Ph.D.'s as Engineering Teachers

As a Ph.D. candidate and a future engineering teacher, I feel a responsibility to answer Marion Richardson's letter ("Who should teach engineering?," 28 Feb., p. 916). [Richardson argued against increasing the proportion of "science-oriented" Ph.D.'s on undergraduate engineering faculties.]

Engineering problems are becoming more complex and the need for the answers to these problems is becoming more urgent. The traditional engineering design courses can no longer be relied upon to prepare a student for an engineering career. On the contrary, such training, emphasizing specific methods alone, may often hinder him. For instance, if he decides to work for a design firm, he would probably have to adopt its methods and "unlearn" certain highly specialized design techniques taught in engineering school. In addition, if he wishes to change his specialty within his field of engineering, he finds he has taken many hours of courses not particularly adaptable to change. A student who has had training in more of the fundamentals and physical principles underlying design has much greater flexibility, both as an engineer in industry and as a researcher. He is able to go from problem to problem with a greater understanding of the ideas involved, rather than knowing only the formulas to use.

Richardson says that teaching undergraduates is boring for a Ph.D. This is not necessarily true. While teaching graduates, one can of course follow those lines that are most closely related to one's own research. But teaching undergraduates still involves a knowledge and use of the work of Newton, Hooke, and their like, and more worthy company cannot be hoped for. Furthermore, in a system of engineering education oriented to the basic sciences, the teacher of undergraduates is called upon to show the derivation of his specialty from these sciences. This requirement creates an excitement and leads to a discipline which result in more effective teaching.

The analogy Richardson makes between medical education and engineering education is one which I find supports my position on these questions rather than his. Medical students, like engineering students, must acquire a strong background in certain basic sciences before their education turns toward practical and clinical courses. These sciences (physiology, anatomy, biochemistry, and so on) are not usually taught by practitioners but rather by specialists in those particular fields. The parallel to science-oriented engineering education is obvious.

The Ph.D. engineer is now essential to the profession. He is responsible for the latest research developments and the most sophisticated knowledge in his field. This is what makes him valuable as a teacher.

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Richardson's letter will, I am sure, receive the approbation of a great number of engineers and teachers. The measure of quality of a school has become ridiculous in that it entails a count of the percentage of Ph.D.'s on the teaching staff; this very measure may be in almost inverse relation to the quality of teaching.

However, the engineering profession must take a large share of the blame for the situation, for in nearly every case, when the engineering societies and institutes are called upon to furnish delegates to the various accrediting bodies, they choose not the successful practicing-engineer members but rather those members who are educators. Consequently the system is simply perpetuating itself. A worthwhile advance will have been made when engineering schools are examined by engineers (as medical schools are examined by physicians) rather than being scrutinized by members of the teaching profession itself.

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Space Flights and Biology

G. G. Simpson's article "The nonprevalence of humanoids" (21 Feb., p. 769) purports to deal with exobiology, a word which I dislike as much as Simpson does, but the picture that he presents is of a subject which I do not even recognize. In raising a few pertinent points I shall brave the built-in defense that in doing so I may be motivated by "many emotional factors and . . . selfish interests" and ignore the gratuitous insult of "ex-biologists now exobiologists."

I cannot think of any exobiologist who would seriously quarrel with the four points that Simpson lists in his conclusion, and I am sure that the final plea to the effect that we should not forget terrestrial science will be generally supported. To put it bluntly, Simpson paints exobiology as a search for humanoid intelligences in the universe. There is literally nobody who is indeed looking for intelligent life in the solar system, nor is it true that exobiology is draining all the funds from other possibly more worth-while research. Any examination of the NASA budget will show that the vast bulk of it is consumed by the manned-space-flight program, while anything that may be labeled exobiology operates on a shoestring. If Simpson wishes to object to the space program he will have to find another scapegoat than exobiology. Rather than review the many erroneous statements which are more competently dealt with by other people, I would like to point out the reason for the urgency of organizing a functioning biology program within the framework of space exploration.

The United States and the Soviet Union are engaged in a program of space exploration regardless of whether we biologists like it or not. If we ever wish to derive any biologically significant information from landings on other planets, then we must plan for it now while it is still possible to include the necessary biological safeguards. The urgency in following a program of space biology is not an intrinsic one, it is imposed on us by external events. The necessity for observing, at least in initial landings, safeguards such as sterility has been widely discussed and needs no further clarification by me. I believe that a landing on a planet such as Mars will yield invaluable data to biology. In the event that living organisms should be found, they will afford us an opportunity to check those physiological principles which we now believe to be generalizations to see whether they apply to all life. In the event that no life is found, we will have at our disposal a planet the surface chemistry of which has not been extensively altered, as has that of Earth, by living organisms. We should in this event be able to learn something about conditions that may have prevailed in an environment in which life may develop. We may learn something about the organic chemistry of a nonbiological world, to discover whether indeed, as we suspect, organic compounds accumulate and what the nature of such compounds is. My main issue with Simpson is that I believe such