

## 50 YEARS OF CURRENT SCIENCE—GLEANINGS

[We reproduce below an article entitled 'Furtherance of Basic Research' that appeared in the August 1955 issue of *Current Science*. In this connection we would like to invite reference to the presidential address of Prof. M.G.K. Menon at the 69th session of the Indian Science Congress held in Mysore in January 1982, which we published in the 20 January 1982 issue of *Current Science*. In his address, after a masterly analysis, Prof. Menon stressed the need for basic research as an integral component of a self-reliant base of science and technology. Our readers, we are sure, would note the identity of views in this article and the address of Prof. Menon.]

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### FURTHERANCE OF BASIC RESEARCH\*

THE concept "basic research" may comprise the systematic endeavour, without preconception, to increase our knowledge and understanding of nature. It is the kind of research that some would characterise as "pure science". If it is indeed pure, it derives that quality from uncompromising objectivity, unconcern over specific aims, and absence of intent to exploit results. It is intellectual adventure: a hunting expedition in unexplored domains where the weapons are the experimental devices and aids to observation by which data are gathered, processed, and made ready for interpretation. The trophies of the hunt are new concepts and principles. They are freely shared, through publication, with all who are interested in them.

For the most part, basic research is conducted by scientists in faculties of colleges and universities. Much research that is sometimes called basic is carried on within government-owned and government-operated as well as industrial laboratories. Such research may lack the above-mentioned purity because it gets an occasional nudge, or at times even a strong push, in the direction of the practical interests of the supporting agency or industry, but it is difficult to separate the above kind of research from all that appears under the category "basic".

#### ROLE OF GOVERNMENT

Since Government is already deeply involved in basic research, it would be academic at this point to argue that it should or should not be so involved. But we may properly discuss whether more or less Government money should go into basic research. Is it possible to

devise a better policy? Can the role of Government be altered in a desirable way? This is a large question. It deserves examination. In response to the question, "Why is Government involved in basic research?" it may be said without reservation that the underlying motivation of the Government in science is the utilization of science. If this appears to be in conflict with our definition, we may take note that if basic research requires justification, it is justified by the experience that new knowledge of science has great potential value to society. Such value comes from eventual utilization. At any rate, this is the argument that must be made to bureaus and legislative committees to justify budgets and appropriations.

In this context, there is an important role in basic research for an enlightened government: to devise ways and means by which vastly larger funds are made to flow to our institutions of higher learning from a great diversity of sources. Funds should come not only from corporations but from the great number of private citizens who are potential donors to such causes. It is here, in the tapping of this source, that Government can play an exceedingly important role in the support of basic research and education. Only Government can bring about a large yield of funds from this source. It can do this by making it possible for the individual to give at nominal or no cost of giving.

But it is clear that the Government has at present an important role in supporting basic research by providing funds for the conduct of such research in the laboratories of its own agencies and, in emergencies, for the procurement of research and development services from non-government agencies. It must also make grants and contracts under which educational institutions may support the work of research scientists on their faculties. Government also has now a responsibility with respect to increasing the numbers of qualified research scientists. Prospectively,

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\*Based on three articles by Paul E. Klopsteg, Monroe E. Spaght and Kenneth S. Pitzer, presented by the authors at the Symposium on 'Roles of Government, Industry and the University in Basic Research' (*Science*, 1955, 121, 8).

Government will have to finance indefinitely the large projects of team research that involve annual budgets quite in excess of the financial resources of any institution.

#### BASIC RESEARCH IN INDUSTRY

One recent study indicates that of the total research expenditures in the United States, about 65% is spent in industrial research laboratories. The industry programmes employ more than one-third of all the people engaged in research. To see where basic research fits into the scene, we should consider the main kinds of research being carried out in industry. We have pure research, which may be defined as the inquiry after knowledge for its own sake, without consideration or hope of practical gain. We also have applied research the investigation carried out in response to immediate, direct, and obvious needs. Basic research is in between.

Despite the lack of pressure, the movement in industry toward more elaborate programmes of basic research has been remarkable. Even though we knew 20 years ago that the great technological advances in industry would require a great deal of research, we could hardly have predicted then that industrial concerns would today be sponsoring programmes as large as those that exist at present.

This has happened for a very good reason. It has paid off. It will continue only so long as it continues to pay off. Although altruistic reasons may be involved in some programmes of basic research, and although industry is increasing its support of study aimed at the long-term social benefit of all mankind, it must be understood that when we talk about basic research in industry today, we talk about an undertaking that is made primarily for the economic advantage of the sponsoring agency. However, it must be remembered that no matter how able the scientists may be, how well equipped the facilities, how diligent the staff, one can never guarantee results. If there is anything certain about research it is this—one may include here pure, basic, and applied research for this confident generalisation—not all efforts will succeed, some successes will never make a profit, and nothing is sure until the work had been done. Thus, an attempt to relate investment in basic research to the specific parameters of the development and capital abilities of an isolated company requires that the investment be large enough to play on the laws of probability. It is obvious that a single venture in basic research can yield nothing; alternatively, it could by chance yield such a wealth of new ideas that the corporate facility for its application would be completely inadequate. This problem becomes less important, the larger the organization, and it disappears completely in a venture the size of a national economy.

#### ROLE OF THE UNIVERSITY IN BASIC RESEARCH

The role of the University is to perform a large portion of the basic research and to train virtually all the men engaged in research. Most of the basic research has been conducted in the Universities in the past, and obviously this should and will continue to be the case. The mission of the University is to create and transmit knowledge. This aim is parallel to the aim of basic research; consequently there is no possible conflict of purpose when basic research is carried out at a University.

From another aspect the University offers the ideal setting for research. The strongest human driving force in basic research is curiosity. H. L. Mencken wrote:

“The value the world sets upon motives is often grossly unjust and inaccurate. Consider, for example, two of them: mere insatiable curiosity and the desire to do good. The latter is put high above the former, and yet it is the former that moves one of the most useful men the human race has yet produced: the scientific investigator. What actually urges him on is not some brummagem idea of Service, but a boundless, almost pathological thirst to penetrate the unknown, to uncover the secret, to find out what has not been found out before. His prototype is not the liberator releasing slaves, the good Samaritan lifting up the fallen, but a dog sniffing tremendously at an infinite series of rat-holes.”

It is therefore a matter not only of getting an adequate amount of money into the University's operation but of handling this amount of money in a fashion that does not hamper the basic character of the work. In other words, the funds that finance research should be available in a manner that does not restrict the operation of the investigator. The funds for University research can best come from normal University budgets, that is, from the same general budgetary framework that includes the salaries of the members of the professorial staff and their non-professorial assistants as well as the funds for chemicals, or materials for the machine shop or the glass-blowing laboratory, and so forth.

Unfortunately, however, the usual University budgets are inadequate even for the present level of basic research, and they have had to be supplemented by funds from various grants or contracts, which in turn have tended to put one boundary or another on the manner of use. The aim ought to be to increase the amount of money coming through regular channels in University operations rather than continually to multiply the varieties of routes through which these funds arrive.

Whether it is feasible for the Government to use a different type of distribution or not, it is clear that the Government should see to it that University research is

adequately financed, not necessarily that the Government finance it directly. If steps can be taken to cause adequate funds to flow into University channels from private sources, this will be far superior to an attempt to modify the Government method of support of research in order to overcome these objections. There will still remain the larger projects that need the Government's attention; it might be better to keep the Government activities in that

sphere.

The foundations, of course, have had considerable experience in handling the support of research with a minimum of restriction. The tradition of a foundation is to say: "Once we have made you a grant, you go ahead and spend it as you see fit". This is a tradition which is well worth copying by both the Government and industry for the furtherance of basic research to the degree it deserves.

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## ANNOUNCEMENT

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BANGALORE 560 080

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