

Chemical and Biological Engineering Collection Development Policy Iowa State University Library

I. General Purpose

This policy provides a general and detailed description of the educational and research programs of the department of Chemical and Biological Engineering (CBE). Within this context, the document describes the overall as well as the short and long-term efforts to support the library material and resource needs of the department and its programs.

In general, a systematic effort has been made to acquire major monograph works, core journals, and relevant conference proceedings that support the primary and secondary research needs of the department and its instructional programs. Among the factors that influence the selection of monographic works are their overall relevance to department programs, potential usage, and state, regional, and national availability. Potential usage is informed by a title-by-title systematic review of Horizon circulation data for works with previous editions and publications with similar subject coverage. Availability is determined by reviewing the holdings of candidate publications by our state and regional interlibrary loan partners in the OCLC WorldCat database. In addition, ISU interlibrary loan reports are systematically reviewed on a semi-annual basis to identify the current and emerging needs and interests of faculty and staff associated with the department.

A conscious effort has been made to provide access to electronic forms of key indexes and abstracts and core journals. Noteworthy recent efforts include:

- increased number of seats for nearly 24-hour access to SciFinder Scholar, the Internet-based, end-user version of the Chemical Abstracts database**
- promotion of continued support for desktop access to the Beilstein and Gmelin databases through the CrossFire database management and indexing system, and**
- promotion of full-text access to the key journals published by the American Chemical Society (ACS), most notably the back files of all ACS e-journals (ACS Legacy Archives).**

Access to the backfiles of the AIChE Journal (1955-1997) is currently being investigated [<http://www3.interscience.wiley.com/journal/107639199/home/ProductInformation.html>]. The ISU Library currently provides electronic access for volumes published since 1998.

II. History

The chemical engineering curriculum at Iowa State was originally offered by the Department of Mining Engineering, Ceramics, and Chemical Engineering. The first students transferred to the curriculum from other curricula in 1913-14 with the first freshman class of 16 entering in the fall of 1914, making the ISU program of the first Chemical Engineering departments [<http://www.cbe.iastate.edu/who-we-are/its-a-fact.html>]. In the original curriculum, the only courses designated as "chemical engineering" were Advanced Chemical Analysis and Physical Chemistry. The first M.S. degree in chemical engineering was awarded 1918 and the first departmental Ph.D. in 1925.

In 1920, Dr. Orland R. Sweeney, for which the CBE facility Sweeney Hall is named, came to Iowa State College to coordinate the chemical engineering program. When he was offered a position as professor in charge of chemical engineering at Iowa State College he agreed to accept on condition that a separate department be established and that he be appointed its department head. Dr. Sweeney started with a staff of one assistant professor and one instructor. Since its formal establishment, research and graduate study have been important strengths of the department.

III. Iowa State University Program

Profession

Chemical engineering is specialization concerned with the application of chemical research to the production of chemical materials and products. Many chemical engineers use this knowledge in jobs that include

- Product design, development, and market research
- Economic feasibility studies
- Research, development and design of chemical processes
- Operation, maintenance, and scale-up of chemical and biochemical plants
- Process design for conservation of energy and environment

[<http://www.cbe.iastate.edu/jobs/chemical-engineering.html>].

Chemical engineers are employed in a wide variety of industries, notably:

— Chemical Process Industries (CPI). The CPI's focus is on the development, extraction, isolation, combination use of chemicals and chemical by-products. Specialty areas include agricultural chemicals, catalysts, pharmaceuticals, industrial gases, paints, varnishes, pigments, inks, petrochemicals, plastics, synthetic resins and composites, paper, rubber, soaps, detergents, perfumes, fats, oils, cosmetics, synthetic fibers, textiles, and films.

— **Biotechnology.** The biotechnology industry uses living cells, materials produced by cells, and biological techniques developed through research, to create products for use in other industries. Work in the field of biotechnology has produced antibiotics, insulin, interferon, artificial organs, recombinant DNA, techniques for waste reduction and recycling, and hybrid plants that are insect resistant.

— **Electronics.** Chemical engineers in the electronics industry are involved with material development and production. For example, chemical engineers are integrally involved in the manufacturing of microchips and intricate circuitry, using their training to develop the materials and processes that allow such circuits to be properly assembled.

— **Environmental, Safety & Health.** In almost every industry, chemical engineers are involved in areas that concern the environment, waste minimization, and personal health and safety. With every process that involves the use and manipulation of raw materials, some by-products are produced. The chemical engineer is employed to minimize the production of by-products, if they are of no use, or find an appropriate use for them.

— **Food & Beverages.** The food and beverage industry includes the handling, processing, preparation, packaging, and preservation of food and beverages.

— **Fuels.** Those industries that fall under the category of fuels include petroleum and petroleum products production, refining, as well as nuclear and synthetic fuels. Chemical engineers are also involved in developing alternative energy sources.

— **Advanced Materials.** Industries in the category of advanced materials use chemical engineers to help develop materials with different properties such as weight, strength, heat transfer, reflectivity, and purity

[\[http://www.cbe.iastate.edu/jobs/chemical-engineering.html\]](http://www.cbe.iastate.edu/jobs/chemical-engineering.html).

Department

Currently, approximately 375 undergraduate students are enrolled in Chemical and Biological Engineering programs at ISU, including about 55 full-time graduate students (ISU 2006-2007 Fact Book: 103). The graduate student body is well qualified and diverse, representing leading colleges and universities in the United States and many other countries [\[http://www.cbe.iastate.edu/students/graduate-students/cbe-graduate-students.html\]](http://www.cbe.iastate.edu/students/graduate-students/cbe-graduate-students.html). All of the department's research

involves collaboration between students and the graduate faculty. With 14 members (ISU 2006-2007 Fact Book: 103) [<http://www.cbe.iastate.edu/who-we-are/people/directory.html>] [http://www.public.iastate.edu/~inst_res_info/FB07files/pdf07/FB07all.pdf] the faculty is sufficient to give students a wide range of choices for research; at the same time, the low student/faculty ratio provides a supportive environment for graduate study.

The departmental facility Sweeney Hall, a 44,000+ square foot modern building, houses departmental faculty and staff, and include classrooms and research laboratories [<http://www.cbe.iastate.edu/research/facilities.html>]. It houses the department and its special facilities for Raman, Fourier transform infrared, and Auger spectroscopies; catalyst characterization; particle size analysis and light scattering; biochemical separations; coal analysis; computer visualization; and chemical vapor deposition and reactive sputtering.

An 35,000-square-foot, \$8 million addition completed in 1994 incorporates teaching laboratories plus extensive research space to accommodate the department's growing involvement with biotechnology and surface phenomena. The new addition contains research laboratories for corrosion and electrochemistry, crystallization, biotechnology, statistical process control, and reaction engineering. The addition also houses analytical laboratories, a small pilot plant, state-of-the-art teaching laboratories, and faculty and staff offices. The department has close associations with a number of university-wide research centers, notably the Plant Sciences Institute (<http://www.plantsciences.iastate.edu/>), the National Animal Disease Center [http://ars.usda.gov/main/site_main.htm?modecode=36253000] and the Ames Laboratory, the U.S. Department of Energy National Laboratory [<http://www.external.ameslab.gov/>].

On July 1 2005, the name of the department name was changed from Chemical Engineering to Chemical and Biological Engineering [<http://www.public.iastate.edu/~nscentral/news/2005/apr/0406.shtml>] to better reflect the nature of the research and teaching currently underway in the department [<http://www.eng.iastate.edu/abstracts/info/che.asp>].

Research

The faculty in the department are acknowledged leaders of research and teaching in a number of areas including biochemical engineering, bioinformatics, biomedical engineering, biorenewables, combinatorial materials design, polymeric materials, nanotechnology, tissue and metabolic engineering, interfacial chemistry and catalysis, chemical reaction engineering, electrochemical engineering, computational fluid dynamics, and statistical process control

[<http://www.eng.iastate.edu/abstracts/info/che.asp>].

The overall research focus of departmental faculty has been categorized within one or more areas:

- **Biobased Products**
- **Catalysis and Reaction Engineering**
- **Biomaterials and Biomedical Engineering**
- **Biochemical Engineering**
- **Computational Chemical and Biological Engineering**
- **Polymeric and Nanostructured Materials**
- **Transport and Thermodynamics**

[\[http://www.cbe.iastate.edu/research/areas.html\]](http://www.cbe.iastate.edu/research/areas.html)

A compendium of current faculty and their specific research interests is available [\[http://www.cbe.iastate.edu/research/interests-projects.html\]](http://www.cbe.iastate.edu/research/interests-projects.html).

Instruction

“The curriculum in chemical engineering includes continued study of chemistry, mathematics, and physics as well as intensive study in the engineering sciences such as chemical reaction engineering, thermodynamics, mass transfer, fluid mechanics, heat transfer, system analysis and process synthesis, and design.

The curriculum in chemical engineering is designed to produce graduates that have the ability to apply knowledge of mathematics, science, and engineering; the ability to design, conduct and interpret experiments, and the ability to design a chemical engineering system, component, or process. Graduates should also have the ability to function on multi-disciplinary teams; the ability to identify, formulate, and solve chemical engineering problems; and the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The curriculum should also assure that graduates have the ability to communicate effectively, the broad education necessary to understand the impact of chemical engineering solutions in a global and societal context, and recognition of the need for, and an ability to engage in life-long learning, as well as a knowledge of contemporary issues and an understanding of professional and ethical responsibility.

The curriculum assures that graduates have a thorough grounding in chemistry, along with a working knowledge of advanced chemistry such as organic, inorganic, physical, analytical, materials chemistry, or biochemistry. In addition, a working knowledge, including safety and environmental aspects, of material and energy balances applied to chemical processes; thermodynamics of physical and chemical equilibria; heat, mass, and momentum transfer; chemical reaction engineering; continuous and stage-wise separation operations; process dynamics and control; process design; and appropriate modern experimental and computing techniques is assured” (<http://www.public.iastate.edu/~catalog/2005-07/courses/che.html>).

Select Courses (ISU Catalog 2005-2007)

- Ch E 310. Computational Methods in Chemical Engineering
- Ch E 356. Transport Phenomena I.
- Ch E 357. Transport Phenomena II
- Ch E 358. Separations
- Ch E 381. Chemical Engineering Thermodynamics
- Ch E 382. Chemical Reaction Engineering
- Ch E 406. Environmental Chemodynamics
- Ch E 408/508. Surface and Colloid Chemistry
- Ch E 415/515. Biochemical Engineering
- Ch E 421. Process Control
- Ch E 430. Process and Plant Design
- Ch E 440. Biomedical Applications of Chemical Engineering
- Ch E 442. Polymers and Polymer Engineering
- Ch E 542. Polymeric Biomaterials
- Ch E 545. Analytical and Numerical Methods
- Ch E 562. Bioseparations
- Ch E 583. Advanced Thermodynamics
- Ch E 587. Advanced Chemical Reactor Design
- Ch E 625. Metabolic Engineering
- Ch E 642. Principles and Applications of Molecular Simulation
- Ch E 652. Advanced Transport
- Ch E 688. Catalysis and Catalytic Processes

<http://www.public.iastate.edu/~catalog/2005-07/courses/che.html>.

The undergraduate major in Chemical and Biological Engineering is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET)

<http://www.cbe.iastate.edu/assessment.html>.

Careers

- **Process Design Engineer - Designs manufacturing facilities and the equipment and material used inside.**
- **Environmental Engineer - Develops techniques to reduce and recover usable materials from waste created during product manufacture.**
- **Plant Process Engineer - Provides technical support and troubleshoots processes in a production facility.**
- **Process Safety Engineer - Designs and maintains plants and processes that are safer for workers and communities.**
- **Project Engineer - Oversees the design and construction of specific processes in a facility.**
- **Research & Development Engineer - Seeks out new and efficient ways of producing existing products. Explores and develops new processes and products.**
- **Attorney - Specializes in intellectual property, patent law, environmental compliance, and safety issues.**
- **Biomedical Engineer - Works to develop artificial organs and to develop new treatments for human diseases.**
- **Technical Manager - Manages people, research programs, and daily operations of the engineering functions.**
- **Professor - Instructs students in the field of chemical engineering and conducts research in pertinent areas.**
- **Quality Control Engineer - Monitors the manufacture of a product to ensure that it meets specifications. Also, tests materials to determine how they perform over time.**
- **Technical Services Engineer - Works with customers, usually on-site, to solve production problems caused by a specific process or machine.**

[\[http://www.cbe.iastate.edu/jobs/careers.html\]](http://www.cbe.iastate.edu/jobs/careers.html)

IV. Subject Boundaries

Some research efforts within the department are more the focus of other ISU departments or programs than Chemical Engineering. A conscious effort is made to purchase publications that support these other research efforts from other appropriate funds or to refer these candidates to the appropriate bibliographer. The major overlapping programs or subject areas and their respective fund and bibliographer are:

- **Biochemistry, Biophysics and Molecular Biology (Heather Lewin)**
- **Chemistry / Heather Lewin**
- **Computer Science / Kris Stacy-Bates**
- **Food Science & Human Nutrition / Diana Shonrock**
- **Material Science and Engineering/ Steve McMinn**
- **Mathematics / Kris Stacy Bates**
- **Mechanical Engineering / Gerry McKiernan**

Representative textbooks are considered and selectively acquired, particularly those that are a latter edition of titles owned by the ISU library and that have documented use. Proceedings are selectively acquired.

V. **General Collection Guidelines**

A. **Linguistic**

English is the primary collection language, although relevant publications in other languages are considered and purchased selectively depending on their relevancy to the research strengths of the department.

B. **Geographical Areas**

Nearly all selected material is published in United States or Europe. However, as with the linguistic parameter, the relevance of the publication to the research and instructional programs of the department is the framework within which a candidate publication is considered for selection rather than its geographical origin.

C. **Types of Materials Collected.**

Monographs and serials form the core of the collections that support this program. Significant national and international conference proceedings are also included. Bibliographies and dissertations are collected very selectively, except for those related to bioenergy and the bioeconomy. Since 2006, a systematic effort has been made to identify relevant English-language conference proceedings dissertations and theses, reports, white papers, and other gray literature to support the departmental and university alternative energy research and educational initiatives

D. **Format of Materials Collected**

While the collection overall is primarily paper, major journals are available in electronic format. *SciFinder Scholar*, an Internet-based abstract and index database and the *Beilstein* and *Gmelin* databases via the Internet-based CrossFire

system provide desktop access to major sources of chemical bibliographic information and data.

VI. Specific Collection Guidelines

In general, a conscious effort is made to acquire the monographic and serial literatures that support the broad and specific research interests of departmental faculty.

VII. Other Resources Available

Databases: Biosis Previews; Beilstein CrossFire; Corrosion Abstracts; CSA Materials Research Database with METADEX; EiCompendex Web (Engineering Index); Engineered Materials Abstracts; Food Science and Technology Abstracts; Gmelin CrossFire; SciFinder Scholar; MathSciNet, Medline/PubMed; Electronic Journals: American Chemical Society; American Institute of Chemical Engineers; ScienceDirect ; Web of Science.

Among the factors that influence the selection of monographic works are state, regional, and national availability. Availability is determined by reviewing the holdings of candidate publications by our state and regional interlibrary loan partners in the OCLC *WorldCat* database.

VIII. Cross-references to Collection Policies

The following subject areas or programs overlap part of the research focus of the Chemical Engineering department:

- **Biochemistry, Biophysics and Molecular Biology (Heather Lewin)**
- **Chemistry / Heather Lewin**
- **Computer Science / Kris Stacy-Bates**
- **Food Science & Human Nutrition / Diana Shonrock**
- **Genetics, Development & Cell Biology (Andrea Dinkelman)**
- **Material Science and Engineering/ Steve McMin**
- **Mathematics / Kris Stacy-Bates**
- **Mechanical Engineering / Gerry McKiernan**

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X. Revision History

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TP

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Gerry McKiernan