Letters

Foreign Research and Dollar Drain

In the 14 January issue Daniel S. Greenberg objected to an examination of U.S. official expenditures for foreign research in terms of their contributions to our payments deficit. Greenberg correctly pointed out that of the $70 million per year which has been spent abroad for research, some $30 million is the portion at issue. He argued that this $30 million sum, though large, should be judged "in terms of scientific results and foreign goodwill" instead of "dollar-drain considerations."

I wish I could agree. But unfortunately, our ability to obtain foreign goodwill has had to be curtailed for balance of payments reasons in other important government programs. For example, the tying of foreign aid to purchases in the United States cuts down the actual assistance we give to developing countries by depriving them of their previous freedom to use aid money in purchasing from the cheapest world resources. Again, through tightened restrictions on duty-free purchases by Americans traveling abroad, we are netting some $50 million per year in balance of payments terms, but at the cost of damage to the economies of many developing countries.

Both actions unfortunately diminish the effectiveness of our foreign policy, and neither has earned us goodwill. Yet they are necessary. Surely it is no less necessary to limit foreign research outlays to those which are most urgent and which cannot be performed in this country. As Greenberg points out, this view is shared by the Administration.

My question is: Are present guidelines limiting research outlays abroad adequate in view of our continued inability to balance our international accounts? Does our support of projects in countries like France serve to diminish the incentive for France to support her own research?

If, as a result, these countries, some of which have been concerned about a "brain drain," succeed in establishing stronger centers of excellent science in Europe and elsewhere, the whole world would benefit. The United States might even earn their gratitude—in the process of following President Johnson's directive to eliminate, in 1966, our balance of payments deficit.

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Mathematics Curriculum: New Study

The School Mathematics Study Group (SMSG) is a national organization devoted to the improvement of mathematics programs in the schools. It has received substantial financial support from the National Science Foundation. Since its beginning in 1958, SMSG has prepared 20 textbooks covering the sequence from grade 1 to grade 12. Already over 5 million child-years have been devoted to study from these textbooks.

The SMSG Advisory Board believes that these textbooks have served, and will continue to serve for some time, as a useful example of a relatively up-to-date curriculum, but that longer-range planning and experimentation should be started before present materials become frozen into a newly orthodox pattern that will require another upheaval a few years hence. The board has, therefore, decided to convene a group to design a new sequential curriculum for grades 7 to 12 and to plan appropriate experimental materials. Major emphasis is to be given to the design of courses which exploit recent progress and to a sequential curriculum which will be responsive to the rapidly developing needs for mathematics in our society. Plans are being made for panels to meet this spring and summer to begin to carry out this decision. We would like their deliberations to take account of the concerns and the suggestions of anyone who is interested in what mathematics is taught in our schools. Some of the questions which the panels will consider are:

1) Are there trends evident in the way mathematics is being used today in our society that should be taken account of in this long-range planning?

2) Are there things now emphasized in school mathematics that are of little value in the further study of mathematics or in the applications of mathematics?

3) Do the general directions of scientific and mathematical research indicate new topics that should be taken account of in school mathematics?

4) Most curriculum development in school mathematics during the last decade paid little more attention to the applications of mathematics than had been done in the past. What are some specific ways of improving this situation?

5) What mathematics should we provide in school for those that are below average in academic ability? Should we think in terms of a hard core of basic skills necessary to get by in the world, or of some more general set of mathematical concepts, skills, and attitudes that should be a part of the general education of all future citizens?

6) Some acquaintance with mathematics is becoming useful, if not essential, to an ever-increasing number of people. Does this indicate a change in the amount of mathematics that should be recommended for all students?

7) It is widely urged that school mathematics take account of the "computer revolution." Should this be done, and if so, in what specific ways?

Comments on these and related issues are earnestly solicited. Communications should be addressed to me.

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Evolution in Arizona

Recent letters concerning the anti-evolution statute in Tennessee (22 Oct., p. 435; 3 Dec., p. 1244) serve as a reminder of the obstacles still lying in the way of free inquiry in certain fields. I think readers should know also of a recent attempt to make it illegal to teach the "doctrine of evolution" in Arizona schools. L. K. Lisonbee has given an excellent summary of events ["Thwarting the anti-evolu-

tion movement in Arizona," *Science Teacher* **32**, 35 (1965)], as well as a more general analysis written in his capacity as president of the Arizona Academy of Science ["Galileo, Darwin, and Mr. Moore," *Ariz. Acad. Sci.* **3**, 199 (1965)].

Opposition to evolutionary material in the Blue Version of the Biological Sciences Curriculum Study textbook began to be expressed by certain Arizona religious groups in 1960. Attempts begun in 1962 to have certain biology books removed from school library shelves culminated in 1963 in a campaign, led by a Rev. Mr. Moore, to pass as an initiative measure "An act defining atheism as a sectarian doctrine and prohibiting the teaching thereof in the common schools in Arizona." The proposed act defined atheism as the "teaching of any theory that denies the existence of God and the Divine creation of man in God's image" and the teaching "that man evolved from a lower order of animals." Opposed by the Arizona Academy of Science and a few outspoken persons in the state (including some clergymen), the anti-evolution movement failed to obtain the requisite 55,000 valid signatures on initiative petitions, and the campaign collapsed.

Lisonbee's accounts should be known to students of the history of the anti-evolution movement in America. My own reaction to the episode was not so much encouragement at the ultimate defeat of the anti-evolution efforts as discouragement at the absence of any really vigorous opposition from local press and lay leaders to this attempt to censor scientific education in Arizona.

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Radiation Exposure: Personnel Records

Blatz's timely letter (20 Oct., p. 553) concerning the futility of accumulating and tabulating records of individual radiation exposure, however slight, leads me to comment on another useless exercise, the practice of monitoring radiation in industrial situations by means of blood tests of the personnel. Surely what is being attempted thereby is an assessment of the validity of the permissible dose and of methods of control of the radiation environment, with the personnel being used as guinea pigs. Interpretation of results in the range of permissible exposures for industrial situations is a problem for medical research. It is not a matter for inquiry at the applied level. Reliable clinical evidence of disturbance of the blood should indicate a gross and long-standing failure of control and monitoring, which would not occur in properly managed industrial situations. Blood testing should be reserved for those few situations where the radiation environment cannot be anticipated or controlled and the expected dose rate is high enough to produce clinically reliable effects. . . .

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New Sciences: French Indifference

An interesting parallel may be drawn to Victor McElheny's report from Paris concerning the difficulties of the three French 1965 Nobel laureates in gaining recognition and support from their government and educational institutions (19 Nov. 1965, p. 1013). Over 60 years ago, Pierre Curie encountered similar indifference from this "Establishment" consisting of the Ministry of Education and prestige universities. Because he had not attended one of the Paris schools as an undergraduate, Curie lacked the support of the most distinguished or influential professors, who advanced the candidacies of their own students whenever a chair of physics became vacant. Because Curie was shy and modest, and found distasteful the tradition of personal calls upon the members of the Académie des Sciences by the nominees, he failed election to this body.

France, however, finally was forced to recognize merit rather than social poise or connections. Though his early work on piezoelectricity, crystallography, and magnetic properties at different temperatures showed his quality and gave him eponymic fame, it was his research on radioactivity that brought Curie the 1903 Nobel Prize in physics, which he shared with his wife Marie and with Becquerel. Repeated offers from officialdom of decorations consistently were rejected. Pierre wanted a laboratory, not a lapel ribbon. For too long, he and his wife had held poorly paid positions, requiring long hours of teaching, in schools not of the first rank—and all the while pursuing their study of radium in the famous tin shed.

Although Pierre had, in 1900, been appointed to a chair in the University of Paris, it was the inferior one of teaching physics to medical students. Further, no laboratory facilities were provided. At last, in 1904, the Ministry of Education created a professorship for him in the Sorbonne, though a proper laboratory never materialized in his lifetime. Also, by 1905, the Académie des Sciences found it embarrassing not to have his membership—an honor never accorded Marie. But on 19 April 1906, shortly before his 47th birthday, Pierre lost his life beneath the wheels of a wagon. As his daughter wrote, "Death is quicker than public officials to claim great men."

The foregoing is the story presented in such accounts as Marie Curie's biography of her husband (1923) and Eve Curie's biography of her mother (1937). While it is essentially correct, one may point to various honors Pierre did receive, the fact that his *graduate* work was done at the Sorbonne, and question whether his contemporaries had it any easier. The significant comparison with the 1965 Nobel laureates, therefore, is not the personal difficulties in a man's life, for which there may be unique causes, but the apparent circumstance that France has not profited from the past and has remained consistently unsympathetic to new lines of research.

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A Truly Remarkable Fly

Coincidences associated with so rare a phenomenon as ball lightning tend to be interesting but not significant. A case which has recently come to my attention would seem to follow this rule.

On 25 August 1965, I was editing an article entitled "Soviet research on ball lightning" prepared by Arsen Iwanovsky of this division for publication in the September issue of the *Foreign Science Bulletin*. We discussed at some length the unusual behavior of ball lightning and the fact that the very few eyewitness reports available contained conflicting statements.

On the same day my uncle and aunt,