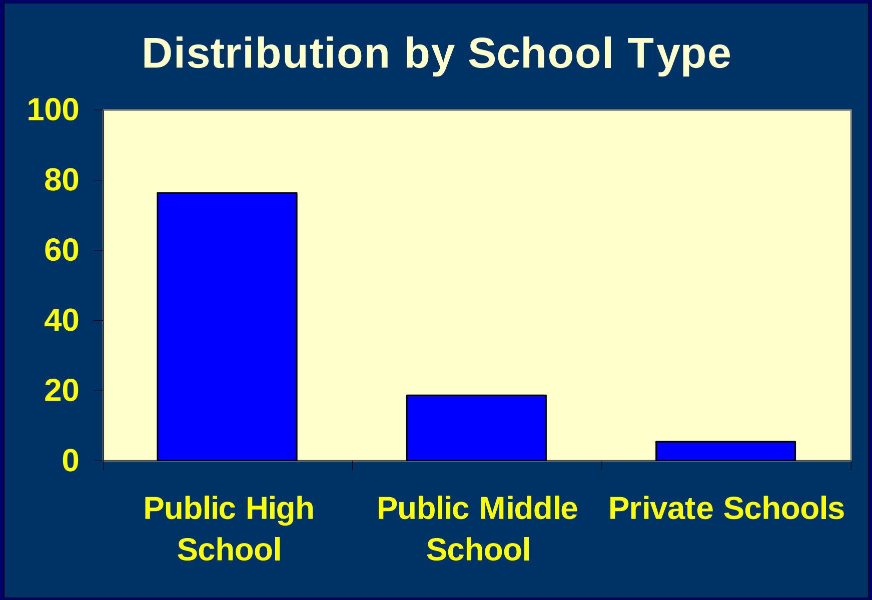
Air UCI Summer Training Program in Environmental Chemistry for Science Teachers

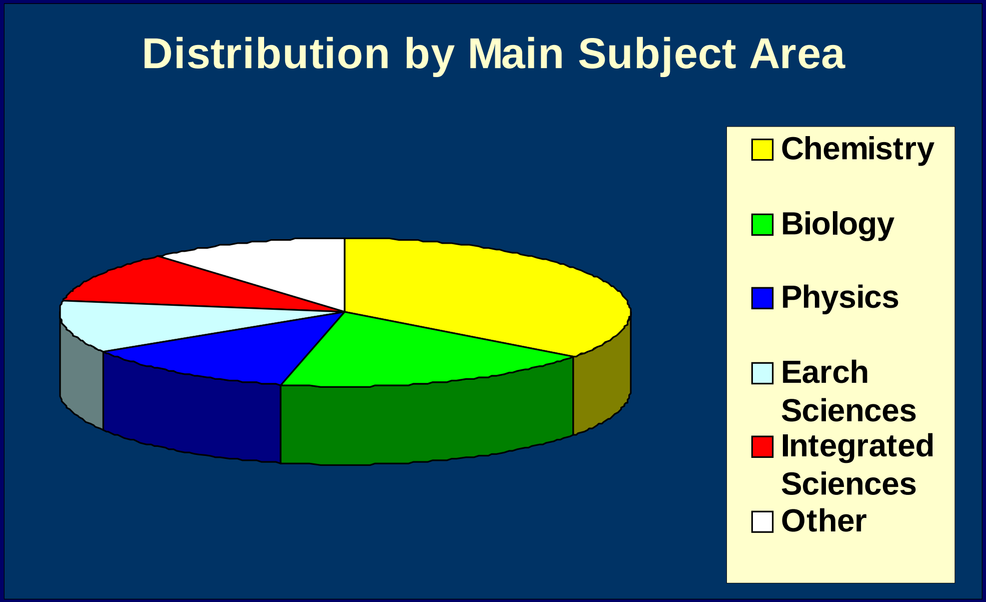
I. July 11 – July 22, 2005
II. June 26 – July 11, 2006
III. June 25 – July 6, 2007
IV. June 30 – July 11, 2008

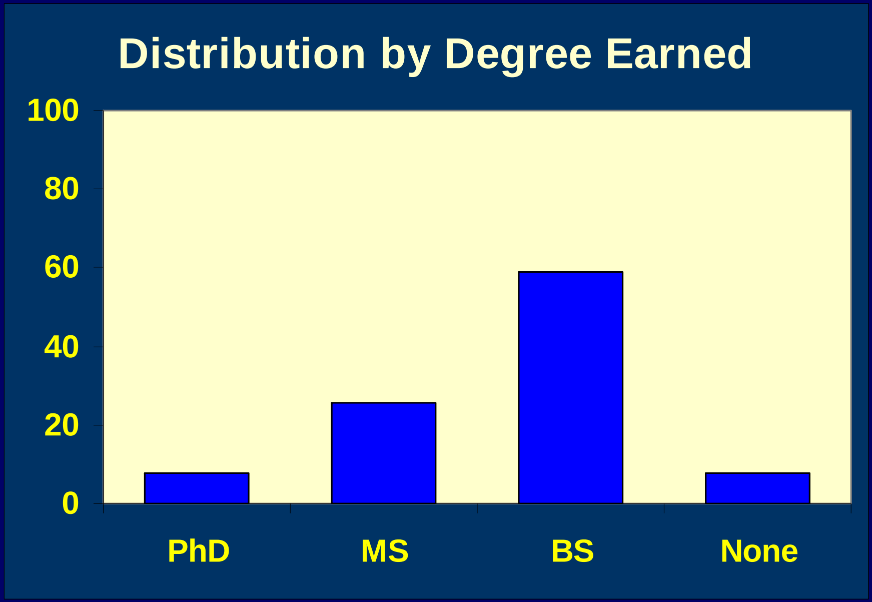
Major source of support:* *The NSF EMSI program
Additional support:* *The Camille & Henry Dreyfus Foundation

Program Overview

- 20 teachers per summer (79 since 2005)
- 9-10 weekdays; 9 am – 4 pm
- $1000 stipend; lunch, text book, parking
- Equivalent to 6 quarter credit units
- Hands-on wet lab and PC work
- Lectures by AirUCI faculty
- Lab tours of AirUCI laboratories
- Follow-up for several years







Program Objectives

- Convey the excitement of research to the teachers through lectures, research and hands-on lab experience
- Provide teachers with background in fundamental chemistry and applications to environmental problems
- Broadly involve faculty, graduate students, and postdoctoral researchers in communicating science to the public

- Be broad in impact:

Teacher (20) → Students (3,000) → Students' Parents (5,000) → Community (10,000)

Syllabus: Lectures

Every AirUCI faculty member is actively involved in the program through lectures, lunch discussions, and lab tours

Professor Mickey Laux
Overview of the atmosphere. Introduction to chromatographic techniques. Laboratory safety.

Professor Donald Dabdub
Basics of computer modeling and simulations: Applications to L.A. basin. Global Circulation Models and predictions.

Professor Barbara Finlayson-Pitts
Interaction of light with matter; Stratospheric reactions; NO_x and photochemical smog; Fluorescence, chemiluminescence, FTIR and UV spectroscopy; Atmospheric applications.

Syllabus: Lectures

Professor <u>Doug Tobias</u>

Molecular structure; Fundamentals of molecular dynamics; Review of computational chemistry.

Professor <u>John Hemminger</u>

Surface science basics and environmental concerns at interfaces; Catalysts and catalytic converters; Seawater and sea salt aerosol; Heterogeneous SO_2 oxidation.

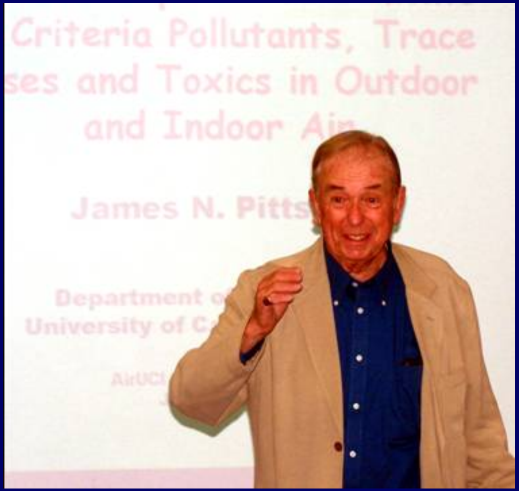
Professor <u>Sergey Nizkorodov</u>

PM10 and PM2.5; Health risks; Light interaction with particles; Aerosols; Composition and effect on global warming; Fuels and fuel additives.

Syllabus: Lectures

Professor <u>Benny Gerber</u>
Hydrogen bonds in chemistry.
First-principles computational methods in atmospheric sciences.

Professor <u>Donald Blake</u>
Measuring trace gases around the world; CH_4, N_2O, OH radical; CFC's and implications for the atmosphere; Pollutant transport



Prof. Emeritus <u>James Pitts, Jr.</u>
Atmospheric chemistry and measurements of toxic air pollutants; Indoor air pollution; Risk assessment; Public health policy; History or air pollution research

Wet Laboratories

- Lab protocols for several wet labs are simplified versions of instrumental analysis labs for undergraduate students
- Funds from the Dreyfus Foundation (awarded to Prof. Finlayson-Pitts) were used to equip these labs with modern equipment in 2000
- A number of graduate students directly participate in the labs

Examples of Wet Laboratories

FTIR measurement of ethanol in vodka and mouthwash, and MTBE in gasoline

Examples of Wet Laboratories

HPLC of PAH in cigarette smoke with absorption and fluorescence detection

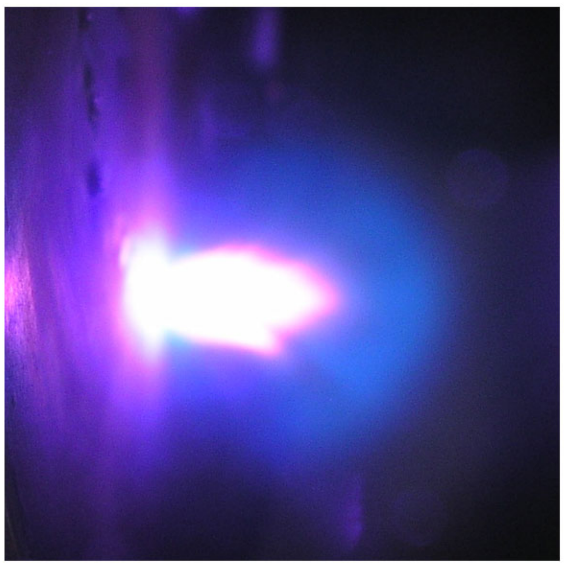
Examples of Wet Laboratories

NEW: Ozone emission and particle removal by air-purifier

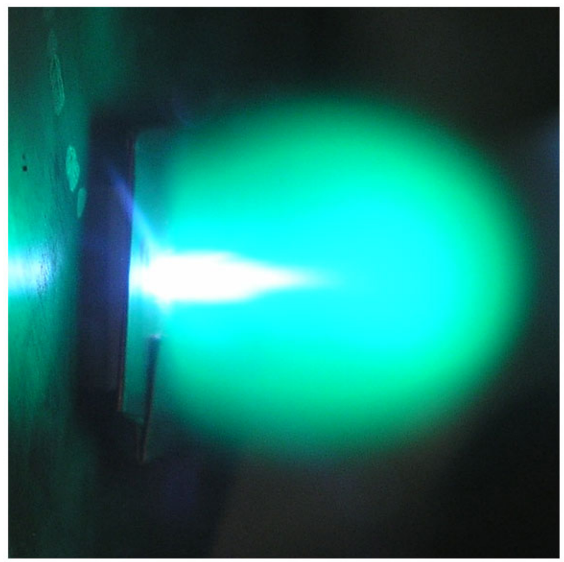
Measurement of aromatic compounds in gasoline with GCMS

Developing New Projects

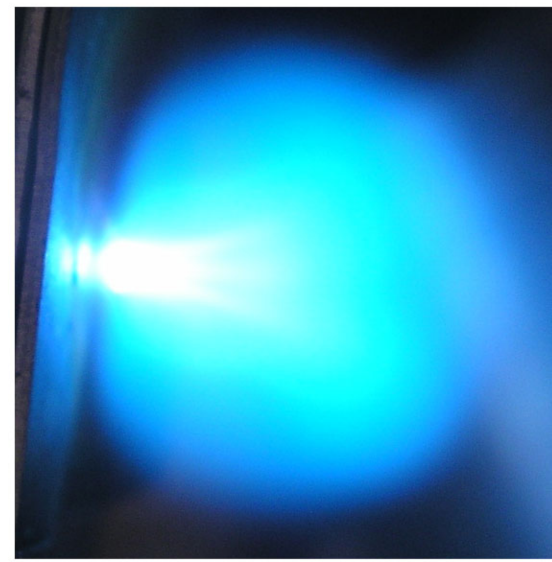
- NEW in 2008: Laser Induced Breakdown Spectroscopy lab
- Developed using funds from the Camille Dreyfus Teacher-Scholar Award given to Prof. Nizkorodov (2007)
- Will also be used in the physical chemistry curriculum



aluminum

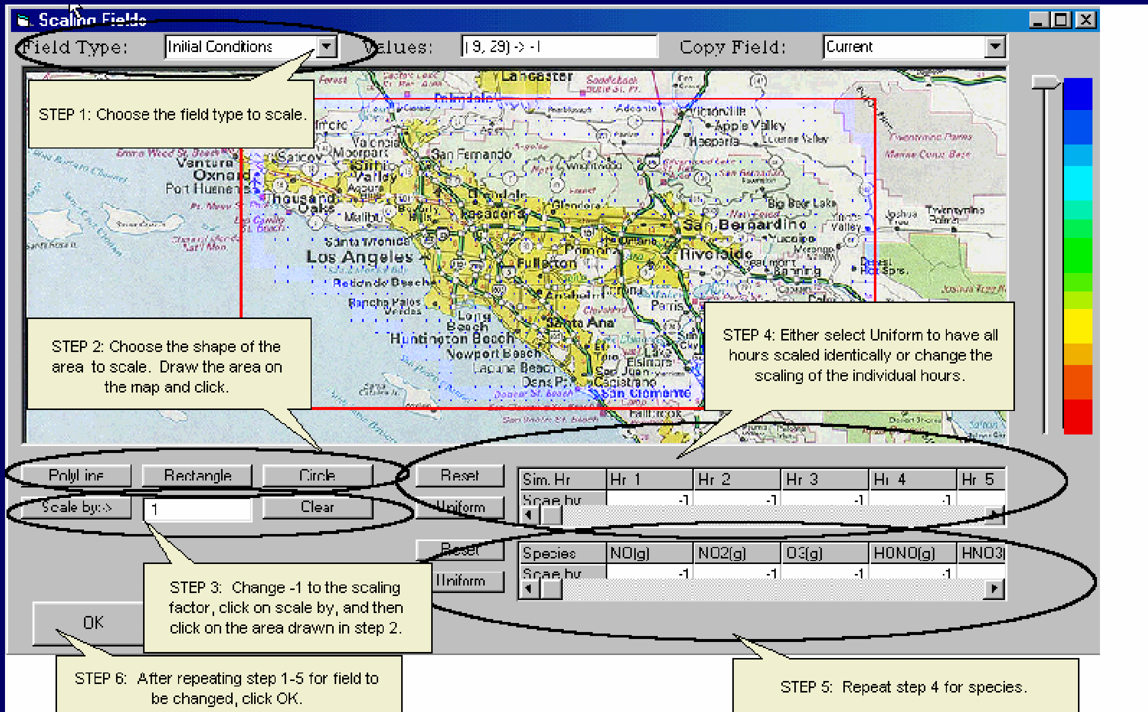


copper

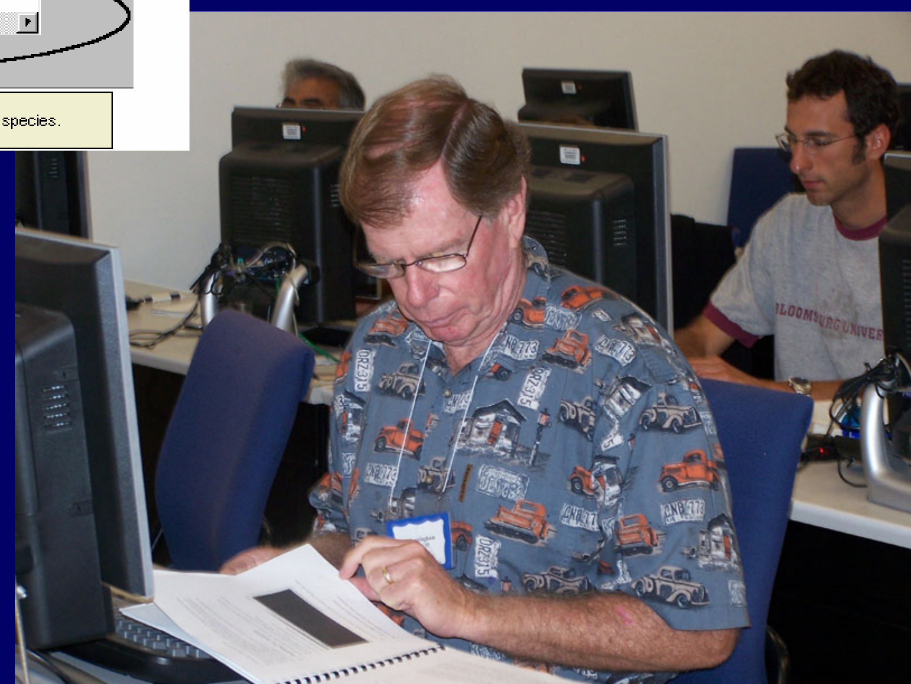


stainless steel

Syllabus: PC Laboratories



Modeling air pollution in the LA basin using "Problem Solving Environment" developed by Prof. Dabdub



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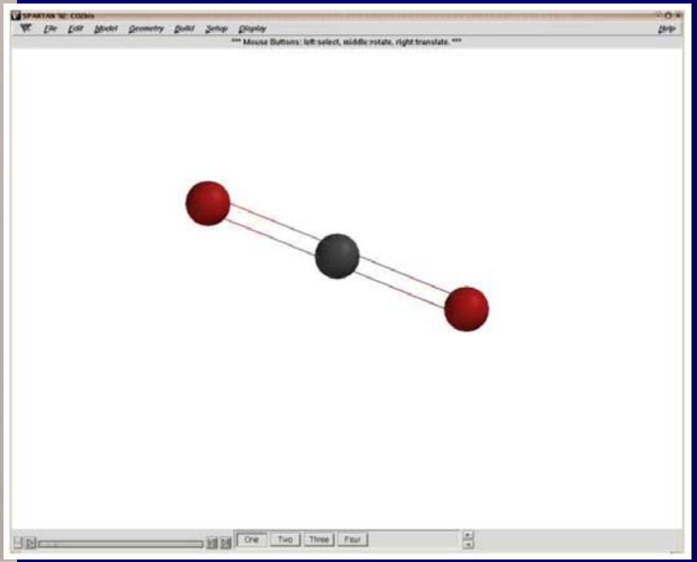
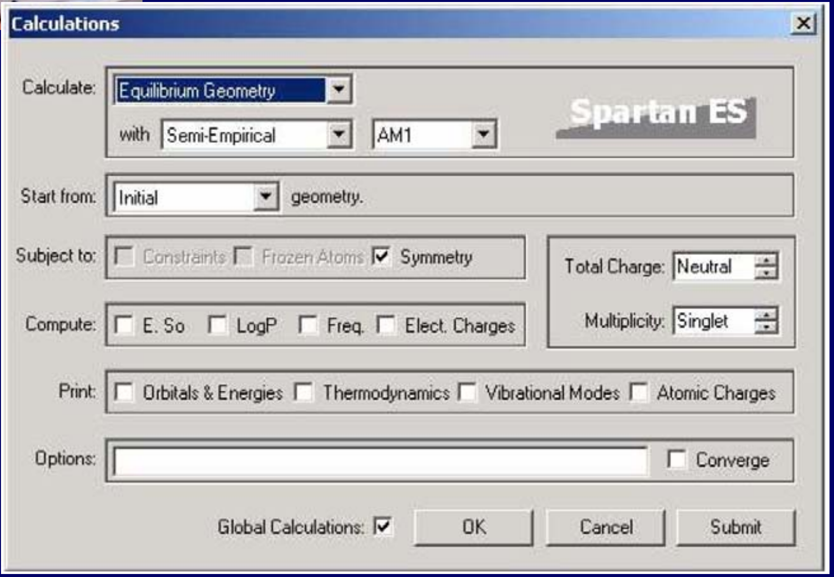
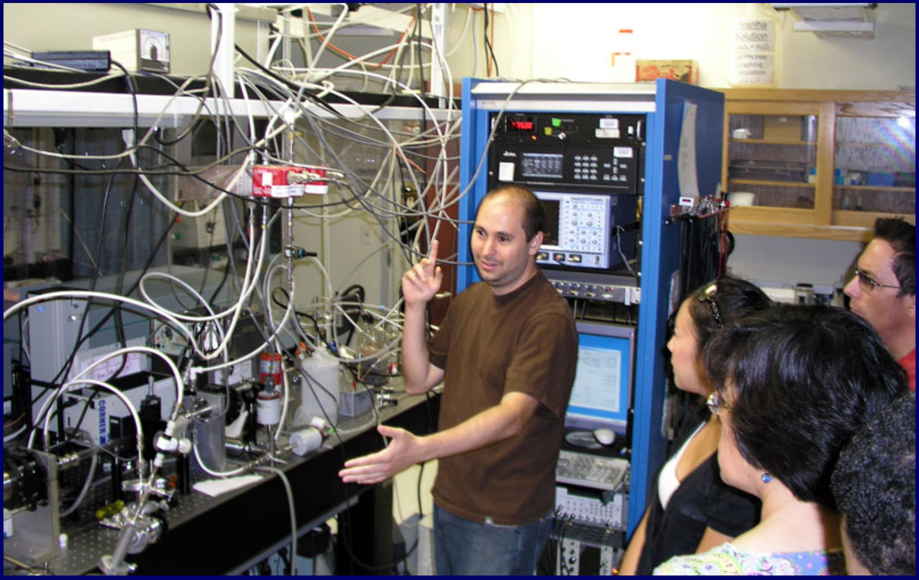
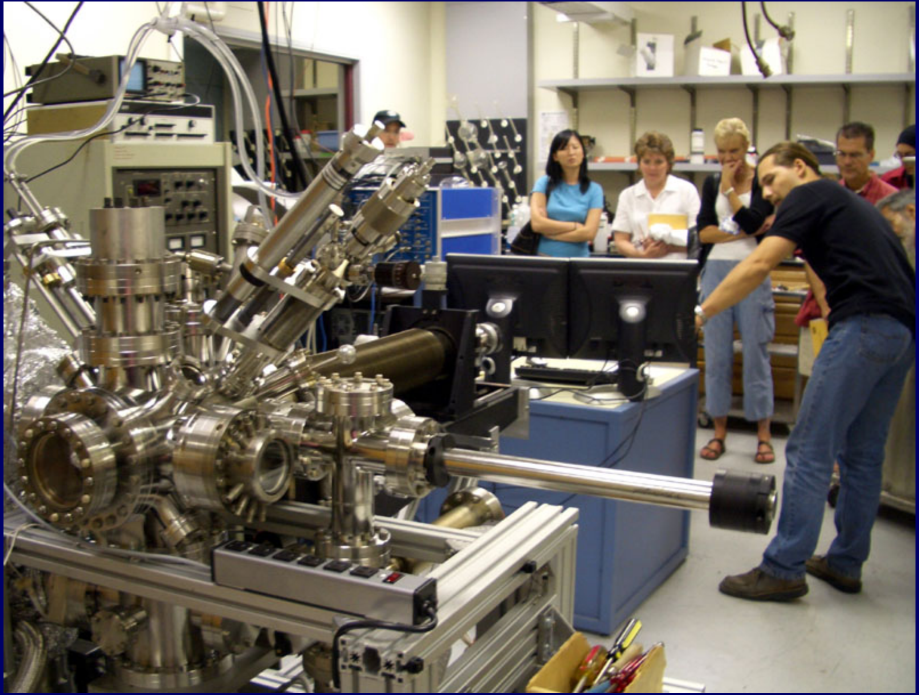




Computational lab developed by Prof. Tobias to predict properties of greenhouse gases using Spartan (N_2O, CO_2, O_3, CH_3Cl, H_2O)

Research Lab Tours





Follow-Up & Evaluations

- Each teacher paired with a grad student or postdoc as a resource during the year
- Detailed evaluation carried out immediately after the program
- Follow-up survey carried out 1-3 years after the program

End-Program Evaluations

Will you be able to incorporate these materials into your classroom?

"I am going to restructure my curriculum so I CAN incorporate an atmospheric chemistry unit."

"I intend to try. In simple ways (amazing graphs, intro to vibration, rotation, to develop my organic unit... really in many ways!"

"Yes, discussion of real-world chemistry applications; chemical reactions, kinetics, Beer's Law."

Follow-up Evaluations

Have you been able to integrate any new information from this program into your course syllabi?

3%	**No, because I do not teach a relevant course**
0%	**No, because I do not think that any of this information is interesting or relevant**
84%	**Yes, to a certain extent**
13%	**My syllabi have changed significantly as a result of taking this course**

"I definitely changed the way I taught my integrated science class, which is taught around the central theme of sustainability. I changed lecture content, changed my focus for alternative fuel sources (towards solar, away from biofuels), changed and made my presentation and explanation of CO_2 as a greenhouse gas MUCH more accurate than it had been."

Follow-up Evaluations

Do you feel you are in a better position to discuss topics associated with climate change, air pollution, and atmospheric chemistry with your students and colleagues after participating in this program?

3%	**Not really, because the material covered in this program was common knowledge**
97%	**Yes, my understanding of these topics definitely improved a lot**
0%	**No, I have not learned much because the program was over my head**

"I thoroughly enjoyed the program. It really changed my views on climate change and hence my instructional program."

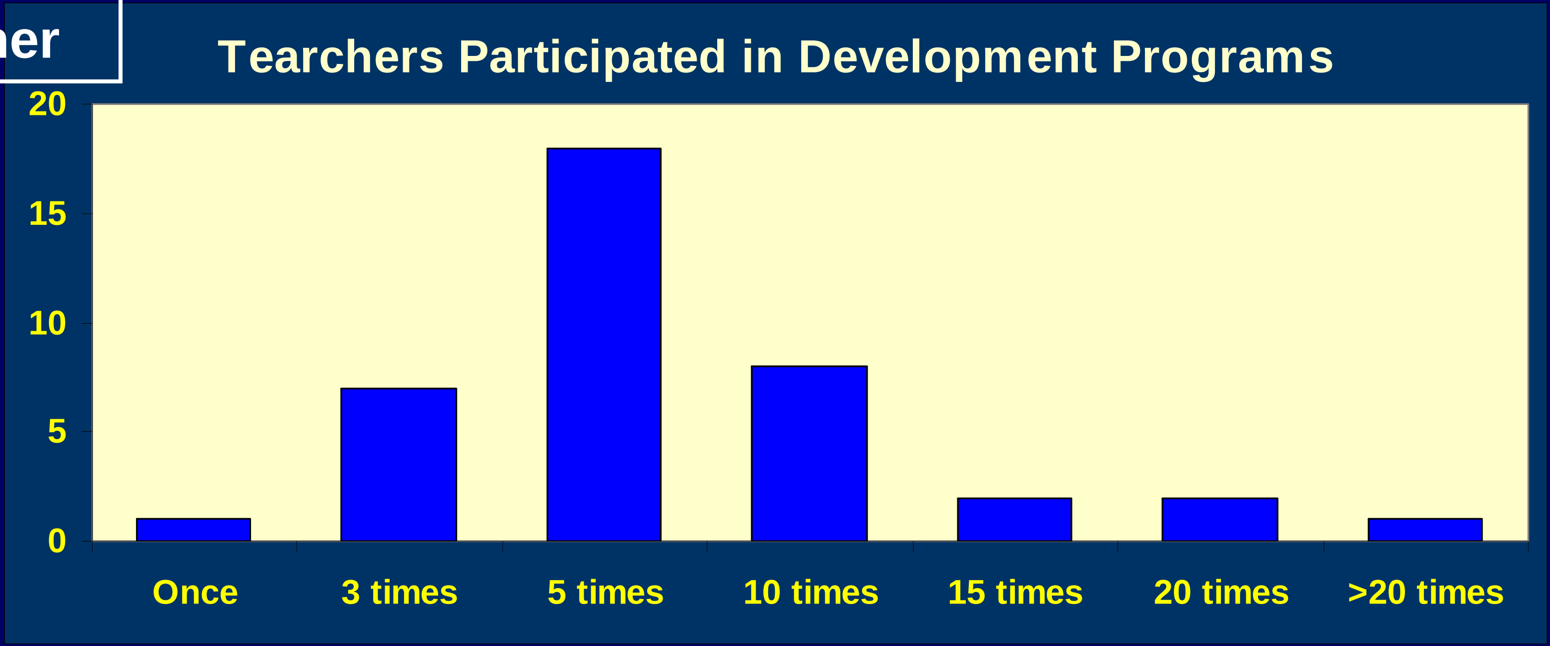
In your opinion, what educational development programs are the most effective in training teachers?

31% — Programs that provide teachers with ready-to-use instructional materials for classroom use in areas that they already teach

8% — Workshops at which teachers can share their education experience

54% — Programs that provide background information on a specific area of science and technology

8% — Other



Follow-up Evaluations

If you attended more than one teacher development program over the last 10 years, please rate this program relative to the others

32%	**The best program I have participated in so far**
42%	**Superior to the other programs I attended**
26%	**Comparable quality compared to the other programs**
0%	**Inferior to the other programs**
0%	**A complete waste of time**

"If I can say one thing about this wonderful and amazing program it is this. DO NOT MISS THIS OPPORTUNITY TO ATTEND!!!"

Summary

- Direct, hands-on exposure to fundamental chemical principles is an effective way of increasing the knowledge, enthusiasm & confidence level of science teachers
- Teachers state that lectures and live interactions with “Tiger Woods of Science” have by far the largest impact on their teaching
- Laboratory work is the second most important factor quoted by teachers in terms of the impact on their development. (A large fraction of chemistry teachers do not have a degree in chemistry, and lack laboratory experience.)
- AirUCI graduate students and postdoctoral researchers learn to accept responsibility for training the next generation and communicating with the public