over a few tens of miles equals the cost of generation of electrical power. . . . Here federal support for civilian technology—now greatly lagging behind support of military and space technology—could make an important contribution.

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It should be noted that all "local practices" of power transmission in Woodside and its environs are PG&E practices. PG&E is the largest electric utility in the country and keeps its costs down toward the minimum, even at the sacrifice of esthetic standards. . . . The super-power line desired by SLAC also has a minimum-standard precedent, constructed last year by PG&E. This 220-kv line, on "towers," is 20 miles long, extends back and forth over the otherwise scenic skyline, and requires a swath 100 feet wide through the forest, which includes many redwoods. . . . The line was constructed, despite objections by conservationists, after the State Public Utilities Commission refused to intervene on the ground that, "no matter how awful the line might look," the complainants must first prove that it violates safety or is otherwise against the public interest.

The arguments now being advanced in favor of the overhead line to SLAC are the same as those used to justify the existing lines: economy and urgency. It is unfortunate that Panofsky should be forced to defend these minimum standards for the region, while admitting that they are unacceptable on the Stanford University lands upon which SLAC is located. But in this he does not express the national interest, for if the public interest in all future developments were truly limited to conformance with existing standards, with only slight and inexpensive improvements, we would condemn many people to live forever with urban sprawl, smog, festering slums, or grossly polluted streams.

In the Woodside controversy both sides represent the "public interest," and the conflict is between short-range and long-range public interests—the sort of conflict that can develop entirely within the federal government, within the AEC, even within Panofsky's letter. The present conflict also brings up problems of federal versus county and municipal jurisdictions. Fortunately, Congress in 1959 established the Advisory Committee on Intergovernmental Relations, with continuing responsibility to bring together representatives of federal, state, and local governments to consider common problems. A hearing by this Commission, and consideration of all aspects of the controversy, might lead to resolution of the problem in the true public interest.

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Appeal by Yugoslavian Scientists

The earthquake which destroyed the city of Skopje last July also wiped out some of the most modern laboratories in Yugoslavia. The young University of Skopje, the third largest university in the country, was leveled in just 15 seconds.

It is now being rebuilt, and classes have begun again, but there is a desperate need of equipment for science teaching and research. Together with UNESCO staff scientists, members of the university have drawn up detailed lists of the items required in each department, and they appeal to their colleagues around the world to make contributions by means of UNESCO gift coupons. Contributions in kind, of the apparatus needed, would also be received gratefully.

For lists of what is needed, please write to UNESCO Gift Coupon Office, Place de Fontenoy, Paris 7, France.

THA HLA
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Boveri and Cancerogenesis

Fritz Baltzer's article on Theodor Boveri (15 May, p. 809) does justice to his merits as an outstanding biologist in the field of germinal chromosomal research but makes no mention of his contribution to cancer science. Shortly before his death, Boveri published a book, *Zur Frage der Entstehung maligner Tumoren* (Jena, 1914), in which cancer was explained as due to a somatic cell mutation. Very little was then known about cancerogens, and cancer was considered about 99 percent a "spontaneous" disease. Boveri postulated that on account of a wrong mitosis in a somatic cell, the set of chromosomes in the cell progeny became abnormal. In the next 15 years this theory found only a few adherents (Whitman, 1919; Levy, 1922; E. Schwarz, 1922; G. Schwarz, 1924). In 1929, K. H. Bauer modified it, replacing the mutated (or mutilated) number of chromosomes with an invisible mutation on the molecular level.

The somatic cell mutation is today considered the most plausible common explanation of the radical change in the growth pattern of a somatic cell, whether this change is initiated by ionizing radiation, by ultraviolet rays, by one of many cancerogenic chemicals, or by burns. It does not detract from the value of Boveri's contribution that so far the somatic-cell-mutation theory in this or that form is still without experimental proof. In any case, it has not been disproved.

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Population Control: the Intrauterine Ring

Daniel S. Greenberg is to be commended for his thoughtful and timely reports on the rapidly changing climate in official Washington in relation to population control and foreign aid. His report on the Fourth Triennial Conference of the International Planned Parenthood Federation (News and Comment, 1 May, p. 513) is an excellent example. He is wrong, however, when he writes that "no means now exist for limiting the families of couples who are only mildly motivated toward this goal" and that "cheap, simple, and reliable methods" do not yet exist. Such a method does exist; it has been used by thousands of women for several years, it costs but a few cents, and it does not require continuing strong motivation. I refer to the modern version of the Gräfenberg or intrauterine ring (see *Scientific American*, Jan. 1964, p. 54, and Annual Report, 1963, Planned Parenthood Federation of America). Berelson and Freedman, reporting on a study in Taiwan ("A study in fertility control," *Scientific American*, May 1964, p. 29), have shown that strong motivation is not necessary for the adoption of this "one-time" method.

The United States cannot afford to wait for an effective method which will offend no one. AID should be aggres-

sively promoting available methods now. It should be apparent to even the most obdurate by now that the net effect of our foreign aid in many cases has been to increase the total number of impoverished and discontented people.

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The ring is an extremely promising development, but many of its most enthusiastic supporters caution that considerably more experience must be gained before it is employed on a mass basis. So far, reports on the ring are highly encouraging, but there is justifiable concern over a number of adverse experiences. These include occasional cases of bleeding, undetected loss of the ring, and conception despite proper placement of the ring. It is not known how the ring functions to prevent conception. This lack of understanding can be regarded as insignificant when viewed against the problem that the ring serves to solve, but in dealing with something so delicate as human reproduction, caution is advisable. AID's efforts in behalf of population planning will not be served if it is later discovered that the agency has been promoting a birth-control method that is harmful over the long run. Fortunately, a good deal of research on the ring is now being conducted.

—D. S. GREENBERG

Chemistry at NSF

The following analysis of the data in the chemistry subsection of Appendix C ("Grants for basic research") of the 13th annual report of the National Science Foundation (1963) is offered both for its own interest and in support of a small suggestion at the end of this letter.

Nearly 250 grants to individual chemistry faculty members at about a hundred institutions are listed. Over $9 million, mostly for projects of 1 to 3 years' duration, was dispensed to these recipients, who included at least one Nobel prize winner, two past presidents of the American Chemical Society, a presidential science adviser, and several other rather famous chemists.

The distribution of grant sizes (from a low of $600 to a high of more than $150,000) is shown in Table 1. Except for the largest grants the distribution would be not far from a Gaussian probability curve. While the implications of this are highly interesting, perhaps suggesting that ordinary applicants base their financial requests on not much more than guesswork (if it is assumed that the amounts received are proportional if not equal to those requested), such wild speculations will not be pursued further.

The institutions favored with the largest share of the money are as a group the same 25 listed (in the "Money Behind Our Colleges," Editorial Projects for Education, Baltimore, 1964) as recipients of 59 percent of all federal research funds for all colleges and universities, though there are individual anomalies. Princeton chemists, for example, received no grants in this section, and several schools not even in the top 100 for general federal support received substantial sums. Still, the overall result was much the same as for federal agencies in general.

There is no hint of irresponsible distribution of large sums of money to individuals either. Recipients of the 23 largest grants were all full professors at major universities, and moreover of mature and responsible years. Not one was under 30, only four were under 40, and eight were 50 or more. Smaller grants often went to lesser rank and age; for example, in the $10,000–$19,999 bracket at least four recipients were under 30 and at least 24 were less than full professors. (Data for this group are incomplete because several members of it are not listed in the American Chemical Society Directory of Graduate Research used to establish academic rank and age.)

The grants by the chemistry section of NSF for 1962–63 were undoubtedly carefully and responsibly allocated. I have the impression that they represented the collective opinions of responsible and careful committees that must have passed judgment on a large number of proposals that were in the main also careful and responsible. However, in view of the small size of NSF support of chemistry relative to that available from several much larger government agencies (a career award from the Public Health Service, for example, can be equivalent financially to a Nobel prize every year or two and may last for life), NSF support must be distinctive if its influence is to be appreciable.

Table 1. Grants by the National Science Foundation for basic research in chemistry. Data from NSF Annual Report, 1963.

Size of grant ($)	No. of grants	Total amount ($)
Under 1000	1	600
1000-10,000	27	128,090
10,000-19,999	47	724,750
20,000-29,999	47	1,207,900
30,000-39,999	40	1,417,600
40,000-49,999	33	1,468,500
50,000-59,999	14	774,100
60,000-69,999	9	583,700
70,000-79,999	8	607,600
80,000-89,999	5	420,800
90,000-99,999	6	565,000
Over 100,000	12	1,415,800

Since the directions for submitting research proposals to NSF are not appreciably different from those issued by many other government agencies, it would be surprising if the proposals themselves were much different. By their very nature, research proposals have a tentative and vague character, and evaluation of them must rest heavily on the status and record of the applicant. Thus the large grants must go to the men with large and established positions, unless the awarding agency is hopelessly irresponsible. The only question is whether the confirmation of the obvious is really a main function of all research sponsorship.

On the assumptions that a more distinctive and possibly more objective type of award would be appropriate for NSF and that recognition of fairly contemporary merit rather than of a long record of past accomplishment would tend to promote science more than research administration, I suggest the creation of one advisory committee to search the contemporary scientific literature for the most brilliant and significant papers it can find. NSF might then negotiate a mutually acceptable grant with authors of such work.

The fact that nearly all published research is already sponsored by some agency should not, I think, detract appreciably from the prestige value of such awards from NSF. Whatever the results in the improvement of scientific research, the effect on the journal literature could not fail to be salutary. The publication of good papers has suffered too large a decline in the scientist's scale of values, and any incentive to improvement would be welcome.

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