Sequence**

Introduction

all sections

Materials & Methods (M&M)

Results & Discussion (R&D)

R&D

R&D

Conclusion, R&D

all sections

Guidelines to authors for any STEM journal.

# Collaboration from Start to End

THE WALL STREET JOURNAL.
WSJ.com

HEAD CASE | FEBRUARY 5, 2011

## Sunset of the Solo Scientist

By JONAH LEHRER

"A brilliant researcher, barely out of his teens and working alone?
Scratch that: Today's ideal scientist is close to 40 and working on a team."

All assignments are prepared by pairs of students (self-selected).
All peer reviews are prepared by pairs of students.
Same grade for both authors of an assignment.

<u>Advantages</u>

Develop criteria for selection of collaborator. Experience collaboration (good & bad).
Peer-to-peer Interaction: Timing, communication, debate, learning, consensus building.
Practical Aspects: Mediate frustration intrinsic to research. Mediate absences, stay on schedule.

# Peer Review of Assignment #1 by _____ (authors' names)

| Each category counts 1/2 | Beginning 1 | Developing 2 | Accomplished 3 | Exemplary 4 | Score |
|---|---|---|---|---|---|
| **Outlining** | Written without understanding of concepts about skeletal outlining, headers and levels. | Skeletal outline present, concept of Headings1 and Headings2 appears implemented, but did not use "outline" feature. | Skeletal outline contains Headings1 and Headings2, and outline feature was used. Only minor errors. | Skeletal outline contains Heading1 and Heading2 in the requested outline. | |
| **Sequence** | Not sequential, most logical steps are missing or are confusing. | Some of the steps are understandable; most are confusing and/or lack detail. | Most of the steps are understandable; some lack detail or are confusing. | Presents easy-to-follow steps, which are logical and adequately detailed. | |
| **Parts & Partitioning** | Parts are not recognizable. | Both parts are present, but they are not complete and/or not well separated. | Both parts are provided but not clearly separated. | Both part are provided and separated by a page break. | |
| **Research Addl. Source** | None provided. | Source provided is of limited relevance and/or quality. | Source provided is relevant but not best quality. | Source provided is high quality and speaks directly to the issue. | |
| **Origin of Sources** | Insufficient and poorly formatted sources. | Source information is provided, problems with the formatting. | Almost complete source information is provided in both parts. Minor formatting errors. | Complete source information is provided in both parts and in the appropriate format. | |
| **Endnote** | No endnotes and cross-references. | Some footnotes or endnotes and cross-references are present. Problems with the type selection and/or citation mark formatting. | Endnotes and cross-references are present. Problems with the citation mark formatting. | Numbered endnotes are present. Cross-referencing used properly. | |
| **Header & Footer** | No header, no footer. | Header or footer present. | Names are given in header, page numbers appear in footer. Minor problems with formatting remain. | Names are given in Header and page numbers appear in the footer. | |
| **Grammar & Spelling** | Frequent grammar and/or spelling errors. | More than two errors. | Only one or two errors. | Grammar and spelling correct. | |
| **TTL** | No TTLs marked. | Some TTLs have been highlighted. Problems with the number / quality of the TTLs. | Too many / too few TTLs have been highlighted and / or TTLs are not well selected. | Appropriate number of TTLs has been highlighted, and TTLs are well selected. | |
| **Information Content** | Does not give any understandable information. | Addresses some issues, but incomplete. | Addresses most but not all issues. | Presents a clear and concise paragraph. | |
| | | | | **Total (Max. 20)** | |

# Peer Review of Assignment #3 by _____ (authors' names)

| | Beginning 1 | Developing 2 | Accomplished 3 | Exemplary 4 | Score |
|---|---|---|---|---|---|
| **Data Import** Counts 0.5 | Three-dimensional table was imported as three-dimensional table. Some cells got misplaced. | Data is correct but incomplete. Some data not imported. | Numerical data is complete and correct, dashes were replaced by empty cell. Minor errors with the names. | Data import complete. No errors in any names, all numbers are correct, dashes were replaced by empty cell. | /2 |
| **Table** Counts 0.5 | Title & column headers are missing. Data not sorted. | Title & column headers are present but problems with formatting. Rows sorted. | Title & column headers acceptable. Rows sorted. | Clean title & column headers. Rows are sorted A-Z. Numbers are formatted. | /2 |
| **Descr. Stats** Counts 0.5 | Never heard of it. | Most of the req. values were computed and are correct. | Count, aver., std. dev., min., max., median & mode are correct. | Count, aver., std. dev., min., max., median & mode are correct. Values are formatted. | /2 |
| **Marked Scatter** | Incorrect chart type. Problems with mark control and/or axes choices. | All data shown. Problems with mark control and/or axes choices. | All data properly marked (symbol, color, size) but lacking axes display (major / minor ticks, labels). | All data shown, properly marked (symbol, color, size), intuitive axes choices (major / minor ticks, labels). | /4 |
| **Histograms** | Bin range missing. Incorrect chart type. Not clear about the concept. | Complete data. Bin range too small/large and/or display unclean. | Complete data, reasonable bin range, full data range. Display unclean. | Histogram of complete data, good bin range, full X-range. Clean, no-gap, column plot. | /4 |
| **Gaussian Function** | Columns of X and Y data present. Not complete and / or incorrect. | (X, Y) data columns are present. Y values computed correctly at least for one test. | Correct (X, Y) data columns are present and graphed in some way for both tests. | Correct (X, Y) data & clean unmarked (X, Y) line plot are shown for both tests. | /4 |
| **Sheets** Counts 0.5 | No idea about sheets. | Several sheets used. Defect partitioning and / or labels. | Parts (a) - (c) on sheet #1, (d) on sheet #2, (e) on sheet #3. No sheets labels. | Parts (a) - (c) on sheet #1, (d) on sheet 2, (e) on sheet #3, and sheets are labeled. | /2 |
| | | | | **Total (Max. 20)** | |

Constructive Comments (to guide the authors' revision):

# Assign. #10: Written Scientific Peer Review

Manuscript Title:

Manuscript Authors:

Recommendation [(a) Publish as is, (b) publish after minor revisions, (c) publish after major revisions, (d) do not publish]: _____

Significance [(a) bottom 50%, (b) top 50%, (c) top 20%, (d) top 10%]: _____

Scholarly anal./pres. [(a) bottom 50%, (b) top 50%, (c) top 20%, (d) top 10%]: _____

Are the conclusions adequately supported by the data? [Yes/No]: _____

Are the literature references appropriate and correct? [Yes/No]: _____

Are the compounds reported adequately characterized with regard to identity and purity? [Yes/No]: _____

Comments (at least 250 words):

**3-fold anonymous peer review of each paper**

# SP10 - SP13: Teaching Evaluations

**MU Chemistry 3700 - Undergraduate Seminar in Chemistry - Spring Semester 2013**

## Teaching Evaluations (scale 0-4, 4 is high)

| Criteria of evaluation | SP10 3700 | SP11 3700 | SP12 3700 | SP13 3700 |
|---|---|---|---|---|
| Consumer Information, SB 389, #1 | 3.56 | 3.67 | 3.72 | 3.79 |
| Consumer Information, SB 389, #2 | 3.88 | 3.86 | 3.79 | 3.96 |
| Consumer Information, SB 389, #3 | 3.56 | 3.38 | 3.66 | 3.58 |
| Organization and preparation of lectures and discussions | 3.73 | 3.61 | 3.90 | 3.84 |
| Instructor's enthusiasm for the subject matter | 3.96 | 3.96 | 4.00 | 3.96 |
| Helpfulness in answering questions and clarifying points | 3.50 | 3.35 | 3.76 | 3.84 |
| Ability to lecture in a manner which is easily followed | 3.46 | 3.52 | 3.76 | 3.72 |
| Ability to stimulate interest in the subject | 3.07 | 3.22 | 2.97 | 3.72 |
| Overall rating of the instructor | 3.69 | 3.57 | 3.66 | 3.88 |
| Your rating of how much you have learned | 3.34 | 3.26 | 3.34 | 3.66 |
| Overall rating | 3.53 | 3.50 | 3.63 | 3.80 |

http://faculty.missouri.edu/~glaserr/3700s13/3700s13_evals.html

# SP13: Students on *Curriculum*

**S01**: It's a great course that offers loads of research experience.

**S04**: It was unique, making it interesting.

**S06**: Different but relatively effective.

**S08**: One of the most interesting and challenging courses I have taken. I wish more classes were like this one.

**S09**: Very interesting topics but lots of work!

**S17**: Dr. Glaser chose a relevant and up and coming subject to study over the semester. Most professors teach from the book and don't relate it to what is relevant and important in today's society.

**S18**: Very good, always interesting class meetings.

**S19**: Different but really effective.

**S21**: Learned how to research a lot better. I learned a lot on my own, not in class, but that may have been the goal of the class.

**S22**: I learned a lot.

*Curriculum is more than accepted, it is welcome & desired!*

# SP13: Students on *Peer Review*

**S16:** This assignments were reasonable but I wasn't fan of the peer reviewing.

**S18:** Peer reviews [comments by fellow students, i.e., in A11] not always explained in a way easy to follow.

**S23:** The peer review grading seems to be an issue, as some students choose to be more rigorous than others. However, Dr. Glaser has a system for addressing issues.

**S23:** I think a group exercise in conducting peer-reviews would help.

*The Peer Review systems works very well!*

Very few requests for mediation; perhaps 2-3 per semester.

Future: Use 1 hour to fill out a PR form for a sample assignment.

# SP13: Students on *Instructor*

**S01**: Very helpful and wants students to succeed.

**S03**: Very knowledgeable. Easy to follow & fun to listen to! Keeps me engaged in class.

**S04**: He made intimidating topics seem doable.

**S05**: Very interested in subject matter, wanted to make sure we understood.

**S07**: Really passionate about getting the best work out of his students.

**S09**: Very Good. The best!

**S10**: He was more interested in the students wanting to learn.

**S11**: Passionate about his teaching. Best teacher I've had in my 8 years of undergrad.

**S13**: Enthusiastic, understanding. Very good, one of the best I've had.

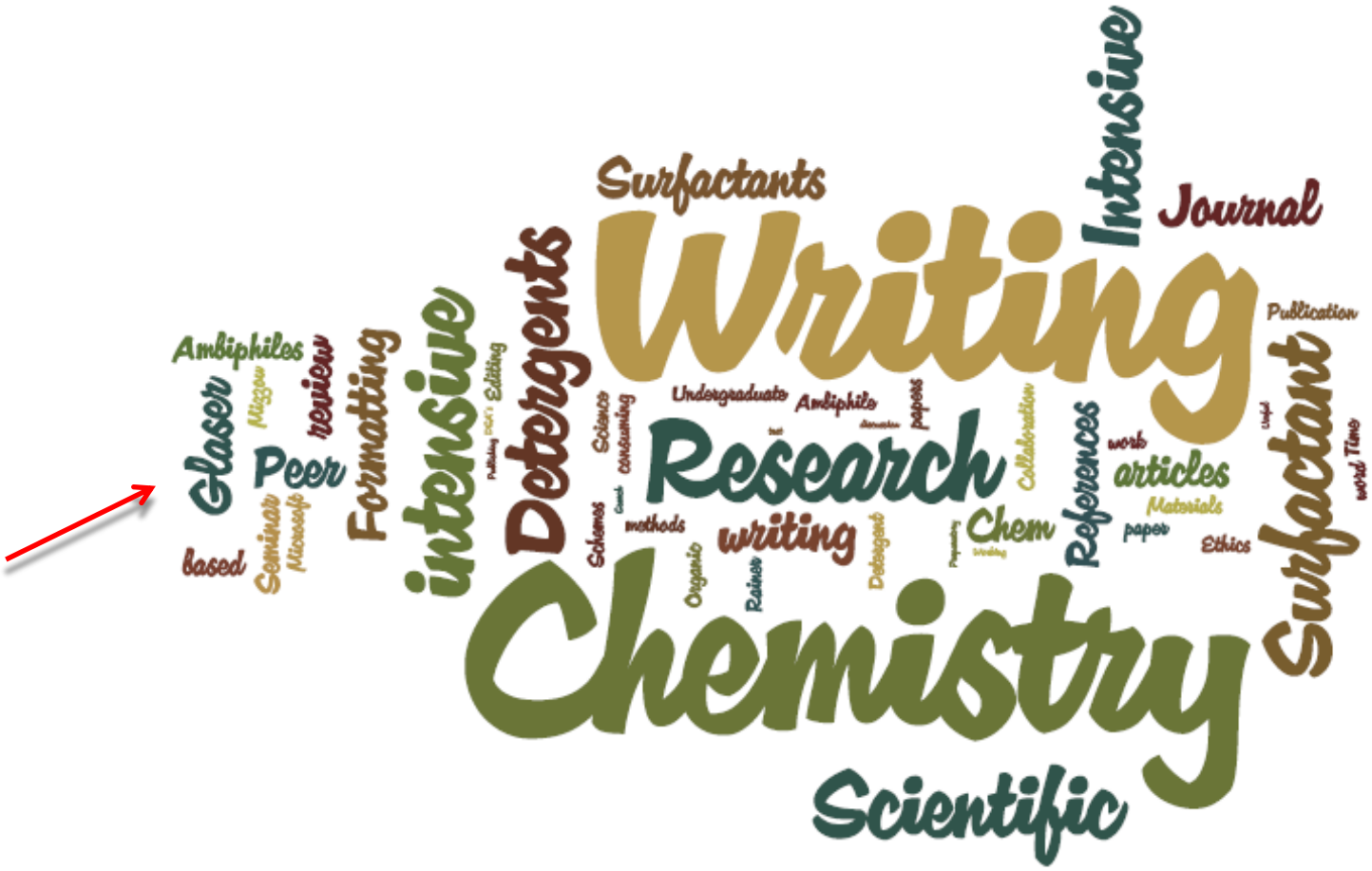
**S14**: Make sure we made improvements to our papers and understood mistakes.

**S17**: Very enthusiastic! Makes you more interested in learning subject matter.

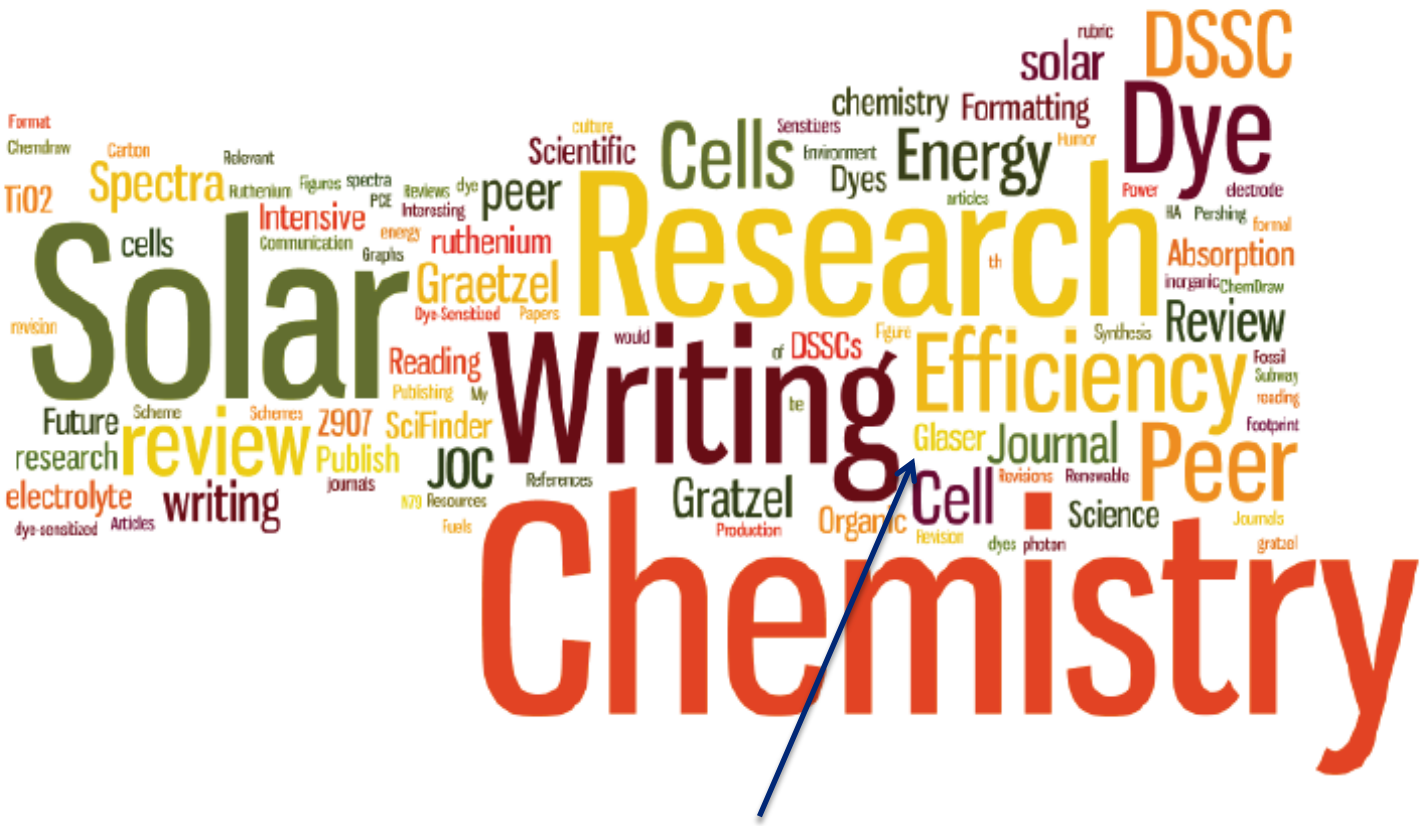
**S22**: He's one of the best, very helpful and enthusiastic about this class.

**S23**: As a lecturer, he is stimulating, enthusiastic, and clearly knowledgeable. Dr. Glaser is one of my favorites, he is able to engage and maintain a discussion. He also seems always excited to teach, which other professors everywhere should learn. He presents himself as competent and well-versed in his field.

# Chem3700 - SP12: Wordle



# Chem3700 - SP13: Wordle



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Eurovariety 2013: "Smarter teaching – better learning", 5 July 2013


# TEACHING CHEMISTRY IN THE CONTEXT OF A CROSS-DISCIPLINARY RESEARCH SEMINAR

Friday Afternoon

Rainer E. Glaser,[a] Jennifer Hart,[b] Eric Ludwig,[b] Jennifer Fellabaum,[b] George Smith,[c] Francis Schmidt,[d] Dix Pettey,[e] and Carmen Chicone[e]

[a]Dept. of Chemistry, [b]Dept. of Educ. Leadership & Policy Analysis, [c]Dept. of Biological Sciences, [d]Dept. of Biochemistry, [e]Dept. of Mathematics

University of Missouri, Columbia, Missouri 65211, USA

**Multi-Equilibria Problems for Mixtures of Acids and Their Conjugated Bases**

Rainer E. Glaser,[#,*] Marco A. Delarosa,[#,§] Ahmed Olasunkanmi Salau[#] and Carmen Chicone[§,*]

Department of Chemistry and Department of Mathematics, University of Missouri, Columbia,

To be submitted July '13

$$H_2O \rightleftarrows H^+ + OH^-,\ K_w \qquad \text{(eq. 1)}$$
$$H_2A \rightleftarrows H^+ + HA^-,\ K_{a1,1} \qquad \text{(eq. 2)}$$
$$HA^- \rightleftarrows H^+ + A^{2-},\ K_{a1,2} \qquad \text{(eq. 3)}$$
$$HB \rightleftarrows H^+ + B^-,\ K_{a2} \qquad \text{(eq. 4)}$$

$$z^4 + (K_{a1} + \alpha)z^3 + (-K_w + K_{a1}(K_{a2} + \alpha - \beta))z^2$$
$$-K_{a1}(K_w - K_{a2}\alpha + 2K_{a2}\beta)z - K_{a1}K_{a2}K_w = 0$$

$$\frac{d[H^+]}{dt} = k_{wf} - k_{wb}[H^+][OH^-] + k_{11f}[H_2A] - k_{11b}[H^+][HA^-]$$
$$-k_{12b}[H^+][A^{2-}] + k_{12f}[HA^-] + k_{2f}[HB] - k_{2b}[H^+][B^-] \qquad \text{(eq. 5)}$$

$$\frac{d[OH^-]}{dt} = k_{wf} - k_{wb}[H^+][OH^-] \qquad \text{(eq. 6)}$$

$$\frac{d[H_2A]}{dt} = -k_{11f}[H_2A] + k_{11b}[H^+][HA^-] \qquad \text{(eq. 7)}$$

$$\frac{d[HA^-]}{dt} = k_{11f}[H_2A] - k_{11b}[H^+][HA^-] + k_{12b}[H^+][A^{2-}] - k_{12f}[HA^-] \qquad \text{(eq. 8)}$$

$$\frac{d[A^{2-}]}{dt} = k_{12f}[HA^-] - k_{12b}[H^+][A^{2-}] \qquad \text{(eq. 9)}$$

$$\frac{d[HB]}{dt} = -k_{2f}[HB] + k_{2b}[H^+][B^-] \qquad \text{(eq. 10)}$$

$$\frac{d[B^-]}{dt} = k_{2f}[HB] - k_{2b}[H^+][B^-] \qquad \text{(eq. 11)}$$

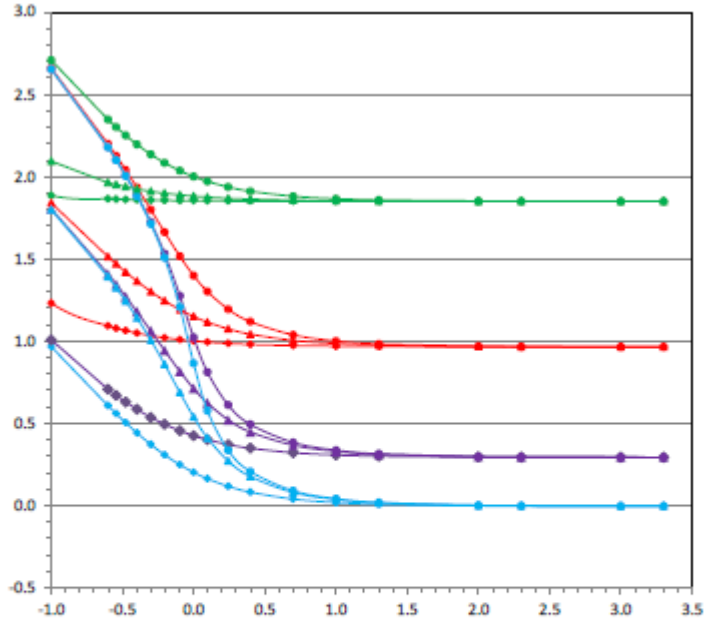
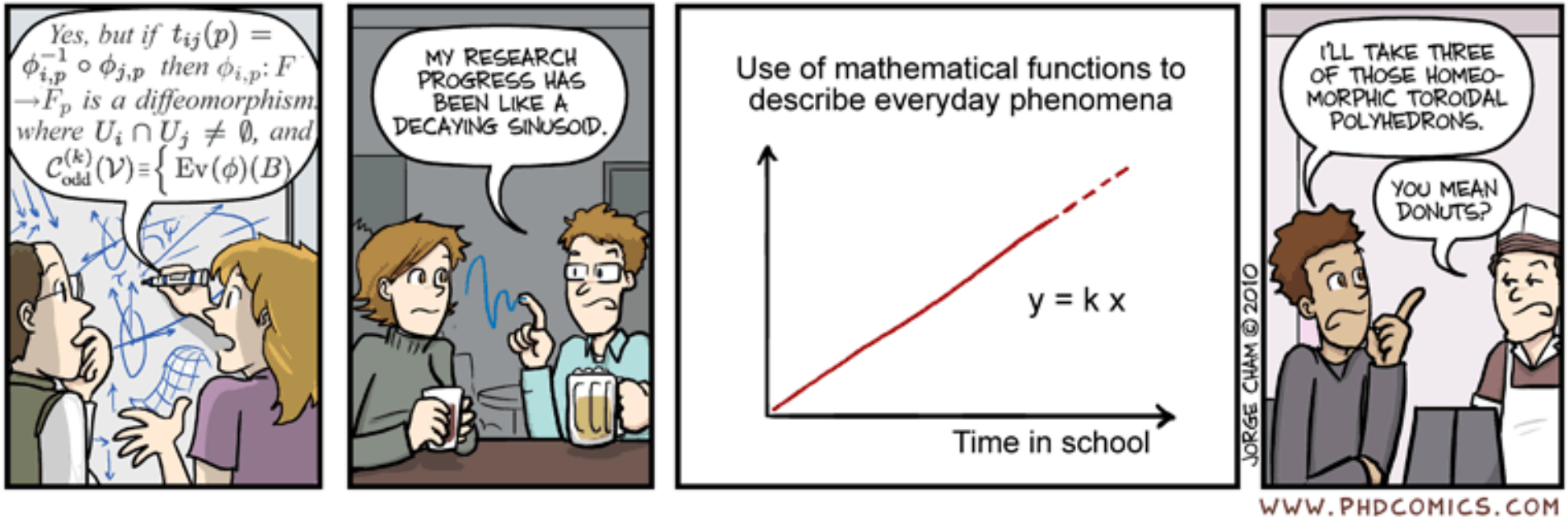



**Figure 2.** *pH*-Values of dilute aqueous $H_2SO_4$ containing bromate as a function of $\log(R_0)$ and for various acid dissociation constants $K_a(HBrO_3)$. Color indicates initial concentration of sulfuric acid: $[H_2SO_4]_0 = 0.01$, green; $[H_2SO_4]_0 = 0.1$, red; $[H_2SO_4]_0 = 0.5$, purple; $[H_2SO_4]_0 = 1.0$, blue. Marker shape indicates acid dissociation constants $K_a(HBrO_3)$: $pK_a = 0$, diamonds; $pK_a = 1$, triangles; $pK_a = 2$, circles.

# Conclusion

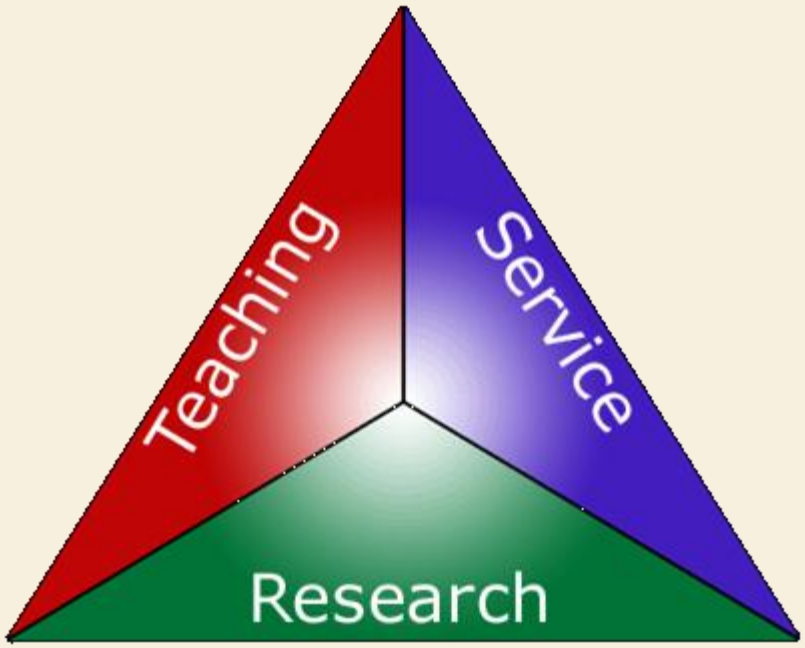
6. How has the MLS program helped you see the connections between mathematics and the life sciences? (From Summer 2012 Assessment)

## "In every way possible, it has."



# Opalescence at the Triple Point

Penny J. Gilmer, *Transforming Undergraduate Education*




The triple point brings together three responsibilities of university faculty: teaching, research, and service.

Instead of working in separate domains, or even along interfaces between two domains, working at a triple point in which teaching, research, and service are one can be tremendously energizing.

# Making Connections to Societal Issues

Thomas Jefferson to Edward Carrington, 1787. ME 6:57

"The basis of our governments being the opinion of the people, the very first object should be to keep that right; and were it left to me to decide whether we should have a government without newspapers or newspapers without a government, I should not hesitate a moment to prefer the latter. But I should mean that every man should receive those papers and be capable of reading them. [Emphasis ours]"

# Acknowledgement

Thank you very much!
Buíochas a ghabháil
leat go mór!
Merci beaucoup!
Vielen Dank!
非常感谢!

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