5. ———. *Science*, **113**, 315 (1951).
6. ———. *J. Am. Chem. Soc.*, **73**, 5681 (1951).

The observations of Nyman, Plantin, and Ostlund on the reaction of dibenzyl-β-chloroethylamine with ethyl bromide are in substantial agreement with the results we reported, except with regard to the relative amounts of chloro and bromo compound in the mixture obtained from the reaction. Our mixture which, on the basis of analyses, we estimated to contain 92% of bromo compound absorbs at 11.12 μ (Nujol mull), as did some of the preparations of Nyman and co-workers. One recrystallization with a recovery of 86% gave a compound which possessed an infrared absorption spectrum identical with that of an authentic specimen of dibenzyl-β-bromoethylamine hydrobromide. Evidently Nyman, Plantin, and Ostlund found that the composition of their mixtures, as determined by absorption at 11.12 μ, varied from one preparation to another. It seems reasonable that the preponderance of chloro compound in one instance and of bromo compound in our mixture may be accounted for by a difference in the ratio of ethyl bromide to amine or in other reaction conditions.

JAMES F. KERWIN
Smith, Kline & French Laboratories
Philadelphia, Pennsylvania

The National Science Foundation and the Scientific Manpower Problem

THE National Science Foundation has now passed into its second year of organized activity. Already its planning and functional accomplishments are evincing trends that are significant of its future course. What is this course in theory and in practice? Does it give promise of achieving its principal goal, which is the broadest possible development of the nation's scientific potential through the critical years ahead?

The foundation's early actions give rise to great hopes for its future—as an agency through which this scientific potential can be directed toward effective ends. Its early grants for basic research have been distributed over the nation on a more equitable population basis than has been the case with any other public or private granting agency. Its first year's fellowship awards show an active and intelligent effort to encourage development in scientifically backward areas of the nation. Certain distributional dangers and pitfalls need sharp re-emphasis, however, if the foundation's efforts are to result in maximal scientific progress in all areas of the nation.

Previous articles (*1, 2*) have dealt with the pitfalls of past distributional techniques, in which current research potential was given much more weight than the longer-term development of the nation's scientific manpower and research possibilities. Funds granted for research will naturally bring greatest immediate results when put to work in institutions best equipped in physical facilities and trained manpower to attack particular scientific problems. Even here there is dependence upon the second and larger aspect of the scientific problem, however, for those institutions best equipped to pursue basic research are already encountering a critical shortage of scientific manpower. All along the line—in industry, educational institutions, and elsewhere—this shortage is becoming steadily more acute.

It is now quite generally agreed that our best efforts must be focused upon the manpower problem and upon its maximal development in all areas of the nation and in all sections of the population. At best, only a small percentage of the total population will be inclined toward a scientific career and especially gifted individuals are as likely to exist in backward areas as in the most progressive. In order that latent talents be discovered early in life, it is necessary that exposure to science be widespread and adequate. Encouragement in the form of fellowships and other grants must be available, but this phase of assistance can come into play only after the gifted individual's interest in science has already been aroused.

The basic attack must thus stem from a broadened exposure (from high schools upward) to *living* science, which can be taught and demonstrated only by those teachers who have had intimate contact with—or participated in—research. Science lives and stimulates interest through research, which thus acquires unique importance to the nation.

Let us, then, analyze the NSF research grants and fellowship awards to June 30, 1952, to see how well it is accomplishing its stated objectives and whether it is falling into past distributional pitfalls. Since the Public Health Service has been the largest granting agency in recent years and has published a comprehensive review (*3*) of research grants by public and private agencies broken down on a geographic basis, we shall use its division of continental USA into seven major areas:

New England: Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, and Connecticut
Middle East: New York, New Jersey, Pennsylvania, Maryland, Delaware, District of Columbia, and West Virginia
Southeast: Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Tennessee, and Kentucky
Southwest: Texas, Oklahoma, Arizona, and New Mexico
Central: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, and Missouri
Northwest: North Dakota, South Dakota, Nebraska, Kansas, Colorado, Wyoming, Montana, Idaho, and Utah
Far West: Washington, Oregon, California, and Nevada

Table 1 shows all NSF research and fellowship grants to June 30, 1952, classified on a regional basis. This breakdown does not include applications from, or grants to, those residing or attending colleges outside the continental United States. Two research grants to the National Academy of Sciences could not be classified by region of use and are not included.

Certain significant facts stand out sharply. The scientifically backward Southeast and Southwest are still faring most poorly under the NSF program, whereas the Northwest shows signs of stimulation (more fellowship applications and greater research

TABLE 1

GEOGRAPHIC DISTRIBUTION OF NSF RESEARCH GRANTS AND FELLOWSHIPS
(Per million population, continental USA only)

	Population (1950)						
	New England	Middle East	South-east	South-west	Central	North-west	Far West
	9,314,453	35,632,349	31,783,727	11,375,319	39,957,577	7,883,055	14,647,510
Fellowship applications	26.41 (246)*	26.58 (947)	11.00 (321)	12.66 (144)	18.87 (754)	22.96 (181)	24.10 (353)
Percentage granted	23.1	23.3	16.8	16.7	21.1	16.0	21.2
Fellowships granted							
By home address	6.55 (61)	6.22 (221)	1.70 (54)	2.11 (24)	3.98 (159)	3.68 (29)	5.12 (75)
By college being attended	12.78 (119)	4.04 (144)	1.10 (35)	0.79 (9)	5.36 (212)	1.40 (11)	5.74 (84)
By college to be attended	15.03 (140)	3.67 (131)	0.79 (25)	0.52 (6)	4.75 (190)	0.76 (6)	6.42 (94)
Research funds granted	$99,800	$193,160	$119,950	$52,800	$306,305	$90,300	$173,200
Dollars/million population	$10,715	$ 5,421	$ 3,774	$ 4,642	$ 7,666	$11,455	$ 11,825

* Actual numbers of applications or fellowships granted are indicated in parentheses.

support). These three areas show the smallest percentages of fellowship applications being granted, and this would be expected because of their less well-developed educational facilities in scientific fields. Of more serious portent is the constant drain of young scientists away from these underdeveloped regions, to institutions in the more favored areas. Even the highly industrialized states of the Middle East suffer losses to the better-supported New England institutions. Students leaving the more backward areas for specialized training commonly do not return to permanent residence in their home states, where fewer openings exist for use of their specialized skills. This drain does nothing toward relieving the scientific backwardness of the region and may even accentuate it. This, however, is contrary to the objectives of the NSF as stated in the news release that accompanied the June 30, 1952, announcements of research grants and fellowship awards:

> While grants were selected primarily on the basis of scientific merit, the Foundation is attempting in its research support program to encourage the development of research activities in smaller institutions throughout the United States. This policy not only will increase the research potential of the nation, but it will result in marked improvement in the teaching of Science at both the graduate and undergraduate levels.

In any competitive system of fellowship awards, those sections of the population with an older cultural background and greater density of institutions of higher learning are likely to fare best. In fact, the distributional percentages achieved by the foundation's screening committees indicate that a positive effort must have been made to favor the culturally backward areas, but even stronger efforts should be made in this direction, if the basic purposes of the foundation are to be achieved. Development in the backward areas should be encouraged by their being allotted more than their proportionate share instead of less, even though awards may not always go to those with highest ranking.

Much more disturbing, however, is the fact that 54% of the New England and Middle Eastern sections' fellowship awards were made to students already attending five of the leading educational institutions—Harvard, Yale, Princeton, Columbia, and Massachusetts Institute of Technology; and 71% of the fellowships are to be spent at these same five institutions. Corresponding pecentages elsewhere in the nation are 43% and 54%, and the high-recipient institutions are the universities of Chicago, Illinois, Wisconsin, and California, and California Institute of Technology. Since support of advanced undergraduate or graduate studies in an institution is tantamount to a direct financial grant, this maldistribution of NSF fellowship awards in reality extends greatest help to those students and institutions already making the best progress.

Although the foundation is prohibited by law from dictating where fellowship time shall be spent, it is not prohibited from—but rather is directed toward—taking every possible step to encourage maximal scientific development *in all areas of the nation.* It thus would seem that one primary foundation function should be the encouragement of scientific study in the country's less favored institutions and regions, so as to provide the broadest possible exposure of talented youth to science, even though at present relatively few of the country's institutions of higher learning offer really good facilities for advanced graduate or postgraduate scientific work.

NSF fellowship applications are submitted to three National Research Council screening panels—the Preliminary Predoctoral, the Final Postdoctoral, and the Final Predoctoral. On the Preliminary Predoctoral Screening Panel the New England and Middle Eastern sectors are represented by 12 members (30%), and the remainder of the country by 29 members. On the combined Final Panels, however, these two northeastern sectors have 13 panel members (52%) to 12 for the remainder of the country. Even more significant is the fact that 8 of the 13 are faculty members

of the area's five most favored institutions. The distributional evils arising from such unbalanced screening panel membership have already received adequate consideration (*1*). Is there any possible justification for such unbalanced representation of the large institutions when an ample supply of scientists is available in the country's smaller colleges and universities?

Everything considered, the National Science Foundation does seem to be getting off to a good start. It has achieved a more equitable distribution of its research and fellowship awards than any other granting agency, public or private, up to now. As it settles into more formalized activity through the years, however, it must guard against domination by well-established cultural influences if it would achieve its basic goal—maximal development of scientific manpower in all areas of the nation.

The time may be at hand for transfer to the foundation of many of the National Institutes of Health grants-in-aid activities, perhaps along the lines recently announced by the director of the Biological Sciences Division, Office of Naval Research (*4*).

CLARENCE A. MILLS

Laboratory for Experimental Medicine
University of Cincinnati

References

1. MILLS, C. A. *Science*, **107**, 127 (1948).
2. *Ibid.*, **108**, 438 (1948).
3. DEIGNAN, S. L., and MILLER, E. *Ibid.*, **115**, 321 (1952).
4. REYNOLDS, O. E. *Am. Inst. Biol. Sciences Bull.*, **2**, 18 (1952).

Binucleate Cell Formation in *Melanoplus differentialis* Spermatocytes

THE spermatocyte cysts of the grasshopper testis contain many nuclei, each without a definite cell membrane. The formation of a binucleate cell has been recorded in the course of a time-lapse cinematographic study of cell division, in which Leitz phase-contrast equipment was used.

Spermatocytes in a dextrose-Belar solution in bicarbonate buffer, pH 7.0, were placed on a roto-compressor slide. One of the cells began to divide from a prophase stage, and the metaphase and anaphase stages passed in normal fashion. When early telophase was reached, there was a narrow tubular bridge between the two newly forming daughter cells. The nucleus in each cell developed a nuclear membrane. During the ensuing 6 hr the contracting cell membrane displaced part of the cytoplasm from one daughter cell to the other. In this phase the nuclei remained undisturbed. Finally, at the tubular bridge, between the two daughter cells, a piece of protoplasmic material resembling mitochondria was extruded from the cytoplasm. After this extrusion the narrow bridge began to expand and the cells came together, forming the binucleate cell.

In 1942 Beams and King (*1*) formulated a theory for such binucleate cell formation while they were studying fixed tissue from regenerating rat liver. This work confirms their theory. There may be other types of binucleate cell formation; this is one kind, however, that has been observed and recorded.

T. N. TAHMISIAN

Division of Biological and Medical Research
Argonne National Laboratory, Chicago

Reference

1. BEAMS, H. W., and KING, R. L. *Anat. Record*, **83**, 281 (1942).

Review of Medical and Veterinary Mycology

SINCE 1944, the Commonwealth Mycological Institute of England has been publishing an annual (now a semiannual) annotated bibliography of the world's literature on medical mycological subjects. The publication, entitled *Review of Medical and Veterinary Mycology,* is very complete in coverage and presents precise summaries of the articles reviewed. We of this laboratory have found the bibliography to be invaluable in keeping informed on developments in this active field of medicine. Undoubtedly, others who are not already acquainted with it will also find this publication to be of value.

It is sold at the nominal charge of 10s. annually. The first number appeared in 1944 (covering the year 1943) under the title *An Annotated Bibliography of Medical Mycology,* and single yearly issues have been published covering the years through 1950. Issues for the years 1943–48 are still available at 6s. each, and the 1949 and 1950 issues at 10s. each. Parts 1 and 2 of the 1951 issue are sold together at 10s.

We are urging those interested to support this publication in order that this service may continue and be utilized by a greater number of workers in medical mycology.

Orders and subscriptions should be placed with The Commonwealth Mycological Institute, Kew, Surrey, England.

LIBERO AJELLO*
LUCILLE K. GEORG
MORRIS A. GORDON

Mycology Unit, U. S. Public Health Service
Communicable Disease Center
Atlanta, Georgia

* The opinions expressed are those of the writers, and do not necessarily constitute endorsement by the U. S. Public Health Service.