

Remarks By David H. Morgan

In opening my part of the panel today I should like to start with a quotation which really "rocked" me. "In ten years it will be difficult to distinguish between engineering graduates and science graduates." Professors in the audience over 55 may relax in that possibly they might retire before their department evaporates if this statement is true. However, I cannot help but believe that chemical engineering has something unique to offer. Of course, I am assuming that the reason there will be no difference between the engineering and the science graduate, in the thinking of the writer of the above statement, will result from engineering becoming science rather than from science becoming engineering.

While not detracting from the necessity for science we should point out that chemical engineering arose from a need to apply the scientific discoveries to mankind's use. It is this application which has made our country great.

As one who has spent over a quarter of a century in education, I have seen movements, "fads," come and go. The disciples seize the new theory and spread the word--many times without fully understanding the concept--far beyond the original great idea.

Some of you experienced the growth of progressive education in the elementary and secondary education levels during the early thirties. Later some of these theories spread to general education at the college level. The testing movement came in and reached the stage where you could hear one superintendent of schools say to another, "Congratulations, John, I hear that you have installed a testing program!" The purpose of the testing program did not seem important. Methods versus subject matter in teaching has long been a source for speeches and articles.

These movements or fads are introduced merely to show that many times in education, as in other fields, the true purpose or value of a new concept depends on the degree to which a given objective is achieved. At the same time we must remember that there are other valid objectives which may or may not be affected by the new concept.

While I have no quarrel with some programs being developed to meet a specific need for engineering science, I am concerned over the appearance of the move becoming a "fad"--getting on the band wagon--throwing everything out of the window that has been found good, and solid, and productive.

We live in a new world. Engineering design taught today may be outmoded tomorrow. Therefore, the specific thought in engineering may give way to newer concepts, but the specifics are not the objective of education. We are interested in the development of the engineer. If learning the specifics which later became out of date has developed his knowledge of principles and applications of science to engineering, then they have achieved their purpose.

In some of the arguments which I have read on basic science versus engineering, the author seemed to believe that basic science will remain unchanged. This is a fallacy, as we all know, because just as engineering applications will change with advancement in knowledge so has our knowledge changed. I learned a basic fact in chemistry, "The atom is the smallest indivisible body of matter." Nothing could be more basic than that.

One of Dow's summer employees, within a year of completing his dissertation, performed a certain function all summer. In one of his courses the next fall he learned that what he had been doing all summer could not be done. In fact, he missed the question on the final examination because he answered according to what he had been doing and not according to the text and the professor. (On his oral he answered according to the professor!)

I am concerned with the number of requests for money to help develop Ph.D. programs in chemical engineering. Money, if granted, would have to come from perhaps some of you. What will be the effect on your program? Departments represented here will provide the staff. What happens to the department? Present graduate departments have staff, equipment, and research geared to a certain size of operation. The statistics recently crossing my desk show that the number of chemical engineers is decreasing. Do we need more graduate schools, or do we need more beginning students in chemical engineering?

I am concerned over the B.S. and M.S. Programs being geared to the Ph.D. engineering science. Certainly all of these students are not going on for a Ph.D. engineering science degree. I do not favor "dropping off" places in a sieve to separate the true engineering scientists from those without ability, or inclination. What happens to the student in an educational program of this nature? He is not prepared for the work which he could enjoy doing.

Perhaps one way to look at this would be to examine what chemical engineers are doing at the Dow Chemical Company.

<u>All Chemical Engineering</u>	<u>Per Cent</u>	<u>No./1,000</u>
Research	30	300
Production	30	300
Technical Service and Development	10	100
Sales	10	100
Design & Process Engineering	10	100
Non-engineering Management	2	20
Miscellaneous	8	80

Although the number actually exceeds a thousand, it is close enough to give us an understanding of the numbers of individuals involved rather than the per cent. From these figures, it is evident that basic chemical knowledge is desired, but engineering is essential.

Of course, if we take the Ph.D.'s alone, the statistics change markedly.

<u>All Chemical Engineering</u>	<u>Per Cent</u>
Research	76
Production	3
Sales	1
Technical Service and Development	3
Design	5
Non-engineering Management	3
Miscellaneous	9

What do we want? A good grasp for fundamentals, an adequate engineering background to fit into our organization, the ability to think systematically, dedication to the profession so that there is a desire to keep abreast of developments persistence, perseverance, and sustained drive to accomplish solution of technical problems of considerable complexity.

One of the strengths of the chemical engineer has been a balance of business judgment, knowledge of scientific principles, and technical problem-solving ability which has made him valuable to industrial management. Certainly, in fundamental research there is a need for the individual well versed in theory in depth. But, should the purpose of chemical engineering education be to make all schools of this type? Should not certain schools concentrate in certain areas of specific competence? Should a school with outstanding reputation in a certain area (e.g. chemical process engineering) abandon that area to start turning out carbon copies of the latest image of an engineering scientist? Is there sound engineering education thinking behind the move--if made--or is it immediate prestige seeking?

Don't misunderstand me. From the Company's point of view, if you have a super-superior chemical engineering scientist finishing his Ph.D. this summer--industry oriented--then sell him on my Company and send him c.o.d. to us! We can use him, but we still shall have need for many Production, Technical Service and Development, and Sales oriented engineers to make the profit after taxes to pay his salary.

Remarks By Harold S. Mickley

Despite the pessimistic views held by some, we are not here to attend a wake or to discuss the best way to bury engineering. Rather, we are here to explore ways to capitalize on our past accomplishments in order to ensure greater ones in the future. My optimistic attitude is borne out by hard economic facts.

The June 10, 1963 edition of "Chemical and Engineering News" reports starting salaries for college graduates. Technically trained people continue in high demand and of these, Chemical Engineers are among the best paid. The median starting salaries for Chemical Engineers are greater than those for chemists:

<u>Degree</u>	<u>Median Starting Salary</u>	
	<u>Chemist</u>	<u>Chemical Engineer</u>
B.S.	500	560
M.S.	578	645
Ph.D.	825	875