layers, a fact which in itself suggests the importance of the polarity of the surface in the retention of the protein. It should be pointed out that our antigen films differ from Rothen's in that his were deposited on an optical gage of barium stearate or octadecylamine.

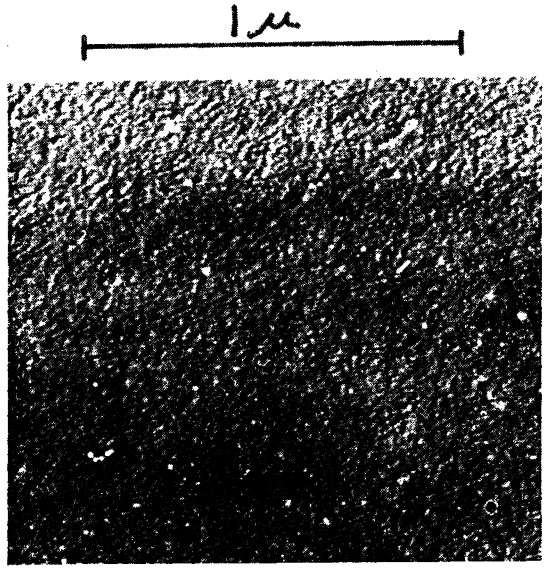

FIG. 1

A direct collodion replica of the protein film was prepared by casting in the usual manner from an amyl acetate solution. The collodion film was stripped and the negative replica obtained was shadowed with chromium at an angle of 1: 5. Fig. 1, representing a magnification of 50,000 ×, shows the appearance of the protein film resulting from the transfer of 6 monolayers of bovine serum albumin. What appear as depressions or pits correspond to ridges or peaks in the original protein film. The heights of these peaks can be calculated from the electron micrograph of the replica by assuming that their slopes are the same on both sides. Such measurements reveal that the projections in this case range generally between 50 and 85 A, with a few greater than 100 A.

In addition, the preshadow replica technique (R. C. Williams and R. W. G. Wyckoff. *J. appl. Phys.*, 1946, 17, 23) was used to prepare a direct positive representation of a slide with one monolayer of protein. Here, too, projections of significant proportions were evident. Control replicas of clean glass slides produced practically structureless micrographs, as expected from collodion cast on glass.

In conclusion, it appears to us that, in view of the considerations and evidence presented above, the claim that the experiments of Rothen establish the existence of *specific* long-range forces is unjustified at this time. It is perhaps unnecessary to remark that because of the fundamental significance of such a conception the most critical appraisal, both theoretical and experimental, of the hypothesis of specific long-range forces should be made before it is regarded as validated.

FRED KARUSH[3] and BENJAMIN M. SIEGEL[4]
New York University College of Medicine and
Weizmann Institute of Science, Rehovoth, Palestine

Research and the Geographic Factor

In the February 6 issue of *Science* (pp. 127–130) Clarence Mills brought forward a strong indictment of existing methods and institutions concerned with the distribution of funds for research on the basis of discrimination against certain geographic areas by favoritism to others. In the April 16 issue of *Science* (p. 391), Thomas Turner has argued contrariwise to the effect that disbursing bodies are under obligation to place research funds where they believe the most productive immediate results will be achieved and that the results of research benefit not merely a community but the country as a whole. The points which Mills and Turner make are interesting, but both writers imply a certain deliberation in the distribution of funds according to an artificially simplified plan which may be questioned. In the past two years the American Neurological Association has been concerned with the collection of certain information which may be considered to cast some light upon the question of the geographic distribution of research funds. It was the specific intention of the American Neurological Association to determine what agencies had in the past allotted funds for research dealing with the nervous system, or for training in one of the disciplines concerned with that system. The Association was further interested in determining what proportion such aid bore to other aid made by the same agencies, whether financial assistance of this type had proportionally increased or declined, and what institutions and geographic areas had been so aided.

The over-all implications of the survey were clear and in conformity with expectation. The principal contributors to such research and training were governmental agencies, over-all aid had increased absolutely and had remained relatively unchanged (though certain basic fields dealing with the neural system were all but ignored), and most of the aid had gone to the larger and better-known institutions north of the Mason-Dixon line and east of the Mississippi.

The survey disclosed certain factors which have a direct bearing upon the last consideration. The agencies, foundations, and funds able and willing to give an account of their present expenditures were few. Still fewer were able and willing to compare their present with past disbursements. Very few indeed were able and willing to make any kind of a breakdown in terms of the exact disciplines aided. There are several obvious reasons why a comprehensive picture could not be obtained from all the agencies, funds, and foundations contacted. In the first place, the mortality among such organizations is high, and only a few of the better known have been in existence or have held to a consistent policy long enough

[3] Senior Fellow of the American Cancer Society.

[4] At present at Polytechnic Institute of Brooklyn, Polymer Research Institute, by special arrangement.

to make comparisons extending over a full decade. In the second place, it is a regrettable fact that some of these bodies are more impressive on paper and in theory than in fact. Finally, there are very few organizations which have really comprehensive records organized in such a way as to yield information other than that which appears in a set form in their annual report. It might be supposed, by a disaffected individual, that a considerable proportion of the agencies, funds, and foundations were deliberately concealing a dubious administrative policy and simply would not yield the information requested. Granting that certain so-called philanthropic foundations are dubious in inception and devious in administration and granting that all offices receive more questionnaires than they have any inclination to answer, the fact remains that all the better-known agencies, funds, and foundations did answer the Association questionnaires to what appeared to be the best of their ability. Since it is obvious that the conclusion that most of the aid was distributed to the northeast came from the answered questionnaires, it is apparent that this aid came from the said larger and better-known organizations.

When this material was examined, certain very interesting observations emerged. In spite of Mills' figures, the older, private philanthropic organizations very evidently made a definite and deliberate attempt to aid research and foster training in areas other than the northeast. It is probable, had the figures been corrected (the records, having been kept confidential, have now been destroyed) for population density and number of educational institutions in given areas, that it would have been found that areas other than the northeast had actually been somewhat favored by such older, private foundations.

In the case of the younger, private foundations and government agencies (most of which date, of course, from the period of the last war) the situation was otherwise. There are several obvious reasons for this. Smaller institutions have a very small factor of safety in personnel. With an accelerated teaching schedule, opportunity for research was wiped out in small faculties. The situation was, of course, worse than that, since the smaller schools actually lost personnel to the armed forces. It can only be hoped that many of these men found their way into government-maintained laboratories. Some certainly did.

Under the circumstances, applications for research and training from many geographic areas failed to appear, and even deliberate efforts by some of the government agencies to encourage research in those areas failed.

Although the war is over, something of the same situation still obtains. The number of bona fide requests for aid for appropriate grants still remains small from certain geographic areas. No one could seriously expect philanthropic organizations, committed to the proposition of developmental research, to make a grant to an institution in a geographic area simply because other geographic areas had received such grants and that area had not. Those individuals who seek to justify the differential in geographic distribution by demolishing such a supposed argument are merely destroying a straw-horse of their own confused construction. Again, one often finds the geographic differential justified on the basis that a grant cannot be made if an application for a grant is not received. In this connection the faculty of a small, outlying institution is in a peculiar position. Its members might well ask: "How can an application be filed if one does not know what is available and where?"

It is upon this question that the American Neurological Association questionnaire throws some light. In the early organizational stages the policies of an agency, foundation, and fund may be extremely nebulous. The organization does not clearly state its policy because it does not clearly comprehend it itself. This is not the fault of the organization. It takes time and experience to develop policies, and it is best not to be too specific until one knows that the way ahead is clear. The requests such a developing organization receives are likely to come from the individuals (or persons associated with those individuals) who are attempting to formulate that policy. This may look like nepotism to the casual observer, but in point of fact it is the inevitable result of a lack of a well-developed and long-range point of view. After all, who knows the future? Before the faculty of an isolated institution becomes aware of the function of a particular governmental agency, that agency's policies may have altered or it may have actually ceased to exist.

How can a given individual in search of information about available fellowships or research grants in a particular field obtain information about these things? The question is not an easy one to answer. Fellowships spring up suddenly, support for particular fields of endeavor ceases. If a directory were prepared, it would be out of date by the time it was printed. If a National Science Foundation is at some time established, a certain more or less stable framework should be provided for at least a basic level of activity in research and training for research. It is the consensus of the Committee on Medical Legislation of the ANA that some of the funds of such a foundation should be allotted on a geographic basis. It should not be necessary to justify allotment of these funds on the basis that the research done with them could not be done better elsewhere. The best-equipped laboratories should not be allowed to compete for such funds. Such funds should be regarded as a developmental investment. If they yield outstanding research, well and good; if not, they will still have served the country as insurance against the possible neglect of a fruitful idea which may have been otherwise overlooked in a certain geographic area.

Although a bill has passed the Senate, no one knows what form a National Science Foundation will take if it is finally established. In the meantime, the best that can be suggested to the individual in search of information as to what fellowships or research funds may be available in a given field is to direct an inquiry phrased in as specific language as possible to the representative of his professional academy, association, or society to the National Research Council, Washington, D. C.

FRED A. METTLER

Committee on Medical Legislation,
The American Neurological Association