

poses only, these teachers avoid a deadening teaching technique that is now discouraging students from taking science courses. I fear that a 2-year sequence of science courses such as Sears recommends would only give further opportunity for each department to pass on to the students in an endless flow the empirical findings that most professors mistake for an understanding of the science they are teaching. What is needed is a situation in which the teacher does not have emotional investment in a body of data and is therefore (one would hope) free to get on with the teaching of science as a method of investigation.

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Sears's editorial focuses on an important problem that has received only peripheral attention. One important reason for its neglect is that instruction in science for liberal education is at best a part-time activity for the academic scientist. True, there are dozens of textbooks in both the physical and biological sciences for the student not majoring in science; pioneering educational programs have been described and evaluated by Cohen, Schwab, and others; conferences on science in general education are held occasionally; and someone with the standing of Sears speaks out once in a while. But promotions and other emoluments are generally lost to the scientist who devotes himself to this area of education; professional society meetings do not consider the topic; the departmental organization of universities ignore it. Perhaps if Sears and others of his prominence were to found and develop a Society for Science in General Education a forum to investigate his and other suggestions would be more readily available; and the neophyte in the field would have a pillar for support.

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Human Experimentation

The News and Comment item on "Human experimentation" (7 Feb., p. 551) has not provoked a discussion in *Science* as yet. As far as scientists are concerned it involves only a minority group: physicians. Yet obviously the issues raised are of broad interest. I would like to comment on the question

of the obligation of physicians to submit themselves to the same procedures that they carry out on their experimental subjects (1).

There is a profound difference between physicians and other scientists which, in the zeal for scientific conquest, is apparently easily overlooked. In medicine, the experimenter and the subject—whether patient or healthy person—are on an identical level of being; they are *fellow* beings in the strict sense of the term. The engineer and his experimental subject, the machine, and the biologist and his, the animal, are not. Medical history is full of accounts of investigating physicians who demonstrated their awareness of this difference by sharing in the experimental situation of their design. In recent American medical history, for instance, Ivy, Sabin, and Salk have done so. Ivy flew frequently to an altitude of 40,000 feet to study the symptoms of bends and to 18,000 feet without supplemental oxygen to study the effect of lack of oxygen (2). Sabin was the first to swallow his oral vaccine (3). Salk injected himself, his wife, and his three sons with his vaccine (4).

Certainly, from the scientific point of view such self-experiments may be irrelevant and serve no "useful" purpose. But if the physician—or, in case he is for scientific reasons unsuitable, a member of his family—does not serve as subject in experiments done for the general welfare, that is, not done for the immediate benefit of a patient, then he creates a hierarchy, a difference between the value of his existence and that of his fellow beings, which is not inherent in his position; conscientious as he may be, he is then plaintiff and judge in one person. The general-soldier relationship—cited by an experimenter quoted in the article—is quite different. Here, the hierarchical structure and the general's freedom of choice "to march behind or in front of his troops" are established by military law. Both parties know the situation precisely even before they come in contact with each other. To see these cases as similar is to disregard the foundation of the physician-patient relationship as visualized in Western culture and as expressed annually in the administration of the Hippocratic oath or similar ceremonies at medical schools' commencement exercises.

The "false heroism" and the "stupidity" of physicians who subject them-

selves to their experiments are manifestations of a more profound insight into the nature of the experimenter-subject relation in medical research and of the place of scientific endeavor in our culture than is the rationalism that the New York investigators invoke. Those who rationalize their lack of participation by pointing to the benefit to humanity resulting from their experiments may be reminded of the story of Charlie Brown in "Peanuts." When he turns a garden hose against men who are planting trees, Charlie is scolded by Lucy—"What these people do is good for humanity." Whereupon Charlie replies, "I love humanity, but I hate people." Charlie may have this privilege; yet significant as his answer is, it is equally significant that he has never—as far as I know—made application to enter medical school.

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References and Note

1. The problems of volunteering and consent, also discussed in the news items, have been treated recently in an excellent monograph, *Clinical Investigation in Medicine: Legal, Ethical and Moral Aspects*, I. Ladimer and R. W. Newman, Eds. (Boston Univ. Law Medicine Research Institute, 1963).
2. *Trials of War Criminals before the Nuernberg Military Tribunals under Control Council Law No. 10*, vol. 2 (Government Printing Office, Washington, D.C., 1949), p. 112.
3. *Ann. N.Y. Acad. Sci.* **61**, 1055 (1955).
4. *Britannica Book of the Year 1956*, p. 610.

Alphabetical Oblivion

It's all very well for a man whose name begins with B to suggest ever so softly (Letters, 17 July, p. 232) that alphabetical listing of authors' names can do away with tender feelings over who is principally responsible for the integrity of the data. It would have been more seemly to have the suggestion from a man whose name begins with W—but, oddly enough, it didn't occur to him.

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... may we not expect a rash of name changes among knowledgeable young scientists? Thus, a Zygmund Zygomus might profitably become an Aaron Aardvaark.

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