The Integrity of Chemical Engineering

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Chemical engineerings is a chemistry-and-physics based discipline. Chemical equilibria and kinetics share equal importance with physical equilibria and transport rates. The conservation statements about chemical systems are as significant as those about physical ones. Furthermore, the processing that accompanies chemical reactions in the manufacturing setting depends heavily on diffusive transport of molecular matter, an aspect of physical chemistry exploited predominantly by the chemical engineer. In this kind of physical operation there has developed peculiar identification with the chemical engineering discipline.

By combining chemical (stoichiometry, thermodynamics, kinetics), physico-chemical (diffusion, phase transformation), and physical (heat transfer, fluid mechanics, strength of solids) principles under the constraints of practical economics, chemical engineering has produced processes of great complexity, carried out in plants that are often enormous (ten million gallons of product per day) and costly (hundreds of millions of dollars). Chemical engineers are responsible for the entire plant and process—their conception, development, design, and economic operation — every component of which must operate properly with respect to all the others if success is to result. This is true systems engineering.

The history and present status of engineering and the engineering industries demonstrate that there is a distinct need and proper place for the peculiar educational experience that a chemical engineering curriculum affords, and for the product of that education. Chemical engineering problems are characterized, indeed, by a degree of complication greater than those usually identified with the other traditional engineering fields. The evolution of our discipline has brought with it methods of attacking such problems, and concepts of exceptional power and wide usefulness. A consequence is that chemical engineers, essential to the process industry, are in demand in a variety of other environments, industrial and extra-industrial. One of their great assets is their ability to work unusually effectively with representatives of other disciplines in the solution of problems of great scope and interdisciplinary character.

Notwithstanding the success of past advances, the techniques and insight provided by chemical engineering are still evolving, and there is strong reason to believe that contributions arising out of them will be even greater in the future. Chemical engineering originated from the consolidation of the principles common to a number of previously isolated use-centers: the paper industry, petroleum refining technology, acid manufacture, et cetera. Its great strength derived from its capacity to unify and establish bonds between these otherwise diverse, discrete industries, and to provide education and training that make the chemical engineer effective in all of them. Today there seems to be some tendency again to fragment the field into use areas with new names but distinct identities: environmental engineering, food engineering, and the like. A competing tendency would generalize certain of the subdisciplines shared by several of the engineering fields into new disciplines: thermal engineering, materials science, and systems engineering are examples. In both cases, the identification of interest centers at which competences from a number of disciplines can converge for the attack of broad superproblems is useful and salutary. But to suggest that they should subordinate or supplant the established discipline of chemical engineering is to suggest the destruction of the burgeoning promise of tremendous future contributions originating in our field.

We submit that future society will benefit most from the maintenance and continued evolutionary development (at the most fundamental level consistent with the definition of the field) of an academic discipline erected on the subject matter at the core of chemical engineering today. Simultaneously, vigorous effort should be directed to those developments at or near the diffuse boundaries where other currently defined disciplines, basic and applied, and chemical engineering merge. We believe that such a frankly disciplinary approach optimizes the task of conserving and extending the treasure of knowledge, understanding, and skill for which chemical engineering has become a particular repository; of applying that treasure to new creative goals in the world of the process industry; and of sharing major interdisciplinary challenge with others in a significant effort which, in using without sacrificing its contributing collaborators, is enduringly synergistic.