

UNIVERSITY INITIATIVES

The Pennsylvania State University, University of California at San Diego, University of Illinois-Champaign Urbana, University of Wisconsin, and University of Washington participate in the Worldwide University Network (WUN), which builds on its partners' commitment to research quality and innovation in order to develop collaborations in interdisciplinary areas of global significance. The program has an international network of major research institutions to promote research collaboration, e-learning, and graduate student and researcher exchanges. The network includes eleven institutions from the United States and Britain, and two Chinese institutions. Visit <http://www.wun.ac.uk> for more information.

The University of California, Santa Barbara (UCSB) launched its Center for Entrepreneurship and Engineering Management to facilitate the transfer of technology to the marketplace. It was built around extracurricular activities, but is now part of the curriculum. UCSB created this program because the institution believes that as technology firms globally strive to gain a competitive advantage, employees trained to understand the profitable relationship between technology and the marketplace will succeed. Visit <http://ceem.engr.ucsb.edu> for more information.

ABOUT THE BOARD ON CHEMICAL SCIENCES AND TECHNOLOGY

The Board on Chemical Sciences and Technology (BCST) of the National Academies serves the nation as its gateway to timely, unbiased scientific advice and guidance on matters involving the chemical sciences. BCST's goal is to ensure authoritative and accurate evaluation of important national issues that hinge on chemical science and technology.

BCST established the Chemical Sciences Roundtable (CSR) to provide a science-oriented, apolitical forum for leaders in the chemical sciences to discuss chemically related issues affecting government, industry, and universities.

“I received my Humboldt Award more than 25 years ago and it completely transformed my life... it was definitely a life changing experience and all of my students, undergraduates and graduates alike are paid by funds from me to travel internationally...I think it is a very critical experience and they all appreciate the opportunity to do that.”

—B.J. EVANS, University of Michigan on the Alexander von Humboldt Foundation Award Program

FOR MORE INFORMATION

Preparing Chemists and Chemical Engineers for a Globally Oriented Workforce is available from the National Academies Press at (800) 624-6242 or at <http://www.nap.edu>.

Visit the Board on Chemical Sciences and Technology (BCST) website at www.nationalacademies.org/bcst, or call (202) 334-2156.

This workshop was sponsored by the U.S. Department of Energy, the National Institutes of Health, the National Science Foundation, and Research Corporation.

THE NATIONAL ACADEMIES™
Advisers to the Nation on Science, Engineering, and Medicine

Going GLOBAL

HOW
CHEMISTS
AND
CHEMICAL
ENGINEERS
CAN
SUCCEED
IN A
GLOBAL
WORKFORCE

THE CHEMICAL INDUSTRY IS NOW MORE GLOBAL THAN EVER

Did you know that the chemical industry is experiencing dramatic changes as companies increasingly develop, manufacture, and distribute their goods and services around the world? Studies show that U.S. multinational corporations had expenditures of \$131.6 billion in 2001, of which \$19.8 billion was from their foreign affiliates.¹

These changes are influencing how R&D is being conducted by international corporations. For example, major chemical companies like Air Products and Chemicals (APC), DuPont, and Degussa are increasingly operating overseas.

- APC has approximately 17,000 employees operating in more than 30 countries; more than 50 percent of APC's activities are now conducted outside the United States.
- DuPont has about 55,000 employees, with more than 40 research and development (R&D) and customer service labs in the United States, and more than 35 of these labs in 11 other countries.
- Germany based Degussa employs 46,000 people and engages in R&D at more than 50 locations around the world.

PREPARING FOR A GLOBAL WORKFORCE

As both manufacturing and R&D activities broaden beyond the United States, scientists and engineers need to prepare to be part of a workforce that is global in perspective. Nearly two-thirds of bachelor's graduates and more than two-thirds of doctoral candidates in chemistry and chemical engineering have

historically gone on to work in industry, so change needs to start in colleges and universities before graduates enter the workforce.

Corporations are now trying to recruit chemists and chemical engineers from diverse backgrounds within the U.S. workforce and around the world. It is becoming more important for researchers to differentiate themselves by acquiring skills such as the ability to speak multiple languages, work in diverse teams, communicate ideas orally and in writing to a diverse audience, and be flexible in learning new subjects.

At a recent workshop² on the globalization of the chemical enterprise, speakers suggested the following steps to increase skills of chemistry and chemical engineering students and improve their marketability in the global workforce:

- Learn to speak more than one language fluently.
- Improve oral and written communication skills, especially with people from different cultures.
- Take classes in subjects such as business, management, patent law, and economics.
- Acquire teamwork and networking skills.
- Sign up for electives in human behavior, psychology, human resources, or cultural studies.
- Learn how to be flexible and adapt to new workplace settings.
- Participate in foreign research experiences through student exchange and study abroad programs.
- Participate in internships and cooperative programs.
- Take advantage of summer breaks by interning or studying abroad.
- Apply for an international postdoctoral position.
- Attend international scientific meetings and conferences.
- Volunteer in a developing country to apply your technical skills to help solve problems in other countries, such as improving water quality.
- Seek out classes that include material about industry from a multinational perspective.
- Work with a mentor at your school who can help you develop your skills and provide career guidance.

SAMPLE PROGRAMS

The following programs, highlighted at the workshop, provide examples of the types of opportunities available. Students can seek out similar programs at other institutions.

PRIVATE FOUNDATION

The Alexander von Humboldt Foundation was established by the Federal Republic of Germany for the promotion of international research cooperation. Through grants and fellowships, it enables highly qualified scholars that do not live in Germany to spend extended periods of time conducting research there. Visit <http://www.humboldt-foundation.de/en/prgramme/preise/pt.htm> for more information.

GOVERNMENT PROGRAMS

The National Institutes of Health (NIH), through the Ruth L. Kirschstein National Research Service Award Program, awards individual postdoctoral fellowships (F32) to promising applicants with the potential to become productive, independent investigators in fields related to the mission of the NIH constituent institutes and centers (which includes many areas of chemistry and biochemistry). Applicants to this program may select mentors at foreign sites. Visit <http://grants.nih.gov/training/nrsa.htm> for more information

The National Science Foundation (NSF) has several programs that help students work in foreign laboratories. The East Asia and Pacific Summer Institutes program sends about 150 U.S. graduate students to Asian laboratories for 2 months during the summer. The international office at NSF sponsors a program that allows students to spend short periods working in an overseas laboratory. In return, students from those countries spend time working at a U.S. school. The international office also supports international postdoctoral research fellowships. Additionally, NSF recently expanded the Integrative Graduate Education and Research Traineeship (IGERT) Program to encourage international exchange of students. Visit <http://www.nsf.gov/home/crssprgm/igert/start.htm> for more information.

¹National Science Board. 2004. *Science and Engineering Indicators 2004*. Two volumes. Arlington, VA: National Science Foundation (volume 1, NSB 04-1; volume 2, NSB 04-1A).

²"Preparing Chemists and Chemical Engineers for a Global Workforce", a workshop of the Chemical Sciences Roundtable, was held on October 16-17, 2003, at the National Academies, Washington, DC.