

GRADUATE EDUCATION IN CHEMICAL ENGINEERING

A Workshop to Help Students Answer the Questions

- *What is it?*
- *Why go?*
- *What comes after?*

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YOU ARE A SENIOR chemical engineering student and you're trying to decide what you want to do when you graduate. On-campus interviews give you some idea about the kinds of jobs you can have with chemical and oil companies. Plant trips are better yet—you get to meet and talk with people on the job and find out for yourself what to expect. But while you are considering a career as a design engineer or jobs in manufacturing or management, you should make sure that you are considering *all* your options. And one option that many students do not take time to consider is the variety of career paths which are open to a student with an advanced degree in chemical engineering.

It is easy to understand why many students don't think about going on to graduate school. Representatives from graduate programs at different schools don't often come to the university placement center



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the way company representatives do. While most students have met chemical engineers with BS degrees, or at least have heard about their careers, not many have met PhD chemical engineers other than their professors. And after spending four tough years in chemical engineering courses, who wants to hear about coming back for more?

PURPOSE OF THE WORKSHOP

There are some very good reasons why a student might want to consider getting an advanced degree, especially a good student who wants to continue being challenged in his career. In order to give students a chance to hear some of these reasons, as well as to meet some chemical engineers with advanced degrees, the Department of Chemical & Petroleum Engineering at the University of Pittsburgh organized a workshop called "Graduate Education in Chemical Engineering."

The first workshop took place on the Pitt campus in the fall of 1985, and its success ensured that it will be an annual event. The one-day workshop was attended by about fifty junior and senior chemical engineering students from eight different schools. Most of the students came from schools in our region, but some participants came from as far away as Michigan State to the north and Virginia Polytech to the south.

The workshop had two main purposes. The first was to give the students some idea of the kinds of careers that having an advanced degree opens up for them. We invited a number of PhD chemical engineers

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working in the Pittsburgh area to join a panel discussion with the undergraduate participants. Hearing first-hand from people who have been working in industry helped show how graduate education affects career paths. This proved to be quite enlightening.

The second purpose of the workshop was to provide specific information about graduate programs at different schools. Each school participating in the workshop was invited to delegate one faculty member to participate along with their interested junior and senior students. Each school represented was assigned a different room in Benedum Hall, the engineering building on the Pitt campus, and the afternoon was set aside for students to visit the various rooms and talk one-on-one with the professors about their programs—a kind of graduate education version of “Career Day.”

AN INTRODUCTION TO CHE GRAD EDUCATION

After coffee and doughnuts and some free time for the students from different schools to get to know one another, the workshop began with a brief slide presentation. The slides were meant to explain what graduate education in chemical engineering involves. Graduating BS chemical engineers must ask themselves whether their career goals make getting a graduate degree something to consider. Students at the workshop were asked to think about how they would answer the following questions

- Do you like to be challenged technically?
- Do you enjoy intellectual stimulation?
- Are you comfortable with open-ended problems?
- Do you like being a pioneer?
- Are you interested in being part of developments which change the direction of technology

They are told that if the answer “yes” comes up more often than not, then they are probably the type of person who would enjoy a career in some aspect of research or development, and that the tools needed for such a career are learned in graduate school. A graduate student researcher learns to think independently and to design a logical approach to understanding.

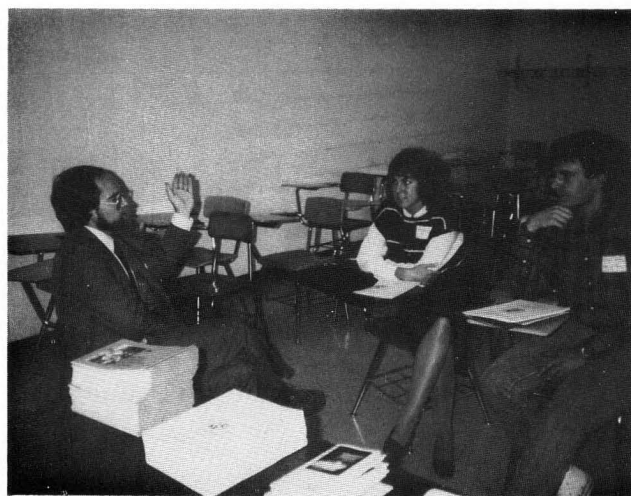
We explain to the students that research problems are usually long-term, long-range problems and their thesis work as a graduate student will differ from their prior work in undergraduate labs because it will involve a completely original problem that is theirs and theirs alone. In undergraduate courses, next year's class will work on the same labs as this year's class, but next year's group of new graduate students will *not* perform the same research being done by this year's students. So individual creativity and original-

ity develops as the student completes a graduate degree.

These aspects of graduate school in chemical engineering, as well as many other important points, were addressed very succinctly in a article by Professor J. L. Duda of the Pennsylvania State University in this journal just two years ago.* That article makes excellent reading for any student interested in going to graduate school. In fact, in planning the slide presentation for the introductory session of the workshop, I drew on many of the points made by Professor Duda.

THE PANEL DISCUSSION

Some of the most important insights into the value of a graduate education in chemical engineering came



Virginia Polytech's Professor Mark Davis makes a point about opportunities at VPI to two Pitt seniors.

from the panel discussion guests. These included Dr. Ed Nemeth, Director of Research at USS Chemicals and a University of Pittsburgh graduate; Dr. Dale Keairns, manager of the Chemical and Process Engineering Department at Westinghouse Electric Corporation and a graduate of Carnegie-Mellon University; Dr. Hubert Fleming, a technical supervisor in the Alumina and Chemicals Division at Alcoa who graduated from Cornell University; Dr. Mark McDonald, a Stanford graduate working at the U.S. Department of Energy as a research chemical engineer; Professor Jim Goodwin from the Chemical & Petroleum Engineering Department at the University of Pittsburgh, who graduated from the University of Michigan; and Mr. George Gallaher, a PhD student at the University of Pittsburgh who spent five years working for Proctor & Gamble as a line manager/tech-

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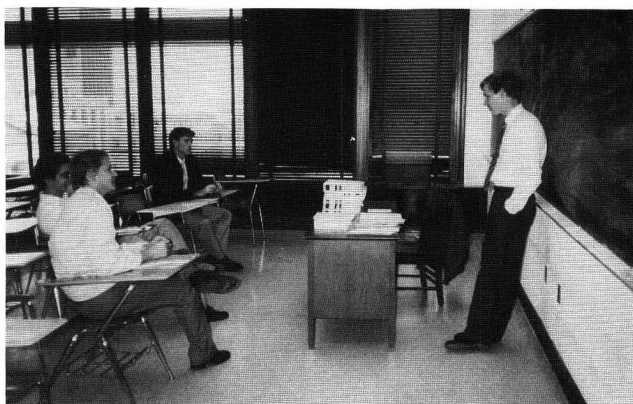
nical engineer before deciding to return to school for a doctorate degree.

All of the panel guests have careers in chemical engineering research in industry, government or academia. Their experiences were especially interesting because they spanned a wide range of career types and career levels. Some of the topics they discussed with the students at the workshop are outlined below.

How did having a Ph.D. affect your career path?

Most of the panelists said that they would not have been able to proceed very far in the careers they chose in chemical engineering research without a PhD. The scientists and engineers who move upward on *both* technical and management avenues in research within a company usually have doctorate degrees.

Two of the panel guests, Dr. Nemeth and Dr. Keairns, are very involved in management. Dr. Nemeth is responsible for the direction of all research



Professor Dennis Miller from Michigan State University talks with students about the graduate program there.

activity at USS Chemicals, including product and process development as well as technical consultation to the chemical plants. Dr. Keairns is in charge of new process/systems development. In addition, both are involved in marketing and strategic planning. It was clear that their careers encompassed a broader range of activities than most students think of when they consider what a PhD chemical engineer does on the job. Their advanced degrees gave these engineers the technical expertise, as well as the problem-solving capability, that is essential in research, development, and technical management. As they gained experience in these technical areas, their responsibilities broadened to encompass some of the planning and marketing aspects of their work. Chemical engineers with advanced degrees often get involved in both technical and management activities within their companies. Dr. Nemeth pointed out that he would not have been



Students participating in the workshop get a chance to mingle and talk over a buffet lunch.

able to reach the level of management in research and development that he has attained without a PhD.

Should I go straight to graduate school, or should I work for a few years first? The answer to this question probably always depends on the individual. One of the panel members, George Gallaher, went to work for Proctor & Gamble after completing his BS. Now, five years later, he is back in graduate school to get a PhD. A top student as an undergraduate, George realized after working for some time that his career interests and his strongest attributes as an engineer were more suited to a career in research—one that only a PhD would allow. It was through working as a BS engineer that he was able to find this out. His experience at P&G gave him a broader view of chemical engineering than most students have who enter graduate school directly from the BS. But George also pointed out that the transition to being a student again after five years in industry is not a move easily made by everyone. In fact, many more students *say* they plan to go back for an advanced degree than actually do.

Several of the panel members went straight from the BS to the PhD degree. The decision to take that approach depends on how sure the student is of his interests and career goals. And it is a decision which concerns personal as well as technical interests. Professor Goodwin spent three years in the U.S. Peace Corps between completing his MS and PhD degrees, teaching in universities in Turkey and in Liberia. He found that the experience was not only personally rewarding but also that it had a significant influence on his later career decisions and interests.

Does it make sense economically to get a graduate degree? There are differing opinions on this point. People have argued both ways—that the time spent in graduate school *will* or *will not* be rewarded by higher salaries for entry-level PhD positions. Actually, most panel members did not consider this an im-

SUMMER SCHOOL '87

The next Summer School for chemical engineering faculty, sponsored and organized by the Chemical Engineering Division of the ASEE, will be held August 9-15, 1987, at Southeastern Massachusetts University, North Dartmouth, Massachusetts. Co-chairmen for the conference are Glenn L. Schrader and Maurice A. Larson (Department of Chemical Engineering, Iowa State University, Ames, IA 50011). Local arrangements are being coordinated by L. Bryce Anderson (College of Engineering, Southeastern Massachusetts University, North Dartmouth, MA 02747) and by Stanley M. Barnett (Department of Chemical Engineering, University of Rhode Island, Kingston, RI 02881).

The 1987 Summer School will focus on the revitalization of the chemical engineering curriculum in response to the changing technological needs of American society. A series of plenary lectures will present new perspectives on emerging technology for semiconductors, biotechnology, and advanced materials. A group of four workshops is also being planned to include 1) Emerging Technology, 2) Computers in Chemical Engineering, 3) Applied Chemistry in Chemical Engineering, and 4) Curricula, Courses, and Laboratories. A poster session is also being planned.

In June 1985 proposals requesting donations to support the 1987 Summer School were mailed to about 150 companies. The following companies or their associated foundations have pledged or contributed \$83,000 to the 1987 Summer School (as of August 1, 1986):

Amoco Oil Company
Chevron Corporation
Dow Chemical U.S.A.
Dow Corning Corporation

E. I. du Pont de Nemours & Company
Exxon
Merck Sharp & Dohme Research Labs
PPG Industries
The Standard Oil Company
Shell Development Company
3M
Union Carbide Corporation

If you have any suggestions concerning key contacts with other possible donors, please call Glenn Schrader (515-294-0519) to discuss how these individuals and their organizations should be contacted.

The estimated budget accounts for: preliminary operating expenses; travel and living expenses for members of the organizing committee, plenary speakers, block chairmen, workshop leaders; special events; and partial travel and living subsidy for university participants. There is no compensation for instructional services. Members of the organizing committee, plenary speakers, block chairmen, leaders of workshops, and their institutions donate their services.

Each department of chemical engineering will be offered partial subsidy for one faculty member to attend the Summer School. Large departments will be offered an opportunity for a second faculty member to participate. Department heads will be asked to name attendees from their department. Industrial sponsors will also be invited to select one or two attendees from their company.

At the end of 1986, a mailing will be sent to all departments providing a preliminary program for the Summer School. For more information concerning the 1987 Summer School, contact Glenn Schrader, Department of Chemical Engineering, Iowa State University, Ames, IA 50011. □

portant issue. They pointed out that being satisfied with the type of career that you have chosen can often add more to the overall quality of life than the realization that over the span of a career you have made a dollar more as a result of your choice. PhD chemical engineers make very good salaries, and the job market is less tied to daily ups and downs of the economy than are BS entry-level positions. In addition, most panelists agreed that the time they spent in graduate school was an exciting, fulfilling, challenging, and learning experience—an experience they would not trade for dollars.

ASSESSING THE WORKSHOP

Probably one of the most important outcomes of

the workshop was that the students received a lot of first-hand information about the kinds of careers for which a graduate education prepares them. By meeting professors from different schools they were able to learn about the variety of programs offered. By discussing career options with working PhD chemical engineers they learned of the excitement that such careers promise. And by meeting and talking with students from other chemical engineering programs who had thoughts and concerns similar to their own, they discovered that getting a graduate education is a viable and exciting option for chemical engineers. [Note: The next workshop will be held at the University of Pittsburgh on Nov. 15, 1986. For more information contact Professor Blackmond at (412) 624-2136.] □