THE GOALS of a Chemical Engineering Department

Modern chemical engineering has developed with one root in chemistry and other roots in the engineering sciences and physics. Its trunk is a multichannel communication cable which might be termed process control and systems engineering. Its major branches consist of the macroscopic concepts of unit operations and of process equipment design. Its outer branches are developmental laboratories, pilot plants, and processing plants. Its leaves and fruits are the products and goods of our consumer economy. Without its roots, it will die; without its trunk, the leaves and fruits will not develop; and without its fruits, it has no reason for existence.

The language of chemical engineering is computer science, mathematics, and graphics. Its verification is experiment; its validation is the utility of its products; its restraints are economics and human well-being.

The identifying characteristic of chemical engineering is change: it deals with changes in state, changes in composition, changes in kind and content of energy, changes in size and aggregation, changes in biological or chemical species, and changes in appearance and quality. Since products and processes are themselves ephemeral, chemical engineering cannot lastingly or properly be defined in terms of certain products, certain processes, or certain processing methods.

As a consequence, its goals are bifold: its current major industrial goal is the economical design and operation of plants and equipment; but its academic goal is the generalization, dissemination, discovery, utilization, and extension of human knowledge in the basic sciences and concepts that comprise its roots and its trunk and branches.

A broadly oriented research and instructional program in modern chemical engineering must be cognizant of these duplicate sets of goals. It must include research in the engineering sciences such as transport and rate processes, fluid mechanics, properties of materials, and thermodynamics. It can include research in chemistry, such as work in polymers. It must include work in systems engineering, in separations processes, unit operations, and process control and economics. Finally, it can be involved in interdisciplinary areas such as bioengineering, biomedical engineering, environmental engineering (pollution), electrochemistry and energy conversion (fuel cells), and computer science and applied mathematics.

Just as the ultimate objective of the university is to serve the community of mankind, so also the goal of a department of chemical engineering must have its purpose in the betterment of human society. For, as a professional man, an engineer is not merely a technical robot who responds passively and unquestioningly to conformist pressures or to the commands of others. Instead he must be aware of, and deeply concerned with, the social and political problems of our time. He must have a high sense of values and be capable of making decisions with regard to principles and ideals derived from these, rather than from narrow self-interest or partisan group-interest. In keeping with this philosophy, a department should investigate methods of establishing communication between the "two cultures" of technology and the humanities. It should also explore programs of educational assistance to other nations.

Of great importance to the implementation of its goals is the need for adequate facilities. But, while bricks and mortar are important, what it infinitely more important is the brilliance of the experienced researcher in his indefatigable task of adding the bricks of human knowledge to the whole structure of man's intellectual development, and the skill of the dedicated teacher in the bonding of these stones with the cement of theory, generalization, and experiment.

R.W.F.