9-day embryo appeared to be perfectly formed. All except one of the advanced embryos were produced by daughters of a male with a history of retarded sexual maturity. Cytological studies indicate that the parthenogenetic embryos carried the diploid chromosome number (Yao, unpublished). In each of four instances where sex was determined, the embryo was found to be a male. These and other observations made during 1954 will be described in greater detail elsewhere.

References

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Communications

Education or Training?

The publication of William Seifriz's article on "A new university" [*Science* **120**, 87 (16 July 1954)] has impelled me to present this communication, the thesis of which is at least tangential to his. During the spring of 1954, I attempted in a very limited and informal manner to learn something of the cultural backgrounds of 15 candidates for the doctorate in botany, horticulture, agronomy, and zoology at the University of Illinois. My procedure was simple: at that point in the oral examination of each candidate at which the chairman of the examining committee places his palms on the table's edge, looks hopefully at the other members of the committee, and says, "Well, gentlemen, are there further questions?" I asked each candidate to identify as specifically as he could the following items; beneath each item are listed the numbers of satisfactory (S) and unsatisfactory (U) responses:

The Renaissance: S, 6; U, 9.
The Reformation: S, 5; U, 10.
The Monroe Doctrine: S, 2; U, 13.
Voltaire: S, 5; U, 10.
The Koran: S, 10; U, 5.
Plato: S, 7; U, 8.
The Medici Family: S, 1; U, 14.
Treaty of Versailles: S, 11; U, 4.
Bismarck: S, 4; U, 11.
Magna Carta: S, 2; U, 13.

I have made several interesting observations on these results: (i) Of the two students who gave an acceptably specific identification of the Monroe Doctrine, one was a Canadian. (ii) Only one student gave an acceptable identification of the Medici family; of the remaining 14 students, 10 had not even heard of the Medicis. (iii) Of the three students who turned in the best performances, one with 9 acceptable answers, two with 7 each, two were graduates of small liberal arts colleges. (iv) One student, a graduate of one of our largest state universities (*not* the University of Illinois!), failed to give a single acceptable answer. (v) The best score (9 acceptable answers) was that of a Canadian student (the other 14 were native-born citizens of the United States). (vi) Only two students were able to identify specifically Magna Carta, one of the great documents in the evolution of human political freedom; of the remaining 13, seven had not heard of Magna Carta. (vii) In a country in which the dominant religion is Christianity, twice as many students were able to identify the Koran as were able to give a satisfactory identification of the Reformation.

It is tempting to speculate upon the bases of these conclusions and upon their significance, but, since the sample was a small one (inevitably so, for the news of questions asked of doctoral candidates travels rapidly through the graduate student grapevine), one is justified in drawing but a single conclusion: perhaps we are overtraining both our graduate and undergraduate students to the detriment of their education.

One of my colleagues in history, interested in my little project, has, with my aid, drawn up a list of 10 notable theories, discoveries, and persons in the history of science and will try this list on doctoral candidates in the humanities to determine whether or not they are as poorly educated in science as my victims appear to have been in the humanities.

HARRY J. FULLER

Department of Botany,
University of Illinois, Urbana

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Scarcity of Instrument Makers

During the past few years, much has been written about the scarcity of scientific personnel—a condition that may still exist but is becoming less acute.

Less attention, however, has been paid to another scarcity that is of longer duration and is, perhaps, more serious. I refer to the scarcity of instrument makers, the men who design and build the tools used by scientists, the "fine instruments" of long ago.

For years, we have been under the necessity of importing our scientific apparatus from Europe where the apprentice system has been—and still is—in general use. The apprentice served 4 years or more in the shop to learn the methods commonly used and then worked as journeyman or improver, learning more about his chosen profession in every shop.

In the United States the apprentice system is no more. Instrument manufacturers now employ toolmakers, lathe and milling machine hands, and so forth, who, while they may be excellent mechanics, know little about the simplest instrument, not even its use. The result is that no men are being trained in the