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Information for Prospective Chemical Engineering Majors

A brief introduction to professional opportunities
in Chemical Engineering and the B.S. program at Northwestern

Department of Chemical and Biological Engineering
Robert R. McCormick School of Engineering and Applied Science

Chemical Engineering

Where did ChE come from?

Chemical Engineering evolved during the 20th century in response to the need to analyze and design processes for the large scale manufacturing of products that involve physical, chemical and biochemical transformations. While ChE is clearly rooted in Chemistry, it's important for students to appreciate that ChE is a distinct discipline. Concerns about efficient utilization of raw materials, cost-effective and safe processing strategies and environmental impact have, over time, shaped the evolution of a unique skill set that characterizes Chemical Engineering:

- *Understanding of molecular transformations,*
- *Ability to work over wide range of scales, from molecular to global,*
- *Quantitative analysis skills, and*
- *A viewpoint by which large, complex systems are synthesized and analyzed.*

Where is ChE going?

The tools imparted by a ChE education have proven to be extremely versatile and productive. As a result, today's chemical engineer is highly sought after to work in a wide array of industries and technologies extending far beyond the profession's roots in large scale chemical processing. This includes: environmental protection, biotechnology & bioengineering, pharmaceuticals, food processing, consumer products, advanced materials, and even employment in the financial sectors.

A major theme, profession-wide, is the ever-expanding application of ChE principles to biological problems. At Northwestern, this is evident in the recent decision to change the department's name to 'Chemical & Biological Engineering.' While this name reflects the scope of scholarly activities in the department, our undergraduate degree currently remains a B.S. in Chemical Engineering. Students with particular interest in biotechnology are encouraged to pursue our optional 'Certificate in Biotechnology and Biochemical Engineering'

Employment Outlook

About 25% of Northwestern's ChE graduates pursue advanced degrees at top graduate or professional schools (including law, medicine & business). The remaining 75% typically work in industry or government. The following table provides a breakdown of industrial sectors, comparing NU graduates against national averages.

Field	NU[1]	Nat'l Avg[2]
Chemical industry, materials	18.5%	28.2%
Fuels, oil companies	7.4%	14.2%
Food, consumer products	14.8%	13.3%
Biotech & pharma	12.7%	8.1%
Engineering design services	10.6%	9.8%
Business consulting, finance	21.2%	6.1%
Electronics, software, comput.	3.7%	15.8%
Other private sector	11.1%	4.4%

1. Based on graduation surveys, 1995 - 2001
2. Based on AIChE employment survey, 2000 & 2001

2004 National Starting Salary Survey:

Major	Starting Salary
Chemical Engineering	**52,539**
Computer Engineering	51,297
Computer Science	49,036
Mechanical Engineering	48,578
Information Science & Systems	42,375
Management Info Systems	41,579
Accounting	41,058
Business Administration	38,254
Political Science	32,296
English	31,113
History	30,344
Psychology	28,230

Source: http://www.jobweb.com/

Curricular Options

Areas of Specialization

Within the ChE program, science & technical electives are chosen to define an 'area of specialization'. Current options include:

Chemical Process Engineering
General Chemical Engineering
Biotechnology
Biomedical Engineering
Environmental Engineering
Polymer Science and Engineering

Customized areas of specialization may be defined to suit your particular interests; usually this is done within the flexible 'general' ChE option.

Certificate in Biotechnology and Biochemical Engineering

A new certificate for BS students with particular career interests in pharmaceuticals, biotechnology and bioprocessing.

Interested in Medical School?

Chemical Engineering is an excellent, rigorous course of study for pre-medical students. Choosing either the Biotechnology or Biomedical Engineering specialization allows you to apply all of the standard pre-med requirements (3rd quarter organic, full year Biol 210 sequence) directly towards your ChE degree as science & technical electives.

Honor's Program

- 3.5 minimum GPA
- 3 units advanced coursework built around a particular emphasis, including at least one grad-level (or highly advanced 300-level) course.
- 2 quarters of 399 research on related topic

ChE and the COOP Program

ChE has traditionally maintained one of the highest rates of participation in McCormick's COOP program (currently ~30%).

Companies recruiting ChE students into COOP positions include:

3M, Air Products, Applied Materials, Argonne National Lab, Aventis, Avery Denison, Baxter Healthcare, BP, Dow Chemical, Eaton Corporation, GE Plastics, Honeywell, Intel, Johnson & Johnson, Kraft Foods, Procter & Gamble, Searle, Texas Instruments, USG and UOP.

This list also provides an indication of the breadth of employment opportunities enjoyed by ChE graduates.

Undergraduate Research

Senior surveys indicate that over 50% of NU ChE students participate in some form of undergraduate research. Typical mechanisms include ChE 399 independent study projects, work-study employments, or paid summer research positions.

The diverse research interests of our faculty are described at: **www.chem.-eng.northwestern.edu**

The Whole Engineer

Northwestern is committed to providing unique opportunities for professional development, extending beyond technical excellence. Two examples are:

(i) annual 'Chemical Engineering Debates' which bring faculty and undergraduate & graduate students together to explore topics of broad interest at the intersection of technology and society, and

(ii) ChE 390, 'Interpersonal and Organizational Effectiveness', and elective course on essential professional skills taught by a former Procter & Gamble Vice President (and NU alum).

Program Educational Objectives

1. *Students will learn about the modern tools of engineering analysis that are based on background in mathematics, computer science, and the physical and life sciences, as well as empirical data and generalizations, that are applied to processes involving physical, chemical and/or biological transformation.*

2. *Students will gain experience in problem solving and will develop skills in innovative thinking in the application of such tools of analysis to realistic systems.*

3. *Students will also have experience in the synthesis and design of processes for implementing physical, chemical and/or biological transformations on industrial scales with attention to safety and environmental issues.*

4. *There will be opportunities for students to develop and practice oral and written communication skills, to gain experience working in teams and to develop interpersonal skills and leadership abilities.*

5. *Students will have formal and informal opportunities to develop broad understanding and appreciation of the Humanities, Fine Arts and Social Sciences and the social and political implications and ethical context of the work done by engineers and scientists in today's society.*

Department of Chemical and Biological Engineering

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