## Who Should Teach Engineering?

Anyone interested in the undergraduate education of engineers cannot but be disturbed by the conflicts that complicate the nation's technical-manpower problems. In the face of the competition among engineering schools for faculty and the heavy demand for research talent by government agencies and private enterprise, educators are pressing for more Ph.D.'s to teach undergraduate courses in engineering. Some researcher ought to add up the number of engineering teaching jobs to be filled and compare it with the number of Ph.D.'s who are making a career of teaching engineering. There is nothing like pressing for the impossible.

Only about 25 percent of the Ph.D.'s in engineering take the examinations to qualify for the P.E. (professional engineer). There is little incentive for them to do so. Their future is in research, in graduate teaching, or in specialized administrative positions. Thus about 75 percent of the Ph.D.'s in engineering cannot engage in private engineering practice or approve engineering work for employers or clients. In other words, professionally and by law they are not considered to be responsible engineers. A Ph.D. in engineering considers himself to be more a scientist than an engineer. This raises the question, Who are better qualified to teach undergraduate engineering—scientists or engineers?

There is little or nothing in the acquisition of a Ph.D. that trains an engineer or a scientist to be a good teacher. The medical profession gives little or no weight to the Ph.D.; there are so few M.D.'s with Ph.D.'s that the AMA does not deem it worth while to keep a record. Medical teaching is done by those who have qualified or who have built a reputation by accomplishment in practice. This is the academic philosophy engineers feel should be applied to their profession.

The inducement to study engineering is to practice engineering, not to become a scientist. Enrollment in engineering has been practically static since 1956; we read in the papers that "The attrition rate of engineering students in American colleges is approximately 54 percent. In some state universities only 20 out of 100 engineering students get their degrees." A primary cause of dropouts, in my opinion, is the heavy dose of science courses—courses that are not well taught. (A Ph.D. teaching subjects at this level is bored to death.)

Perhaps we need to be reminded of the circumstances that led to the founding in 1932 of the Engineers' Council for Professional Development. It was instigated by young engineers who had taken their undergraduate training during the early 1920's, when the engineering curriculum was in its first cycle of intensive concentration on technical and science courses with a minimum of courses in the humanities. Graduates of this kind of curriculum found themselves on a dead-end street. They were not being given serious consideration for the kind of management and executive jobs they had believed themselves to be qualifying for by studying engineering. Now engineering education is again in a cycle of technical saturation. Yet the products of scientific research need to be developed, designed, and produced by a profession that is socially and politically well oriented. It is estimated that there are only 64 employers that can profitably use the science-oriented engineers that engineering schools are being pressed to produce. Many employers of engineering talent are becoming concerned about the present trend.

The engineering profession, if it is to solve such problems as this, needs a coordinated and unified leadership. This is not being supplied by the engineering societies, of which there are over 120. There is little direction or guidance in the professional publications. Perhaps the current investigation of the nation's research and development programs by Congress will help to produce it.

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## Population Problems and Infectious Diseases

H. Frederiksen, in your issue of 17 January, comments on the National Academy of Science report "The Growth of World Population" (*1*), with particular reference to Ceylon. I recently analyzed and reported data (*2*) which I collected in Ceylon in 1956–58, reaching the following conclusions:

(i) The rate of increase of population in Ceylon jumped markedly immediately after World War II. (ii) This increase can be explained by the decreases in deaths from the principal infectious diseases. (iii) These reductions in death rates were caused by the application of new methods of prevention and treatment of infectious diseases of all kinds, not only malaria. (iv) The incidence of malaria in Ceylon, as well as its effect upon the population size, has been grossly exaggerated. Probably half the illness ascribed to malaria in the days before DDT was in fact nonplasmodial. This illness still exists today after the malaria has practically vanished, only now it is called influenza. Studies in 1957 showed that much of this "influenza" was caused by arbor viruses, particularly dengue.

During 2 years in East Pakistan (1958–60), I concluded that if the health and environmental projects planned for that province were put into effect, especially that for the provision of a tube well for each village, the rate of population increase for that province would parallel that of Ceylon and would rise in 10 or so years from 1.8 percent per annum to 2.8 percent (*3*). In fact, if an extra 4 or 5 rupees per annum per head were made available in most countries in southeast Asia, and the money were spent on preventive medicine instead of hospitals, the rate of increase of population in the whole of this area could be raised rapidly to close to 3 percent per annum.

Population increases of this magnitude pose many problems. Since the rate of increase of productivity of this part of the world is unlikely for some time to exceed 2 percent, there is every prospect that the welfare of the people will go backward instead of forward. Birth control is not the answer at present; for the next decade or two its effect will be scarcely comparable to the opposing effects of preventive medicine. Some major scientific breakthrough in this field will be necessary before a deliberate major reduction of the birth rate will be practicable. Nor can the benefits of public health and medical care be denied to the people of any country for, as the example of Ceylon shows, when the people realize that scientific treatments can alleviate their sufferings, they demand them and the government has to supply them. No leader would dare tell his people that every year tens of thousands of them must die of leprosy, tuberculosis, and so on, just because productivity cannot increase fast enough.