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Feature

The First Century of Chemical Engineering

In England, during the same period, Davis proceeded with the publication of his *Handbook of Chemical Engineering* (1901), which was revised and published in a second edition of over 1,000 pages in 1904. Davis's textbook was particularly important because it introduced the notion of "unit operations," although the term itself would not be coined until 1915 by Arthur D. Little at MIT. As developed by the two men, "unit operations" referred to the idea that all chemical processes can be analyzed by dividing them into distinct operations, such as distillation, extraction, filtration, and crystallization, all of which are governed by certain principles. More than anything, however, Davis was responsible for coining the term *chemical engineering* to describe this new engineering area that addressed problems of the chemical industry.

In the United States, MIT is considered the first university to have offered, in 1888, a four-year curriculum in chemical engineering, in 1888. Other universities soon followed MIT's example: the University of Pennsylvania (1894), Tulane University (1894), the University of Michigan (1898), and Tufts University (1898). Each of these four-year programs in chemical engineering were housed within the chemistry department.

The Institution of a Profession

In this climate of international competition and academic excitement the young field of chemical engineering found the right ground to thrive in. In 1903 a specialized publication appeared. *The Chemical Engineer* was not exactly a scientific journal, but it included practical articles written by practicing industrial chemists and engineers, including William Walker. By 1905 this magazine had a circulation of more than 1,600, including about 570 chemical engineers.

By 1904 tensions were bubbling up among members at American Chemical Society (ACS) meetings about the relationship between chemistry and chemical engineering. At that year's meeting Hugo Schweitzer, a prominent New York industrial chemist, declared himself "absolutely against the introduction of chemical engineering in the education of chemists. "In the same meeting M. T. Bogert agreed with Schweitzer, saying that progress in "technical chemistry" was best achieved in research laboratories by researchers without engineering training. But the engineers found a defender in Milton C. Whitaker, a professor of chemistry at Columbia University, who argued that a chemist was "generally not the man who is capable of transmitting from a laboratory to a factory the ideas which he has developed "because he lacks education "in the engineering branches."

The controversy soon spurred action. Three years later a group of 12 chemists and engineers met at the Chalfonte Hotel in Atlantic City to discuss the future of their profession. At the end of their discussion they formed the so-called Committee of Six to explore the "possibility of forming a chemical engineering organization." The Committee of Six represented the core of what would become AIChE's leadership, which included Walker as well as three men who would go on to become presidents of the organization: Arthur D. Little (1919), Charles F. McKenna (1910), and John C. Olsen (1931). Discussions continued for almost six months after the meeting, but it was finally decided that an organizational meeting was the next step.

The Committee of Six, joined by 15 other chemists and chemical engineers, held its next meeting in January 1908 at the Belmont Hotel in New York. Once again Bogert, by this time president of the ACS, raised the objection that his organization already served the needs of practicing industrial chemists. Nevertheless, the Committee of Six stood firm and decided to form a new organization dedicated to chemical engineering. On 22 June 1908 the first meeting of the AIChE convened at the Engineer's Club of Philadelphia. According to minutes recorded by William Meade, "enthusiasm ran high" among the 40 men in attendance.

As originally envisioned, one of the primary goals of AIChE was to raise the professional status of the 500 or so chemical engineers then working in American factories and chemical manufacturing plants. Partly as a way to placate the ACS and partly in an attempt to make membership exclusive—and therefore prestigious—the AIChE

initially adopted strict membership requirements: members had to be at least 30 years old, be currently engaged in “applied” chemistry, and have either 5 or 10 years of industrial experience, depending on whether the applicant held a science degree. These requirements kept membership small (well under 1,000) through the first two decades of the organization’s existence.

In those days the training of chemical engineers was a subject of much debate in AIChE meetings. Whitaker, an influential professor of chemical engineering at Columbia University and an early president of AIChE (1914), expressed his views on the training of chemical engineers as follows: “The chemical engineer works in the organization, operation, and management of existing or proposed processes with a view to building up a successful manufacturing industry . . . His fundamental training in chemistry, physics, mathematics, etc., must be thorough and must be combined with a natural engineering inclination and an acquired knowledge of engineering methods and appliances.” He continued by giving a description of the types of courses that should be taught, which he classified as courses for “fundamental training” (chemistry, physics, mathematics), “associated training” (electrical, mechanical, civil, and general engineering, and business economics), and “supplementary training” (laboratory and administration courses). For Whitaker it was important that a distinction be made between the education of a chemical engineer and that of an industrial chemist. The chemical engineer would study both chemical processes and unit operations, while the industrial chemist traditionally learned specific procedures for producing bulk quantities of feedstock chemicals. His views affected his graduate students, prominent among whom was Eugene E. Leslie, who would later teach at the University of Michigan.

Over the course of the 20th century, chemical engineering gradually developed a specific disciplinary identity, focusing first on unit operations, then adding applied thermodynamics, chemical-reaction engineering, applied mathematics, and computer science. By the mid-1970s, researchers realized that chemical engineers could contribute significantly to areas outside of the core of classical chemical engineering, including interdisciplinary areas such as the biochemical and biomedical sciences and materials science. Today chemical engineers are leading the way in sustainability, nanotechnology, high-performance materials, and electronics manufacturing.

The establishment of AIChE in 1908 gave shape to the dreams of the “converted chemists” who were calling themselves chemical engineers in the face of opposition from employers as well as professional colleagues. After a century of growth AIChE is unquestionably the world’s leading organization for chemical engineers, with more than 40,000 members in more than 90 countries and more than 100 local sections. Now, in the beginning of the 21st century, chemical engineers’ contributions remain critical not only to the global economy, but also to modern life.

For Further Reading

American Institute of Chemical Engineers Web site. www.aiche.org.

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