

## ANNIVERSARY ADDRESS—1978

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NEARLY all my distinguished predecessors have used the occasion of the Anniversary General Meeting to express their views on the functions and organisations of Science in India. I feel that this year in particular, there is a special need for a close examination of these issues; for, while Indian science is on the threshold of great achievements, its organisation, as things stand to-day, may prove to be a source of hindrance to its early and effective application to the solution of national problems. A delay in its application may lead to wrong conclusions as to the value of science to society itself and detract from the use of the methods of science to future developments, be it in the sphere of increasing the country's industrial potential or building a national personality reorientation of our philosophy to suit the 21st Century.

It will be recalled that in August 1977, the Council of INSA had issued a Press Release expressing concern over the inadequate realisation of the value of scientific methods, the limitations of such an approach and why the reorganisation of existing structures based on consultation was required in order to make it a more efficient tool for national development. In the beginning, only some abstracted versions of the release appeared in a small number of dailies. However, its impact became more perceptible later.

I am glad to note that our two sister Academies, the Indian Academy of Sciences and the National Academy of Sciences, whose Presidents are both Fellows of this Academy, have also expressed views similar to ours, but perhaps in a more pointed manner as they were issued much later than the Press Release of the INSA Council and also after the decision of the Government to make major changes in the existing framework for scientific organisations. It is gratifying to note that a constructive view of these changes has emerged taking into account the importance of inter-disciplinary research activities. It is a happy augury that the various Academies have independently come to almost identical conclusions. As these conclusions taken in totality reflect the views of a large body of the science community, I take it to mean that Science Academies have an important role of an advisory nature to play in the formulation of science policy.

Consultative processes are essential in a country like ours which has a large and diverse science structure and where the implementation of science policy is beset with enormous difficulties. It is only a truly scientific society which can effectively examine the vast potential of present day science and suggest methods by which it can be kept in the forefront of development and

not allowed to take on an imitative role, incapable of providing the required level of confidence needed to achieve national self-reliance. In a democracy, no set of scientists, however carefully they may be chosen, can replace the collective wisdom of a body like INSA, which has indeed been recognised by the Government, as early as in 1945, as the premier society representing all branches of science. I would, therefore, like to make a plea for the effective utilisation of the potential of the Academy for the benefit of the country much in the same way the USSR Academy of Sciences, the National Academy of Sciences, USA and the Royal Society of UK, are given pride of place in their respective countries. It is to be noted that the USSR Academy of Sciences even implements policy. We, as a body of scientists, should not appear to be bargaining for leverage. On the contrary, we are here only to give our considered advice. If confidence is reposed in us, we will naturally rise to the occasion in a manner that would enhance the prestige of Indian Science.

The reorganised National Committee on Science and Technology has as one of its members, the President of INSA and I believe that the views of the Council of INSA will be given due weight at the deliberations of the NCST. We take pride in the fact that the new Chairman of NCST is a distinguished past-President of INSA and he has already assured me that our views will be given special consideration.

Among those countries of the world which have a scientific base of some consequence, we are the one that spends the least on science. In spite of this and in spite of the fact that our per capita GNP is amongst the lowest in the world, the quality of Indian science is greatly respected abroad and scientists and students from other countries come to us in fairly large numbers to share the knowledge developed in our laboratories. At various symposia organised by learned bodies, I am amazed to see the excellent quality of work in various disciplines contributed by research workers who are working under the most difficult conditions of financial, administrative and other forms of logistic support. By any norms of national planning, the allocations for science and technology should be increased if we are to survive as a modern nation and not become merely a geographical entity. The usual reason given against any increase of financial support is that we are a very poor country and that we cannot afford more. Some even say that we must cut on science to help one more villager to survive. If we have to make such cuts on science, it is not that one more villager will survive, but it is like cutting the very arm of the nation that can help uplift the villager. In our history, whenever we allowed ourselves to neglect science, we reached the lowest levels of degradation, especially during the 18th and 19th centuries, a stage from which we have not yet truly come out. We must never let this happen again. We must continue to support science as has been the policy since independence. This support should be enhanced, and widened in scope to cover the many developments that are taking place in the world.

Our country is a very large one and it should have every aspect of science operating at all levels, be it basic science (sometimes called ivory tower science) or the kind of "bare foot" technology intended to help in our rural programmes.

There must be a continuous flow of knowledge from the high “ivory tower” to the down to earth level pervading through the entire scientific community. No branch of knowledge is unnecessary to a nation on the move. As an example of a discipline which does not give the impression of having any immediate value to the community, I may refer to abstract mathematics. This type of mathematics does not even have the possibility of being a source of entertainment like music or painting. It is there for its own sake, but is there anybody who would suggest that we should stop support to mathematics in this country? It is not that mathematics should be supported because it does not involve much financial investment (an incorrect statement in itself). It should be supported purely because such support would be in the spirit of involving ourselves in the very foundations of thought and structure of modern science. It is this very spirit that has allowed us to survive in the past as a nation with a remarkable continuity of culture. However, such an attitude requires our accepting the established laws of science as supreme. A very distinguished scientist abroad once said to me that it must be frightfully difficult to undertake scientific research in India because of the widespread atmosphere of non-science. There is no doubt that social conditions affect not only the growth of science, but even the use of scientific methods and, ultimately the absorption of science in the processes of change and development.

Over the centuries, the need for rule by law as a sign of civilised existence has come to be generally accepted. Our lawyers clamour for this and swear by Manu, Mitakshara and Macaulay as though their pronouncements were the laws of God himself. But few have tried to critically examine their relevance to modern life. If you ask me why there is need for a large scale use of third degree methods in our police investigations, I would say that it is an outcome of the existing criminal procedure code itself. There have been great advances in the forensic sciences, but how much of this has any value in our country? The greater use of science in detection of crime can result in lesser use of third degree methods and consequently lead to a lesser misuse of authority. But this change requires an acceptance of the laws of science which have a better claim to being a creation of God. In all material matters, the laws of science are supreme and such is the humility of science that when a more correct law is discovered, the older one is discarded if there is sufficient evidence to do so by a feedback process that is natural to it. However, such ready acceptance of newer concepts requires our implicit faith in mathematics, statistics, the law of the exact science and their projection into Biology.

Sometimes people make a difference between scientific research and industrial research. This is actually a very colonial view of industrial development. If the country really has to be industrialised in the fullest sense of the word, both must exist simultaneously. We can compare science and technology to a human body where the legs and hands represent industry, but the brain represents scientific research. If we do not have scientific research helping and controlling industry as a well assimilated part for our development, we will be merely importing not only equipment from outside, but even ideas. This will completely place us in the hands of those who control industry elsewhere.

By its very nature, science requires nurturing of excellence which is wrongly levelled as "elitism". Good science can come only from those specially fostered in a special environment. While we can have mediocre music for use in restaurants and similar quality work of painters to be hung up on the walls of hotels, we cannot afford to have such a thing as a mediocre scientist. To keep a scientist working at his most effective and creative level, he has to be treated as something out of the ordinary. His morale has to be kept at the highest level, otherwise, the investment made on him will all go waste. It is for this reason, advanced countries give a very special position to scientists and more so if their merit is indisputable. It is in the fitness of things that a scientist must be treated with solicitude which should be made a part of national concern rather than controversy. This acceptance of the scientist's position, however, requires a proper method of assessing him.

Research workers can be classified into three different groups : one just about to start his work, one at the peak of his activity and one who helps progress and promotion of science by his overall maturity and experience. In the first category, the identification should normally be available through university gradings. Unfortunately, in India, this method of assessment is not satisfactory due to the large number of graduates being turned out in our universities. In such an over-crowded situation, the identification of a single person who shows great promise becomes very difficult. Consequently, the training of a highly gifted person requires very special attention. It is for this reason that a secondary selection process from among those coming out of universities and their subsequent training is required for the proper development of a research worker in his earlier stages. At middle levels, when the research worker is at his peak of activity, the problem of identification is different as it requires great vision to recognise the merit of a man contributing at the frontiers of science. The identification of good people at this level by means of newspaper advertisements is a futile exercise. For one thing, a scientist in this group usually does not like to migrate from the place he is already in. He is suspicious of new environment and new colleagues. It requires tremendous persuasion to get a good scientist to work in another laboratory on a different set of problems which requires his expertise. It is, therefore, hardly likely that he will respond to an advertisement. It is also difficult to believe that a UPSC type of interview is any better, specially when it takes the shape of a judicial operation. Unless the people who have to work with the scientist concerned are also emotionally involved in the selection process, a satisfactory identification will not result. The so called objective method of selecting scientists by outside committees may satisfy norms, but fail to identify the best men. The problem is made worse when confidential reports are written on the candidate with a view to avoid any comments concerning his inadequacy with respect to the solutions of particular types of problems. Whereas the objective identification of deficiencies is meant to help in locating a scientist in the environment most appropriate to his strength and weaknesses, it is often used in current selection processes as adverse remarks thus invalidating the use intended for such reports. Taking every-

thing into account, a certain degree of rational bias in favour of excellence is an essential part of choosing the right man for scientific research. Unfortunately, it is true that there is a tendency to lay too much stress on the dangers of nepotism through relationship, caste, locality and other unpleasant factors. While nobody can deny their existence, it is, I believe, a passing phase. Its incidence can be minimised by an appropriate choice of selection committees and by proper tradition and leadership. In any case, there is always an element of risk involved in any attempt to recognise good people. Many of the difficulties one faces in selection operations are more due to shortage of posts and to the fact that salaries and posts are associated with one another. I have found from personal experience that if there is a delinking of salaries with designation, a younger man can take up more responsibilities because of inherent ability and not necessarily come in the way of the older scientist who may deserve a higher salary due to the passage of time. In the choice of scientists at the very highest levels, other constraints of a non-scientific nature will naturally play a part and it is here that the Academies and learned bodies can play an important role in the assessment procedure.

There has been considerable debate as to who is the user of any technical development that has come out of a laboratory. I am afraid, it is certainly not the Ministry concerned. To me the Ministry is a body which is meant to help the scientist to get on expeditiously with his work, to give all assistance to him in solving administrative problems and to act as a protective agency in legal and other matters that may arise in the coordination between a research laboratory and an industrial user. At least this is how, I recall, Dr. Homi Bhabha defined the role of administration in scientific research. Unless administration has clearly understood its assistance role, there will be much cause for misgivings. Due to historical reasons, many Government laboratories are classified as subordinate offices and are treated as such. This classification has come from British times and has remained unchanged if not in form, certainly in spirit. The Ministry officials are only too conscious of the fact that all the statutory powers are with them and some of them even insist that they have the last word on the subject, purely for purposes of continuing the status quo. It is possible that the Director of a laboratory can work smoothly with the Ministry, but keeping good relations becomes a major aspect of his activity involving severe compromise on several issues. Usually, the differences are not important when the concerned laboratory is involved only in routine operations. If, however, the Director wishes to make changes and do something out of the ordinary, which is the essence of scientific research and requires a constant process of delegation of powers, it is remarkable how departmental opposition comes to play, a fact noted by Lord Rutherford himself. As I see it, by its very definition, a Ministry's approach is to routinise matters as much as possible and thus, if it is in direct control of a laboratory, only routine work will emerge. On the contrary, all scientific work is based on continuous innovation, be it in scientific administration or in scientific research.

It also does not follow that the user of any results of a laboratory is

necessarily the industry concerned. The main concern of the industry is to make profits and their approach to research is that it should lead to increased efficiency leading to increased production rates, but when new processes or new items of development which may have an overall national economic value are involved, the industry in general rarely shows much interest. It is for this reason the autonomy of a laboratory has to be carefully preserved. It is not for me to describe what autonomy immediately implies, and how it can be maintained, but I think the Academy should give serious thought to this and prepare a paper taking all aspects of the problem into account and make it available for public discussion.

I would now like to deal with an approach that has been considered as a solution to some of these problems and has been implemented as such. This is the process by which scientists are given secretarial power. To me this seems to be an admission of defeat; for, it means that it is not possible to delegate powers to scientists to get on with their work and that unless a good scientist is sucked up into a secretarial structure, which is inevitable, he will not be able to survive or protect the interests of science. I do feel that there must be a way out of this, whereby scientists holding high posts can be given appropriate powers, which would be commensurate with their stature and their level of functional responsibility. In some cases, where a scientist is of high calibre, it may be necessary to vest him with powers and a status that may be even more than that of a Secretary. The aim of the whole exercise should be to decentralise effectively decision making powers in order to truly promote as rapidly as possible the progress of science and technology.

I have brought to your attention some of the difficulties concerning organisational matters of a laboratory. But the purpose of a Presidential Address is not to merely categorise all these problems. They are being brought to your attention more by way of examples so that a unified approach can be attempted and well before the end of the century we can say that India has a mature system for the organisation of science.

If, in this context, INSA has to play an important role in the promotion of science, it has itself to undergo many changes. It has a legacy of constraints by way of very inflexible statutory regulations copied from foreign institutions from the pre-independence era. Since no changes to the statutes are possible without a three-fourth majority, it really means that no change is possible at all. From previous experience it seems that out of a total of 387 Fellows, only about half of them take interest in the working of the Academy. To improve participation, the Council has encouraged the functioning of Regional Chapters and I am glad to report that there is a continuous inflow of reports of activity from them, particularly those from Bombay, Calcutta, Hyderabad and Madras. I would urge that if any changes are to be made to the Academy Statutes, the desire should come from the Fellows from the various regions. Any fundamental changes on important issues should be initiated only with the full support of Regional Chapters. There is also the question of how much the Academy should recognise the excellent work being done in the country by Engineers and Medical men from the point of view

of representation within the Academy. In order to get a proper assessment of the situation in these fields, I have suggested to the Council that other learned bodies should have an affiliation status to the Academy in some form, so that there is a continuing exchange of views on the problems of medical and engineering sciences and other fields of knowledge and between the learned bodies and the Academy. Close collaboration with State Academies would help in the collection of information concerning regional and rural problems.

The Academy is here to help all the sciences in India and is committed to taking only a positive and helpful attitude. Sometimes it is forced into rather unpleasant situations because among the body of scientists, a code of conduct and ethics has not yet come into organised existence. We still have the old complaints of papers being published in a hurry with unverified results, insufficient credit being given to junior workers, plagiarism in some form or other, and above all, difference of opinion between scientists arising from sources of a non-scientific nature or personal prejudices. These, I presume, are essentially problems of a transitional nature which necessarily arise during the process of achieving maturity and growth. I would not give too much importance to these unless one can show that they are indeed causing definite damage to the image of Indian science. At the same time, it should not be the intention of the Academy to shy away from problems and claim a state of *sanyasa*. It should be amidst all scientific controversies bringing forth effective solutions without ever losing its commitment to basic principles.

INSA is essentially a scientific body and will recognise no other solutions on scientific matters except those under the principles defined by science. There is much controversy in the country about imponderables, such as the powers of miracle-men and the effectiveness of various indigenous cures and medicines. I know from my own experience that every other village in the South has its own methods of medication and that a large number of the Indian scientists retain their faith in miracle cures. While I doubt the principles on which these cures and medicines are based, I must concede that several of them may indeed provide remedies, psychosomatic or otherwise. But, as far as we are concerned, we can recognise only one science and that is medical science. Unless the claimed cures are understood with respect to biological processes based on principles of the basic sciences, they can continue only as unverified cures and that too only as long as they are not dangerous and do not lead to toxic side effects. But they cannot be said to be part of medical science. Objective statistical verification of all successes is an essential part of science.

Another variation of the above syndrome which is very much in evidence in the international scene is the conclusion stemming from a non-scientific approach to current problems. The International Atomic Energy Agency has, in recent reports, analysed the various application areas where the peaceful uses of atomic energy are bound to play an important and beneficial role in the future. No less an authority than Academician Kapitza has recently expressed the view that for the effective exploitation of geothermal resources, peaceful

nuclear explosions are necessary. In spite of all this it is surprising that a large part of the world should stress on only the evil aspects of atomic energy. While the social obligations of a scientist, both in the national and international plane, cannot be lost sight of, it does not mean that they should succumb to new kinds of superstitions.

In conclusion, I would like to say that in the interests of science in India, scientific bodies like INSA must strongly express their views in the formulation of Science Policy, and the organisation and administration of science, otherwise the very need for their existence will only be a very minor one.

I would like to express my sincere thanks to the members of the Council who have been with me on all important issues. There has never been any controversy, though all issues have been carefully discussed and examined. I also wish to express my thanks for the support of INSA staff, first headed by its Executive Secretary, Dr. B. V. Subbarayappa and later by Dr. S. K. Das Gupta. My special thanks are due to our past-President, Dr. B. P. Pal. It is due to him that we have been able to create several staff vacancies so that we can fill them with promising young men. This should greatly increase our effectiveness. I would also like to thank the Fellows from all over India for their voluntary assistance on many matters.