Letters

Seeks Records for TV Series

We are producing a series of half-hour films for television concerning the years of Truman's presidency. One of these deals with the decision to drop the atomic bomb on Hiroshima and Nagasaki. We would appreciate help in finding pictorial (particularly films) or written material showing opposition by scientists during the Truman era to the use of atomic energy for war, as well as material on atomic research from 1940 to 1952.

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Graduate Education—Depth and Breadth

It seems to me difficult to put into practice the principles of training suggested in your editorial "Trends in scientific research" (17 Jan., p. 201), particularly in my field, physiology. Students in physiology may be primarily interested in biophysics, in behavior, in metabolic regulation, in control systems, or in "classical" areas of mammalian or cellular physiology. Because physiology embraces all these areas, it may well be the first of the life sciences to face the possibility of losing its identify as a separate discipline. This is made more probable by the fact that graduate students and faculty members specializing in one or (rarely) more of these subspecialties can frequently find a sponsoring department other than physiology which is centered around the chosen subspecialty. While this could be a stimulus towards amalgamation of traditionally separate departments, it has unfortunately turned out to be primarily a contribution towards the creation of new departments or units. For example, most neurophysiologists know little if any chemistry and are proud of the lack, and many biochemists are similarly happy with their lack of information about neurophysiology. Neurochemistry has been created to attempt to fill the gap, and eventually it may do so. If, however, physiologists continue to desert the department of physiology as new subspecialties such as neurochemistry or particular branches of biophysics are generated, then perhaps only those mammalian physiologists who are directly affiliated with medical specialties will remain in the original department. The department in turn will become more homogeneous and more strongly wedded to the needs of the medical school. The net consequence may well be a narrowing rather than a broadening in the training of prospective physiologists.

While it is true, as you imply, that workers in biological sciences frequently use the same tools and speak some of the same words, it is erroneous to deduce that communication among disciplines has necessarily improved. Narrowness of viewpoint is certainly not discouraged by the rigidly separate departments, but more importantly, in my judgment, this narrowness is self-replicating because of the overpowering specialized knowledge of a particular field required before the beginning researchist can decide where the unknown begins.

How does one advise a graduate student who has taken the broad survey courses in his field and in related areas, who is already committed to one of its subspecialties, and who tends to resist efforts calculated to give detailed exposure to one or more other fields? He may point to the happy narrowness of many of the successful practitioners in his chosen discipline and from this precedent argue that productivity is more a function of depth than of breadth.

He will probably agree that he must have the fundamentals of physics and chemistry together with the necessary mathematics, but he may argue over the interpretation of the words "fundamental" and "necessary." In view of the dire warnings that the time of greatest creativeness is likely to be during the student's 20's and early 30's, dare his adviser insist upon a systematic exposure to "two or more disciplines" before admitting him into the laboratory as a semi-independent or independent researchist?

It seems likely that if a student has had a good undergraduate background in the sciences and applies himself well to the learning of one broad discipline as a graduate student, he should be equipped to evolve with his field. If he has learned to think imaginatively and to read critically, then there is little danger of his becoming obsolete even if his original subspecialty becomes obsolescent. It seems to me that the major problem is to devise a program that will train the student to think imaginatively and read critically.

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Erasmus and Charles Darwin

The review by Ritterbush of *Erasmus Darwin* (6 Mar., p. 1024) prompts me to make the following comments. I should like to draw attention to what Charles Darwin himself said of the possible influence of Lamarck's and of Erasmus Darwin's works on himself. In his autobiography he writes that Lamarck's views on evolution produced no effect on his ideas. He goes on:

> I had previously read the *Zoönomia* of my grandfather, in which similar views are maintained, but without producing any effect on me. Nevertheless it is probable that the hearing rather early in life such views maintained and praised may have favoured my upholding them under a different form in my *Origin of Species.* At this time I admired greatly the *Zoönomia*; but on reading it a second time after an interval of ten or fifteen years, I was much disappointed, the proportion of speculation being so large to the facts given [*The Autobiography of Charles Darwin, 1809-1882*, Nora Barlow, Ed. (Collins, Toronto, 1958), p. 49].

The strength of Charles Darwin's argument in the *Origin of Species,* as in all his work, is in his power of generalization based on observations. Erasmus Darwin was given to speculation "on every subject," which impelled Coleridge to coin the word "darwinising" to describe wild theorizing.

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