In Memoriam . . .

OLAF ANDREAS HOUGEN

(1893-1986)

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Olaf Hougen, who died on January 7, 1986, was one of the giants in chemical engineering: a brilliant researcher, a formidable teacher, and a world-famous author, whose books influenced the course of his profession.

He was born in Manitowoc, Wisconsin, on October 4, 1893; his father was a Lutheran clergyman. He received his BS (*cum laude*) at the University of Washington, and his ChE and PhD degrees in 1918 and 1925, respectively, at the University of Wisconsin, all of his degrees being in chemical engineering. In 1918 and 1919 he spent 18 months in the research department of the Carborundum Company at Niagara Falls, New York.

His teaching career covered a period of over 40 years, most of it at the University of Wisconsin; he also held teaching appointments at the Illinois Institute of Technology, UCLA, the Norwegian Institute of Technology (Trondheim), Kyoto University, and Nagoya University. For three periods, totalling eight years, he served as departmental chairman; even when he was not chairman, he exercised considerable influence and leadership.

Professor Hougen joined ASEE in 1930; he was active in the organization of the Chemical Engineering Division and served as its chairman in 1935-36. Some of his papers on chemical engineering education were published in the *Journal of Engineering Education.* He felt strongly that his colleagues should participate in ASEE activities and take advantage of that organization to exchange ideas with chemical engineering teachers at other schools.

To many generations of students Professor Hougen was known affectionately as "Big O." And he was big: big in stature (well over 6 feet tall), big in his profession, and big in compassion and understanding. He was a skilled teacher, with deep knowledge of his subject material; he knew how to get his students to think their way through difficult problems without intimidating them. His insistence on high-quality performance and his emphasis on high standards were balanced by his kindly attitude and his spontaneous sense of humor. He felt that serving the students by helping them to master difficult technical material was a most important assignment. It was well-known among the students that Professor Hougen's thermodynamics course was the best one on the campus, and students from the chemistry and physics departments regularly attended his lectures; his course dealt with real materials (not just ideal gases and ideal solutions) and the problems worked in the course dealt with real processes and real chemical systems (not just schoolbook exercises).

Students all over the world profited from Olaf Hougen's teaching via his books: *Industrial Chemical Calculations* (O. A. Hougen and K. M. Watson, 1931, 1936); *Chemical Process Principles, I, Material and Energy Balances* (O. A. Hougen and K. M. Watson, 1943; revised along with R. A. Ragatz, 1954); *Chemical Process Principles, II, Thermodynamics*, 1946; revised along with R. A. Ragatz, 1959); *Chemical Process Principles, III, Kinetics and Catalysis* (O. A. Hougen and K. M. Watson, 1947); *Chemical Process Principles Charts* (O. A. Hougen and K. M. Watson, 1946); *Reaction Kinetics in Chemical Engineering*, CEP Monograph 1 (O. A. Hougen, 1951). The "CPP" trilogy was immensely successful and influential because of its pedagogical soundness, clear scientific basis, and excellent illustrative examples.

Perhaps less well known to chemical engineers was Olaf Hougen's particular dedication to Norway, the land of his forebears. He served the Organization for American Relief to Norway as treasurer for Wisconsin during the years 1940-1945 (for which he received a citation from King Haakon). In Madison he was a member of the Ygdrasil Literary Society and served one year as its president. He was a member of the committee for the selection of the first chemical engineering professor in Norway in 1949. In 1951 he was Fulbright Professor at the Norges Tekniske Høgskole; during this time he prepared a comprehensive plan for the organization of the Chemical Engineering Department at NTH. He actively promoted scholarly exchanges between Norwegian and U.S. academic personnel in chemical engineering. He rounded off his professional career by serving as Scientific Attaché to Scandinavia while assigned to the U.S. Embassy in Stockholm in 1961-1963. In 1960 he received an honorary doctorate from NTH in recognition for his many outstanding contributions.

Olaf Hougen was given many other honors and awards, including the Lamme Award of ASEE; the Warren K. Lewis, William H. Walker, and Founders Awards of AIChE; the I&EC Award of ACS; membership in the National Academy of Engineering; and honorary memberships in the Society of Chemical Engineers Japan, the Venezuelan Institute of Chemical Engineers, and the Indian Institute of Chemical Engineers. Typically he never talked about his numerous awards, and, in fact, many of his colleagues, friends, and family members did not even know about them.

Olaf and his wife Olga were often hosts for staff members, TA's, and students. An evening at their home was always comfortable and full of fun. Olga was an animated story-teller and radiated good humor and hospitality. Foreign visitors were welcomed with open arms and made to feel a part of the group. Having lived abroad themselves they were both sensitive to the needs of visitors far from home.

Gentlemanly, considerate, thoughtful, kindly, loyal, humble, genuine, professional, dedicated, scholarly, responsible—these are the adjectives that describe Olaf A. Hougen. Those of us who had the opportunity to interact with him are indeed fortunate. We now have the responsibility to try to live up to the high standards set by this great man and good friend.

HOUGEN'S PRINCIPLES

Some Guideposts for Chemical Engineering Departments

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The Department of Chemical Engineering at the University of Wisconsin Madison owes much of its success to certain guiding principles formulated by Olaf A. Hougen. Listing these principles seems an appropriate way to pay tribute to his memory. Many of the principles listed below were stated by him on many occasions; some of them I heard from him in private conversations; and a few of them were perhaps not enunciated explicitly, but I have inferred them from many years of observing that extraordinary teacher. The twelfth and last guiding principle on this list was found by Professor W. R. Marshall among some of Professor Hougen's papers.

1. THE UNDERGRADUATE PROGRAM SHOULD BE PRACTICAL AND CONSERVATIVE, WHEREAS THE GRADUATE PROGRAM SHOULD BE IMAGINATIVE AND EXPLORATORY.

Professor Hougen clearly recognized that we have an obligation to train most of our undergraduates so that they can assume responsible jobs in industry. However, he also made it clear that at the graduate level we must be boldly pioneering in new fields. He had a knack for deciding what important new subject areas were emerging and what kinds of new faculty members were needed to develop them.

2. THERE SHOULD BE A SMOOTH FLOW OF INFORMATION FROM GRADUATE RESEARCH TO GRADUATE TEACHING TO UNDERGRADUATE TEACHING.

We should not experiment on the undergraduates by giving them untested material. Professor Hougen felt that every undergraduate course should be backed up by graduate course instruction and research, so that the undergraduate program would always be under pressure to be modernized. The modernization and modification of undergraduate courses should, however, be done only after careful testing at the graduate level.

3. IF YOU CAN'T FIND RELEVANT PROBLEMS TO GIVE THE STUDENT, THEN YOU SHOULDN'T BE TEACHING THE MATERIAL TO THE STUDENTS.

At the time of Professor Hougen's 85th birthday party, Aksel Lydersen (of Trondheim, Norway) said that this remark was something that he would never forget. Professor Hougen felt very strongly that our teaching should emphasize topics which are useful for solving the industrial problems of the present and future. He was very perceptive in recognizing the significant problems faced by chemical engineers in industry and attempted to plan his courses and his textbooks to address these key problems.

4. USE THE BEST AVAILABLE INFORMATION FROM THE MODERN SCIENCES.

Good engineering analysis and design must utilize the most up-to-date material from chemistry, physics, and mathematics. Professor Hougen certainly demonstrated this idea in his own research, teaching, and book writing. The *Chemical Process Principles* volumes bear testimony to his thorough familiarity with the best current thinking from the pure sciences.

5. WELL-FOUNDED AND WELL-TESTED EMPIRICISMS ARE TO BE PREFERRED OVER THEORIES THAT HAVE ONLY A LIMITED RANGE OF APPLICABILITY.

Professor Hougen was always on the lookout for clever, scientifically based correlations, backed up by lots of experimental data, for use in chemical engineering design. His own contributions to "generalized charts" of all kinds are well known. He felt very strongly that every effort should be made to present results in a form that could be easily used by practicing engineers.

6. IT IS VITAL FOR ENGINEERS TO KNOW HOW TO SOLVE PROBLEMS WITH LIMITED AND INCOMPLETE DATA.

One time Professor Hougen gave a seminar entitled "From Cork to Mollier." Everyone knew who Mr. Mollier was, but all efforts to discover the identity of Mr. Cork failed. The seminar dealt with the problem of predicting the Mollier diagram by sniffing the cork of the bottle containing the material! Professor Hougen's students certainly came away from his thermodynamics course fully aware of many clever methods for physical property estimation.

7. STUDENTS ARE IMPRESSIONABLE AND LEARN QUICKLY, AND THEREFORE A PROFESSOR MUST MAKE CERTAIN THAT HE TEACHES IN A RESPONSIBLE WAY.

One time Professor Hougen called me on the carpet because, in a graduate seminar introduction, I had suggested that the speaker's new theoretical methods would soon replace the tried-and-true engineering correlations. He took issue with this, and said that I had no right to make an unqualified statement of that sort in front of the graduate students and that I had left them with a totally incorrect impression.

8. IT IS IMPORTANT THAT THE STUDENTS HAVE A GOOD GROUNDING IN THE BASIC FUNDAMENTALS; THERE'S NOTHING WORSE THAN A STUDENT WHO HAS A THIN VENEER OF HIGH-POWERED THEORY.

Whether or not students go into industry or on to graduate school, they appreciate being well-grounded in the elementary ideas of the undergraduate subjects. A thin coating of unassimilated and poorly understood material is of little value, and Professor Hougen was adamant that we should stress the basic ideas. He did not hesitate to recommend remedial course-work for incoming graduate students whose backgrounds were weak.

9. WE MUST ALWAYS RECOGNIZE THAT OUR STUDENTS AND OUR TEACHING ASSISTANTS ARE YOUNG PROFESSIONALS.

Students and young colleagues of Professor Hougen always felt that he wanted them to share with him in the responsibility for the development of chemical engineering as a profession. He was always giving encouragement to colleagues and students to develop their strong points and their professional interests; he was also aware that everyone has limitations in his talents, but he knew how to work around them.

10. HE RECOGNIZED THAT FACULTY MEMBERS HAVE AN OBLIGATION TO ASSIST COLLEAGUES IN OTHER INSTITUTIONS.

Professor Hougen was always willing to give help to professors in other schools and in other countries. He would go out of his way to take care of foreign visitors and to assist them in achieving their goals of improving chemical engineering in their own nations. He recognized that the preparation of textbooks was a key responsibility for professors in leading research departments, and he made substantial contributions in that area along with his colleagues Professor K. M. Watson and Professor R. A. Ragatz.

11. WE HAVE, AS FACULTY MEMBERS IN A STATE-SUPPORTED INSTITUTION, A RESPONSIBILITY TO SERVE THE TAXPAYERS BY PERFORMING OUR JOB WELL.

We all know that state-supported universities have their ups and downs financially. Professor Hougen often said that he felt that the citizens of the State of Wisonsin had been very generous in supporting our university and that we have a duty to perform our assignments as well as we can with the limited resources available.

12. DO NOT SHOW EMOTIONS OF BITTERNESS OR BERATEMENT OR BELITTLEMENT; ASCRIBE THE BEST MOTIVES TO YOUR ASSOCIATES; SAY NOTHING DEROGATORY.

These words, written in a note to himself, are sterling words of advice for the creation of a collegial atmosphere within a department. Professor Marshall quoted the above words at the memorial service for Professor Hougen, and as Professor Marshall said ". . . indeed, Olaf lived by this creed."

The departmental staff members of my generation have grown up with these principles because we were young faculty members when Olaf Hougen was in his prime. If succeeding generations of professors can follow these guidelines, our students will be assured of a high-quality education and the profession of chemical engineering will be a dynamic and lively profession.

Editorial

OLAF HOUGEN: Teacher, Researcher, Educator

In previous editorials (Vol. XX, 3, 100) we indicated that the goal of a department or of an individual professor should be to serve society (the profession, university, department, students, etc.) rather than to seek high ratings (in the case of the department) or personal recognition (in the case of the professor). In this issue we illustrate this principle through the example of the late Olaf Hougen and the University of Wisconsin.

When Professor Hougen and his colleagues began their authorship of *Chemical Process Principles*, their motivation was to demostrate how scientific principles could be used in practical situations to achieve a quantitative result of importance to industry (see Principles 4, 5 and 10). They did not write their pioneering three-volume text with the prime goal of gaining recognition for their department or for themselves, but instead did so with the goal of fulfilling a professional/societal need. The consequence of their work, however, was that Wisconsin's PhD students became very much in demand as they "seeded" various departments, spreading the Wisconsin attitude around the nation and even the world. These missionaries in turn had PhD students who became disciples of the Wisconsin attitude themselves (see the Hougen "tree," *CEE*, Summer 1968). As a consequence of this service to the profession and society, Wisconsin continually ranked first in the nation in surveys such as the Cartter report and in subsequent reports of quality in chemical engineering education. But the Wisconsin department, in achieving this recognition, did not disregard teaching in a zealous drive for ratings; instead it emphasized teaching and recognized that research is a form of teaching. A reading of the above paper on Hougen's principles, by Professor Bird, clearly indicates that Olaf Hougen was at once a great teacher *and* a great researcher who saw in both of these activities an opportunity for service.

Later, Professor Hougen played an important role in the development of transport phenomena when he brought Professor Bird back to Wisconsin and charged him with the responsibility of putting on a firm scientific basis the computation of energy, mass, and momentum transfer. Instead of an inane competition for prestige, let us follow the example of service as set by this great man.

Ray W. Fahien