

Medal Lecture

INSA : An Eventful Journey – Its Evolution and Road Ahead*

P. N. TANDON

Past President, Indian National Science Academy, New Delhi 110 002 and President, National Brain Research Centre Society, Nainwal Mode, Manesar 122 050, India

(Delivered on 25 April 2013)

Surely, science is not merely an individual's search for truth. It is something infinitely more than that It must have a social objective before it.

... Pandit Jawaharlal Nehru (1947)

I take this opportunity to thank you, Mr. President and the Council of the Academy for this great honour you have done me. There is no greater recognition than one by one's esteemed peers. Looking back at my more than three decades of association with the Academy, I have often thought of what all the Academy had given me. Being elected to the Academy was in itself the greatest recognition for a clinician, that too for a surgeon like me, struggling to bring scientific rigour to practice of medicine. This was soon compounded by an opportunity given to me to serve this prestigious Academy as its Secretary, Vice-President and the crowning glory as its President – the first Clinician to be so recognised. But more than these overt symbols of recognition, what I cherish most is the opportunity to get to know not only some of the most outstanding scientists of the country, but some of the rare human beings, whose friendship helped me to broaden my intellectual horizon, emboldened me to strive for higher attainments, prompted me to involve myself in tasks beyond the call of my profession. In short, it helped me to become a better human being, not just for the service of my profession, but may I humbly submit, the higher cause of science in particular and the country in general.

It is therefore not surprising that as a mark of my gratitude to the Academy, I have chosen to speak

on a subject concerned with the Academy itself. What I am going to say is not something which has not been said before, by many of our distinct Past Presidents and other Fellows. The purpose is not to keep reminding ourselves what we all wish to achieve but time has come to seriously discuss how to remodel our policy and programme implementation strategy in the light of the rapidly changing national and global milieu to face the new challenges, and explore the new opportunities.

No doubt much has been done in this regard from time to time. Every President and the respective Councils have left their imprint on the ongoing march to achieve higher goals for the Academy since excellence is not a destination but a journey. This reminds me of the thought provoking remark of one of our very distinguished Past Presidents – Dr. B. P. Pal.

“When one attempts to do any kind of stock-taking on the termination of a tenure of office one is reminded of the saying, - *Everybody sets out to do something and everyone does something, but no one does what he sets out to do*”.

There is also a historical background for me to chose this subject for this presentation. At the very first meeting of the Council, an extraordinary one, that I attended as Secretary in 1981, Prof. M. G. K. Menon, then recently elected President of INSA, devoted it primarily to consider the role the Academy should be playing beyond its routine traditional activities of electing Fellows, recognising talent, representing India in ICSU and other foreign academies etc. Himself occupying some

*Expanded version of the Address delivered on 25 April 2013 on the occasion of the Award of INSA Medal for Promotion & Service to Science.

the highest positions in the Government in the field of Science and Technology, he suggested, “that the Academy had a role different (than the Government Science Departments and Agencies) and far more important in respect to the policy and programme planning for development of S&T and its application for the societal needs”¹. Shri Rajiv Gandhi, former Prime Minister of India during his interaction with the members of his Science Advisory Council expressed his intent to establish it for similar reasons. He said that each science department of the Government has its own turf to guard and hence is unable to provide a holistic impartial view on important policy matters. However, in the current environment with advisory institutions like SAC-PM, SAC-C, Principal Scientific Advisor (PSA) to the Government important question arises if a body like INSA has a role in this regard. It is worth pointing out that from its very inception most Presidents have considered it the duty of the Academy to provide inputs to the Government on policy matters where science and technology can play a significant role (see later). Thus for the purpose of this talk, I am prompted to revisit “the main Objectives of the Academy” as enshrined in our constitution, and to reflect on the journey we have travelled so far and the need for its future direction. I have attempted to give an historical perspective relying on the discourses of our Presidents and gleanings from other academies of science internationally.

Throughout my association with the Academy the question about the role an academy is expected to play or should play has remained a subject of great interest.

The Progressive English Dictionary defines ‘Academy’ as a society of learned men. However, the first Academy was a pleasure garden in Athens which is supposed to have belonged to an ancient Attic hero named Academes. In this garden, in 387 BC, Plato founded a School of Philosophy where he taught for nearly 50 years. This Academy is reported to have lasted for over 200 years. This school came to be known as “Plato’s Academy” and

all Academies since then inherited their designation from this prestigious organization. No doubt the structure and functions of the Academies established globally have changed to suit the purpose and needs of a given place and time but basically it remains as “an assembly or society of men, uniting for the promotion of some discipline”. It was only in the seventeenth century that Academia Nazionale dei Lincei was established in Italy (1603) primarily for promotion of science, as were the Royal Society, London (1660) and the Institute de France: Academie des Sciences, Paris (1666). The foundation of learned academies in the 17th Century was driven in great measures by the desire to replace knowledge based on faith by knowledge based on evidence. Thus the motto of the Royal Society, London – *Nullius in Verba* which roughly translates as, *Do not believe anything just because someone tells you it was so*. This is remarkably similar to the teaching of Buddha who said, *Believe nothing merely because you have been told it or because it is traditional or because you yourself have imagined it. Do not believe what your teacher tells you merely out of respect of your teacher. But whatsoever, after due examination and analysis you find to be conducive to good, the benefit and the welfare of all beings – that doctrine believe and cling to and take it as your guide*.

The Royal Swedish Academy of Sciences was established in 1739, The American Academy of Arts and Sciences in 1780, and the US National Academy of Sciences only in 1863. Most other national academies, of which there are now over 100 merit-based science academies, came into existence in the twentieth century. Over the years, a number of regional academies like the Third World Academy of Science* Federation of Asian Science Academies & Societies (FASAS, AASA)**, All European Academy, the African Academy of Sciences have been established. In 1996, the Inter Academy Panel, now having nearly 103 academies of science globally, came into existence.

*The Academy of Sciences for the Developing World.

**Merged and now known as AASSA (Association of Academies and Societies of Sciences in Asia) in October 2012.

¹Item IV: Minutes of the Meeting of the Council held on 20th February, 1981.

1. THE ORIGIN

India witnessed a national renaissance in early decades of 1900 following a prolonged period of foreign domination. Alongwith a kindled sense of nationalism there was a remarkable upsurge of all forms of intellectual activities be it art, literature, language and philosophy. It is not surprising that this was also one of the most glorious eras for science in the country. Intellectual giants like J.C. Bose, P.C. Ray, Srinivas Ramanujan, C.V. Raman, S.N. Bose, M.N. Saha, P.C. Mahalanobis, H.J. Bhabha, S.S. Bhatnagar among a host of others made Indian Science taken note of globally. It was during this firmament that it was felt that for further promotion of Indian science, its international projection and its use for national development, required a responsible central body which could represent the scientific community as a whole. Thus in December 1929, Prof. M.N. Saha² published an article in Allahabad University magazine entitled, “*A Plea for An Academy of Sciences*”.

He proposed its ultimate aim ought to be to organise scientific workers to persuade them to take more interest in the scientific matters in National interests” and “..... to exercise a healthy influence on the Government in its administrative policy regarding scientific matters”.

He presented this proposal at the Science Congress held at Allahabad on 2nd January, 1930. As a consequence of this effort, the Academy of Sciences of the United Provinces of Agra and Oudh – (the fore runner of the National Academy of Sciences, Allahabad) was registered on 4 December, 1930. The Academy was formally inaugurated in 1 March, 1932 at Allahabad. The founding of this Academy was reported in *Nature* (London) in its issue of 8 October, 1932.

Sir C.V. Raman³, the Editor of *Current Science* published an editorial on May 1933, mentioning that neither India nor the outside world has at present the

means of receiving a complete picture of the total annual output of scientific work conducted under the auspices of the Government⁴, the universities and other semi-official centres. He added, *It seems to us that the early establishment of a National Academy of Sciences should secure closer and better organised co-operation of activities among all research institutes in India, and exercise through its official journal a wider influence for the consolidation and promotion of the best interests of science.*

Around the same time, the Government of India desirous of joining the International Research Council (ICSU) and its affiliated unions sent letters to Provincial Governments, Scientific Departments, Learned Societies, Universities and the Indian Science Congress Association seeking their opinion whether like other countries there should be an organization like a “National Research Council” which should be the adhering body representing India in ICSU. In response to this communication the Executive Committee of ISCA appointed a committee for its recommendation. This committee was of the opinion that, “conditions in India at present are favourable to the formulation of (i) a National Research Council (NRC) and (ii) the National Committee”. It recommended that the ideal constitution for the NRC would be analogous to that of the Royal Society, London or that of one of the National Academies of Sciences in European countries. Prof. M.N. Saha in his Presidential Address at the Bombay Session of ISCA made strong plea to establish an Indian Academy of Science on the model of the Royal Society, London. The General Committee of ISCA passed a resolution on 3rd January, 1934, recommending the establishment of an Indian Academy of Science.

²Prof. Meghnad Saha was elected a Fellow of the Royal Society (London) in 1927 at the young age of 34.

³Sir C.V. Raman had already received the Nobel Prize in 1928.

⁴Government of India had established the Ecological Survey of India in 1851, the India Meteorological Department in 1875, the Botanical Survey of India in 1890 and the Zoological Survey of India in 1916. In the meanwhile in 1857, the Universities of Calcutta, Bombay and Madras came into existence to be followed by the University of Allahabad thirty years later. The Indian Association for Cultivation of Science founded by a medical man, Mahendra Lal Sircar, came into existence in 1876. It may be mentioned that except for the Indian Chemical Society founded by Sir P.C. Ray in 1925, there was no scientific society of an All India character at that time.

While various committees consisting of the leading scientists of the day including Sir C.V. Raman, Prof. M.N. Saha, Prof. P.C. Ray, Prof. B. Sahni, Prof. S.P. Agharkar among others, were discussing the various issues related to the establishment of the Academy, on the initiation of Sir C.V. Raman. The Indian Academy of Sciences was registered on 27 April, 1934 at Bangalore.

On 16 September, 1934 a meeting held at Calcutta attended by Sir C.V. Raman and his associates from Bangalore Academy alongwith the Members of the Committee constituted by ISCA finally decided that a central body called the National Institute of Sciences of India (NISI) be established with its office in the Asiatic Society of Bengal. Thus the National Institute of Sciences of India came into existence on 7 January 1935 with Dr. L.L. Fermor, as the President of the Institute⁵. It was in October 1945 that the Government decided to recognise the NISI as the premier scientific society representing all branches of science in India and its headquarter was moved to Delhi. NISI was designated the adhering organization to ICSU on behalf of the Government of India in January 1968 and its name was changed to Indian National Science Academy in 1970.

2. THE ACADEMY IN 1990s

On being elected the President of the Academy, (1991), I was tempted to revive the debate regarding role of the Academy in the changed environment. This was reinforced by an "Open Letter" from Prof. V. Ramalingaswami, a Past President of the Academy, to my predecessor Prof. M.M. Sharma, "Science in the Service of Society – the Indian Paradigm", wherein he mentioned that the purpose of this letter was, *simply to draw attention to some issues that had struck me as deserving of attention at this time, which reflect upon India's science policy to*

facilitate discovery and its application for individual and collective betterment of the quality of life of her people. And furthermore, "India's greatest problem is not only facing the challenge of discovery but also in exploiting the opportunities of applying the fruits of science with equity and access to people" (**Annexure I**).

In addition in March 1991, I received letters from two distinguished Fellows of the Academy Dr. N.K. Notani and Dr. V.G. Bhide with suggestions to enlarge the scope of the activities of the Academy (**Annexures II, III**). It was therefore decided that the Academy should devote a special session to discuss this subject in the May (18 May 1991) meeting of the Council to be held at Kodaikanal. Prof. J.C. Ahluwalia, Secretary vide his letter dated 24 April, 1991 intimated the fellowship about the proposed discussion meeting alongwith the Council and sought their inputs (**Annexure IV**). After detailed discussion the Council decided, that INSA may take steps to take a renewed look at the objectives, vision and scope of the Academy.

I, therefore, took the liberty to address a letter to all Fellows of the Academy dated 22 June, 1991, on the subject (**Annexure V**). Herein, I referred to the discussions held at the May meeting of the Council and took the liberty to express some concerns. As is not unusual only 50 responses were received and as expected the opinions were divided as to whether the Academy should do more than just recognising and promoting excellence.

In the August (1991) meeting the Council decided, "President INSA may constitute a Committee consisting of at least three members from the present Office-bearers and two members from rest of the Council which will prepare a document on the "Role of the Academy". And further, "The document prepared by this five-member Committee will then be discussed in detail during the December Council Meeting at PRL, Ahmedabad". This matter was once again referred to during the Presidential Remarks at the Annual General Meeting held on 4 October, 1991.

It was decided to request Dr. Varadarajan, then Vice-President INSA, to initiate the follow-up action.

⁵It is not necessary to detail here the deliberations of the various committees that preceded this ultimate consensus. This is being documented separately as a detailed history of INSA. Suffice it to say that it was after much discussion and consultations among the leaders of science of the day a consensus was arrived at. This is reflected in the existence of the three science academies in the country.

He therefore planned a day-long brain-storming session at Ahmedabad, involving a large number of Fellows alongwith the Members of INSA Council. The deliberations of this session were then brought out as a comprehensive document, **“Role of the Academy: Agenda for Next Decade”** (Proceedings of Discussion Meeting ultimately published by the Academy in April 1993). My views expressed in this 1992 discussion meeting are summarised here⁶.

“While fully agreeing that the first aim of an academy should be to spot, encourage and foster excellence in Science & Technology, provide for a forum where free and frank discussions could take place on all aspects of science and technology, I am convinced that academy has a much larger role. **An Academy Should act as a “Brain Trust” for the People and the Government.** In its capacity, as an independent body of distinguished scientists it should provide a reasoned opinion on all issues related to development of S&T on one hand and the role of S&T in development on the other.

And, “The academies should act as **“Watch Dogs” or “Crystal Gazers”**. The multidisciplinary expertise available in the academy should enable it to foresee, evaluate and determine the new developments and directions likely to take place in S&T internationally”. In his presentation at this Meeting Prof. V. Ramalingaswami, Past President, commented, *I would submit that INSA should discover itself. It should realise its power as well as its limitations in advancing public welfare.*

3. OBJECTIVES OF THE ACADEMY

Let me first reproduce the Objectives of the Academy as envisaged by our Founding Fathers:

Objectives

- (a) Promotion of scientific knowledge in India including its practical application to problems of national welfare.

- (b) Coordination among Scientific Academies, Societies, Institutions, Government Scientific Departments and Services.
- (c) To act as a body of scientists of eminence for the promotion and safeguarding of the interests of scientists in India and to present internationally the scientific work done in the country.
- (d) To act through properly constituted National Committees, in which other learned academies and societies may be associated, for undertaking scientific work of national and international importance which the Academy may be called upon to perform by the public and by the Government.
- (e) To publish such proceedings, journals, memoirs and other publications as may be found desirable.
- (f) To promote and maintain liaison between Science and Humanities.
- (g) To secure and manage funds and endowments for the promotion of Science.
- (h) To perform all other acts that may assist in, or be necessary for the fulfilment of the above-mentioned objectives of the Academy.

Need for a Periodic Reappraisal of the Role of an Academy

Over the years the Academy has continued to add to the scope of its activities. It has added special cells for collecting archival material and a Science Policy Study Cell. Its international collaboration with other academies has been expanded. It catalysed the creation of FASAS (Federation of Asian Science Academies and Societies), the Inter Academy Panel of World Academies of Science (IAP) and the Inter Academy Council (IAC). INSA continues to play a significant role in the activities of the ICSU and the Third World Academy (TWAS) from its very inception and more recently in meetings of the Science Academies of G8+5 countries.

⁶P N Tandon: Introductory Remarks and Background of Discussion: Role of the Academy: Agenda for next decade; INSA, 1993, pp 3-13.

However, it is essential that every institution to maintain its relevance must have periodic evaluation of its policies and programmes, reassess its strengths and weaknesses to meet the challenges of the ever changing national and international demands. Alan Gregg (1945)⁷ Vice-President of the Rockefeller Foundation, talking about medical institutes remarked, “All human institutions must reckon with two forces: one is the inherent intent to supply stability of purpose and effort, the other is to be promptly and delicately responsive to changes in the environment and even changes in the objectives. And furthermore, “we cannot safely exalt our need for stability and continuity to be the end – all and be – all of an institution. We must needs adjust the institution to change – or see it perish of its own brittleness”. Inaugurating the Golden Jubilee Celebrations of the Academy on 16th January 1984, the then Prime Minister Shrimati Indira Gandhi remarked, “Every institution must renew itself and be constantly thinking of its work in future”. Members of the Academy, so much more than others, are in a position “to understand the implications of the developments in science, to educate public opinion and to advise the Government”. This sentiment has recently been echoed by academician Lamberto Maffei, Vice-President of the Accademia Nazionale dei Lincei, one of oldest Academies of science thus, “The renovation of academies is not only necessary because we must follow the rapidly changing times, where new problems abound, together with new necessities and new needs”. Similar sentiments have been expressed by leaders of some other renowned Academies:

The Royal Society, a 350 years-old-academy has reviewed its role from time to time. Thus, in 1990, Lord Porter described the role of the Society under three areas : International scientific affairs, the support of British science and advice to the Government. He commented, “As in this period of turbulent change, we approach the new millennium, we should ask ourselves, what will be the place of national academies in the 21st Century”.

⁷Alan Gregg: Medical Institutions in Prospects and Retrospects in Neurology Little Brown & Company, Boston 1955

More recently the Royal Society defined its five strategic priorities for 2007-2011⁸ as:

- Invest in future science leaders and in innovation;
- Influence policy making with the best scientific advice;
- Invigorate science and mathematical education;
- Increase access to the best science internationally and
- Inspire an interest in the joy, wonder and excitement of scientific discovery

During its 350 Anniversary, President Martin Rees⁹, called for the Royal Society’s wider role thus, “..... the Royal Society’s core values have enduring relevance. Today scientists, like their forebears, probe nature and nature’s laws by observation and experiment, but they should engage with the needs of the society and with public affairs. Such engagement is needed more than ever before, and on a global scale¹⁰.

Prof. Yvan Guindon, President of the Royal Society, Canada, mentioned, *The National Academy of Canada has to constantly adapt and modernize. Two years ago, we decided to revisit our roles in our programmes to better achieve our missions*

Prof. Wong of Academia Sinica reiterated, *The original concept for structuring the Academy has already been outdated. With the drastic changes in our social environment over the past century, the structure of the traditional academies may no longer be practical and need to be reviewed.*

⁸Strategic priorities of the Royal Society. <http://royalsociety.org/about-us/priorities>.

⁹Martin Rees: The Royal Society’s Wider Role: Editorial. Science 328, 1611, 2010

¹⁰A detailed report, “The Scientific Century: Securing our Future Prosperity: 2010, published by the Royal Society R. S. Policy Document 02/10 Issued March 2010 DES 1768 is illustrative of the efforts it makes from time to time in the direction.

An Editorial in *Nature* (483, 123, 2012) quoted Paul Nurse, President of the Royal Society, London thus, *Paul Nurse does not think he is sitting in an ivory tower, and he has made it clear that he considers that scientists have duties to fulfil and battles to find beyond the strictly scientific.* In his Dibleby Lecture Nurse raised the issues such as interactions with industry, commerce and the media, in addition to the need for an immigration policy that attracts foreign scientists and inspirational science teaching in primary education as some of the priorities for British Scientists. More recently Neil Lane¹¹, Scientific Advisor to the US President advised, “Our policies for managing science are in need of refurbishment, largely having been designed for a world that existed over a half – century ago” Caroline Wagner¹² discussing the same issue in a commentary on, “The shifting landscape of science” pointed out, “Recognition of an important and undeniable trend: the globalization of S&T affairs resulting in the shift from a reliance on so-called “national system in innovation” to an emphasis on a series of new, globally net-worked systems of knowledge creation and exploitation”. This is even more true for our Academy, having been born in pre-independent India, faced with the need to meet the national developmental priorities and now the challenges of the globalising world.

To familiarise myself of the developments in the Academy over the years I have read through the lectures of the Past Presidents from 1935 to 1984 published at the time of the Golden Jubilee of the Academy, and also the unpublished addresses till 2010. In its Foreword of 1984 Volume, Prof. A.K. Sharma, then President INSA pointed out, “There has been an introspection from time to time by my predecessors on the role of Academy in relation to the realization of its objectives of promoting excellence, projection of Indian Science in International Forum, generating a temper of Science in the country and lastly safeguarding the interest of

scientists of India. A matter of serious consideration at present is its relationship with the government as the highest autonomous scientific organization of this country”.

In his Address during the Platinum Jubilee Session of the Academy (2009) former President Prof. Menon suggested, “As we meet today on completion of 75 years of existence of the Academy, it would be good for the Academy to set up a small high level committee to go into the addresses given by the Past Presidents and to ask ourselves: how can we be more effective in promoting the advancement of science and its value to society”. I have attempted to summarise the salient thoughts of our Past Presidents based on their addresses. (**Annexure VI**)

Indeed the question of the broader role of the Academy, other than electing Fellows, recognising excellence, and organising symposia and seminars was uppermost in the minds of many past presidents.

4. COMMENTS ON OBJECTIVES OF INSA

a) Promotion of Scientific Knowledge in India Including its Practical Application to Problems of National Welfare

Promotion of scientific knowledge remains the primary goal of all science academies. That the knowledge so generated should be utilised for national welfare is being increasingly recognised as a necessity. The manner and extent to which an academy could contribute to this objective however remains undefined.

Prof. A.N. Khosla (1962) in his Presidential Address considered the Academy’s role in science education thus, “The Institute has to ensure up-to-dateness in everything related to science and engineering education and in basic and applied research, through a carefully planned programme of documentation and literature exchange with national and international scientific bodies”. He advised that, “the future of science in this country will be determined by our basic educational policy. We must ensure improvement and up-to-dateness in the teaching of science. We must evolve programmes to provide a gifted student at the

¹¹Neil Lane: Science policy tool: Time for an update Issues in Science and Technology, Fall 2011 issue.

¹²Caroline S Wagner: The shifting landscape of Science Issues in Science and Technology Fall 2011 issue.

graduate, undergraduate and secondary school levels research experience and educational opportunities far beyond those offered by the normal curriculum and to ensure that those with special aptitudes and ability from whatever walks of life, have the fullest opportunity for the realization of their talent”.

Prof. Seshachar’s Address (1973) was devoted to another level of education i.e. the Universities. In his address ‘Science and the Universities’ he lamented that, “The picture that emerges from this analysis is a dismal one, and the only institution in the country, devoted to the great mission of transmission of knowledge lie in disarray, and not only science, but all scholarship is at a discount in the country because the fountain head of that knowledge, the Universities, are suffering from neglect and decay”.

In recent years the state of higher education in India has been a subject of several discussions and symposia and even some reports. In 1985-86 the Academy along with the SAC-PM debated this subject and submitted its recommendations to the Committee drafting the New Education Policy.

Prime Minister Dr. Manmohan Singh in his Address, inaugurating the Platinum Jubilee of the Academy on 10th January 2009, stated, *Maintaining the standards in science and education, while expanding the base at such a pace is indeed a difficult task. At the same time, it is important that we raise the standards of science teaching and research uniformly so that we are not left with islands of excellence in a vast sea of mediocrity.*

INSA as an institution has played a somewhat limited role in this regard specially in the field of practical application of scientific knowledge. Recognition of excellence by electing Fellows, instituting medals and professorship or introducing Young Scientists Awards only indirectly promote scientific knowledge. INSA Visiting Scientists Programme initiated in 1991 to support younger scientists from less endowed institutions to conduct research and training in advanced research institutions/laboratories within India is one such activity. In recent years the Academy, either on its own or along with the other science academies in the

country, has initiated some educational programmes primarily for college and university students and to a limited extent for school children through initiatives like Committee on Science Education (Prof. S.K. Joshi 1993), a Science Education Panel (Prof. G. Mehta 2000), and more recently the Three Academy Programme on Education¹³. Academy is playing an important role in the INSPIRE programme of the Department of Science and Technology, Government of India. Stray efforts have been made to produce educational material. There are several other Science Promotion Programmes of the Academy which are aimed at this objective. Basic research, a pre – requisite for applied research leading to developmental activity, conducted by the academic institutions, was supported by the Academy in the past by instituting programmes of support to individual scientists,, interdisciplinary and multi-institutional groups. With the emergence of major funding bodies in the country for supporting scientific research, the Academy modified its own programmes. The programme now involves five positions of INSA Research Professors, a Platinum Jubilee Chair for promotion and service to science, support to superannuated INSA Fellows, research projects of INSA Young Scientist Medal Awardees and INSA Visiting Scientists.

The Academy also provides partial financial assistance for organising international/national conferences, symposia or seminars in India.

However, the Academy has not made deliberate efforts to promote practical application of scientific knowledge to problems of national welfare. At the time when the objectives of the Academy were formulated there were no official agencies to support such activities. The country relied upon transfer of such knowledge from our colonial rulers whose primary motive was to perpetuate and sustain their own interests. In the changed environment today with multiple S&T Departments and Commissions the primary responsibility in this respect rests with them.

¹³Mukunda, N Science Education Initiatives of India’s Science Academies *Patrika* 56, 8, 2012

It is important to point out that several other academies abroad have now initiated educational programmes e.g. “La Main á la Pâte” (Hands on Training) for school children by the French Academy (1996); the “Young Academy” of German Academy of Sciences, Leopoldina (2000), On-line Educational Website for schools of the Australian Academy of Sciences; “The UK Science and Mathematics Workshops” with contributions from the Royal Society (2007); US National Science Resource Centre sponsored by US National Academy of Science.

Recommendations

While it may not be the function of the Academy to produce teaching – learning material for schools and colleges as suggested by some of our distinguished Fellows during the 1992 meeting on “Role of the Academy”, the Academy should find ways and means to convey the excitement of science to students through (i) lectures by Fellows, (ii) arranging visits of selected students to our outstanding science laboratories, (iii) producing “hands-on” videos (multimedia) of science experiments for schools, and (iv) if possible adopt selected schools/colleges by our local chapters for “mentoring”.

(b) Coordination Among Scientific Academies, Societies, Institutions, Government Scientific Departments and Services

This has been the vision of our founding fathers from the very beginning. Dr. L.L. Fermor, the first President of the Academy (NISI) envisaged the Institute to “have as one of its major activities, the coordination of the labours of the various Academies”, which included the Asiatic Society and the Science Academies at Allahabad and Bangalore (Inaugural Presidential Address 1935). Prof. B. Prasad (1942) reiterated this and referred to the origin of NISI, “in response to the keenly felt need for a body which could co-ordinate the work of all scientific societies, institutions, Government Scientific Departments and Services and cognate agencies throughout the country¹⁴”. Dr. D.N. Wadia (1945)

¹⁴Unlike today there were no Science Departments at that time, Services, most probably referred to the various National Surveys - Geologica, Zoologica, Botanical etc.

pointed out that, “Consequent upon the announcement by the Education Department of the Government of India recognizing NISI as the premier scientific organization of the country, the Council under his Presidentship accepted new duties and responsibilities. These included, “To act as advisers to the Government on all scientific matters. And to coordinate the activities of scientific academies, societies, institutions”. As late as 1973, Prof. D.S. Kothari felt that INSA has a special role in “Strengthening of Scientific Societies in the Country”.

Keeping this in mind INSA (earlier NISI) had the representatives of the Asiatic Society and the Academies at Allahabad and Bangalore on its Council. INSA nominees are represented on the Council of several institutions and organizations:

National Surveys – Geological, Zoological, Botanical etc.

Council of Indian Statistical Institute

Birbal Sahni Institute of Palaeobotany, Lucknow

Indian Council of Philosophical Research

Indian Science Congress Association

Indian Association for the Cultivation of Science

Indian National Academy of Engineers

Indian Institute of Advance Study, Shimla

To maintain some liaison with other scientific societies, till 1980s, the Academy used to provide some token financial support to various societies for the publication of their journals. With the huge multiplication of the scientific societies, it is neither possible nor necessary to do so.

After working in isolation till recently (except for a couple of occasions in the past) a decade ago, through the personal efforts of Prof. G. Mehta (1999) and enthusiastically followed-up by his successors, there has been increasing collaboration not only between the three science academies but also the academies of medicine, agriculture and engineering.

From time to time questions have been raised about the need for three different science academies (besides the three professional academies) in the country. The general consensus, however, has been that it is not desirable to undo this historical reality. Further, each of these academies, though having some common objectives, has developed a special niche for itself which is serving useful national needs. Increasing interaction between these academies on issues of national importance is obviously very valuable and needs to be pursued actively.

From its very inception, the Academy has been keen on playing an active role *vis-a-vis* the Government as is obvious from the observations made by most of our Past Presidents. In its Inaugural Address Dr. Fermor mentioned, "Another aim of our Institute is to provide a reservoir of knowledge and experience in all branches of science available in the study of scientific problems connected with general welfare of the country

This means that, should the Government or any other organization require advice upon problems of scientific interest it will be able to rely upon securing the best opinion available in India". One of the ways proposed to achieve this objective was for the Government to establish a National Research Council with an active role for the Academy. This was also advocated by other Past Presidents, R.N. Chopra (1939), Bainsi Prasad (1941), J.C. Ghosh (1942) and D.N. Wadia (1945).

Dr. Khosla (1961) expected that the Institute (Academy), "..... can and must play a positive role in recommending policies and directing research towards concrete achievements in the shortest possible time". Dr. Mahalanobis (1958) while reporting about the Functions and Responsibilities of NISI advised NISI to take up greater responsibility for national planning and national development. He felt that NISI was not very active in advising the Government. However, Dr. Bhabha (1963) regretted that twenty years after its recognition by the Government as the premier scientific body "the Institute has not earned for itself the position in the life of the country, which it should have". Dr. T.R. Seshadri (1969) also advocated greater interaction

with the Government, Like Prof. Seshadri, Dr. R. Atma Ram (1969) while emphasizing the role of the Academy *vis-a-vis* the Government found Academy's involvement to be marginal. Prof. Seshadri pointed out that "Although as early as 1945, the Government declared NISI as premier Science Academy in the country, consultation of the Institute by the Government has been sporadic and half hearted". In his Presidential Address Dr. Atma Ram (1970) expressed the need for formulating and communicating views to the Government.

Dr. R. Ramanna (1977) said, "that in the interest of science in India, scientific bodies like INSA must strongly express their views in formulation of Science Policy and the organization and administration of science, otherwise the very need for their existence will only be a very minor one".

As mentioned earlier, Prof. Menon (1981-82) strongly advocated that the Academy should provide well researched objective opinion on issues of national importance related to science and technology like the Royal Society or the US National Academy does. Needless to mention that during its 1992 meeting on the "Role of the Academy" the need for INSA to provide such reports to the Government on its own initiative, even if not requested by the Government, was advocated by a number of speakers.

In recent years, the Academy has prepared statements on subjects like Animal Experimentation, Compulsory Iodination of Salt and Science Education in India, GM Foods etc. In addition on the request of the Government it provided advice on draft Manual of Patentability Criteria, B.T. Bringle and on Higher Education in Science and Technology for the Planning Commission. Following the release of the Academy Commissioned Report, "Science in India", it was felt that INSA should bring out such reports on a regular basis. In his 2001 Presidential Address Prof. G. Mehta suggested that the "Academy should bring out every two years a report on "Health of Science in India". More recently at the time of release of the special publication, "Science in India: Achievements and Aspirations", the Hon'ble Minister of Science & Technology Shri Prithvi Raj Chavan suggested that the Government will be keenly interested and fully

support the efforts of INSA to bring out yearly a compilation of contributions of Indian Science. This would not only help in wider circulation of this information both nationally and internationally, but it will also help the Government in formulation its plans and programmes based on reliable data”.

Comment: The Academy has not yet formulated its policy on the subject. It is interesting to note that the Founding President of the Academy, Dr. L.L. Fermor while discussing its functions stated, “In addition we propose to resuscitate in a different form the labours of the Board of Scientific Advice, by publishing annually - A Review of the Progress of Science in India”.

It is interesting to note that in the earlier years the Government often sought the opinion of the Institute on such issues. Some of the examples are:

- a) Immediately after the inauguration of NISI in 1935, the Government of India (Indian Office London) approached its first President Dr. L.L. Fermor if NISI could help in development of scientific methods for crime detection.
- b) NISI supported the efforts of the Geological Survey of India in installation of seismographs by setting up a sub-committee on Seismology which later became the Indian Research Council for Seismology
- c) NISI was requested by the Department of Scientific and Industrial Research (London) to coordinate the Investigations on Natural Illumination
- d) In 1943, the Government requested NISI to undertake preparation of a National Register of Scientists on the lines prepared by the US & UK. Prof. P.C. Mahalanobis and Dr. S.P. Agarkar supervised this activity till 1949 later transferred to the Department of Scientific and Industrial Research. NISI provided inputs for creation of the Anthropological Survey of India, construction of multipurpose dams in different parts of India, Deterioration of river fisheries etc. (For details see **Annexure VII(a)**).

It may be mentioned that traditionally British Government holds the Royal Society, in great esteem and often seeks its opinion on many policy issues, not that it always accepts its views as gospel. On the other hand, even if its opinion is not sought, if the Society considers it an important issue, it on its own prepares a well-studied and discussed report and forwards it to the Government. Lord Todd one of the past Presidents of the Royal Society summarized the role of academies thus, “In addition to promotion of excellence and responsibility of international scientific relations, there is finally an important function for the national academies as advisors to government an Academy should have an important role in policy making”. Thus the Royal Society in 1986 established a Science Engineering Policy Study Unit. Sir Micheal Atiyah, another President of the Royal Society in an interview, commented that, “The Society itself has become more and more involved in scientific policy at national level”.

Although a private body, the US National Academy of Sciences, by tradition, has a somewhat special relationship to the federal government. The Academy has evolved an organization and a set of procedures by which the intellectual resources of the entire national scientific and technological community are made available to the process of the government, yet remain independent of the government.

Emilio Q Daddario¹⁵, Chairman of Board of American Association for Advancement of Science (AAAS) in his Introductory Remarks at the Asian Regional Seminar on “Contributions of Science and Technology to National Development” organized by INSA in 1978, remarked, “We, therefore have a necessary responsibility to inform, recommend and influence scientific and technical decisions made at the governmental level. We must examine and design new options and strategies in the utilization of science and technology aimed at meeting the basic, social, economic and human needs of the majority of people”.

¹⁵Emilio Q Daddario in Contributions of Science and Technology to National Development: Proceedings of the Asian Regional Seminar, held at INSA, New Delhi, October 4-6, 1978.

Prof. J.A. Bernard, President of the French Academy of Sciences in an address in 1980 remarked that in the twentieth century the Academy became a place where science was recorded and discussed. However he added the second function is that of a government advisor.

The Charter of the Royal Society of Canada includes, “providing a pool of expertise as a source of non-political, disinterested and independent advice for government and other bodies” among its other functions.

Among the several objectives of the Royal Swedish Academy of Sciences (established in 1739), is “to act as a voice of science and influence research policy priorities”. Among the stated objectives of the Australian Academy of Sciences (Founded 1954) is to publish science policy reports and to make submission to the Government ministers and parliamentary inquiries. President of the Academy is an *Ex-officio* Member of the Prime Minister’s Science, Engineering and Innovation Council.

In China, Russia and most East European countries the Academies are virtually government bodies, no doubt carrying a great prestige and varying degree of autonomy.

One of the important objectives of Inter Academy Panel (IAP - renamed as The Global Networks of Science Academies) was to encourage national academies to develop expertise for playing a role in policy planning. Several multi-academies programmes were initiated for this purpose like those on science education, mother and child care, S&T for megacities, GM foods etc.

From time to time INSA has produced a number of reports dealing with Policy Issues and has submitted these to the Government (See List – **Annexure VII(b)**). However, it is hard to say if these really had an impact on national science policies. Of course, in many committees appointed by the Government to formulate national policies and programmes INSA Presidents and Fellows were invited as Members in their individual capacity. Thus Dr. Bhabha and Prof. Menon played an important role

in formulation of the National Science Policy and the Technology Policy of India. Several Fellows of INSA contributed significantly to the S&T Policy enunciated in 2003.

With the burgeoning of the various science departments, commissions, advisory groups and structures like SACC, SAC PM, PSA, Member Science in Planning Commission, (and earlier similar bodies like NCST), one has to sincerely consider as to what could be the niche role for INSA in this respect. However, a few years ago, on the initiative of Prof Vijayan the Academy established a nucleus for such activities in the form of a Science Policy Cell. In this regard, it is worth-quoting Prime Minister Dr. Manmohan Singh’s statement while inaugurating the Platinum Jubilee of the Academy 2009. “Indian scientists did solve many pressing national problems. INSA had played a major role in this process. We value its role as an apex body advising the Government and the country on issues related to the development of science and technology”.

c) To Act as a Body of Scientists of Eminence for the Promotion and Safeguarding of the Interests of Scientists in India and to Present Internationally the Scientific Work Done in the Country

It is regretted that with regards to the promotion and safeguarding of the interests of scientists in India the Academy has hardly played any role. Prof. A.K. Sharma in his Presidential Address (1983) acknowledged as much: *one of the important issues in which I hope you will agree with me is that the Academy, as a body of scientists has not yet looked into the problems of status of scientists in the country, particularly safeguarding their interests. This is a vital issue to which the Fellowship should give a serious thought.*

However, INSA continues to play an important role in supporting presentation of scientific work done in the country internationally. This is done through the ICSU-National Committees, sending delegate to various ICSU sponsored conferences, symposia, seminars, nominating Indian scientists, both senior and junior, under the Inter-Academy Exchange

Programmes, (approx 100 per year), organizing bilateral seminars and symposia with other collaborating academies with 57 such Science Academies/organisations in 49 countries. This is supplemented by exchange of publications with other academies.

d) To Act Through Properly Constituted National Committees, in which other Learned Academies, Societies may be Associated for Undertaking Scientific Work of National and International Importance which the Academy may be Called Upon to Perform by the Public and by the Government

Academy has never been asked to perform any such activity. Even, otherwise, as constituted the Academy is hardly the place where such work could be carried out. No doubt many Fellows of the Academy in their individual capacity perform such activities. It is, therefore, desirable for the Academy to consider whether to retain this as one of the objectives of the Academy.

e) To Publish Such Proceedings, Journals, Memoires and other Publications as may be Found Desirable

The publications of the Academy include: *Proceedings of the Indian National Science Academy, Indian Journal of Pure and Applied Mathematics, Indian Journal of History of Science*. In addition, the Academy publishes Monographs, Proceedings of Seminars and Symposia, and Biographical Memoirs of the deceased Fellows of the Academy. From time to time the Academy publishes commissioned status reports on selected subjects prepared by distinguished Fellows.

The Academy has also been publishing, “State of the Art” reports from time to time. Thus, in 1984, at the time of the Golden Jubilee several reports were commissioned. **Annexure X** shows number of such reports and special publications published during the years 1983-2013. In addition the National Committees of ICSU produce reports for submission to ICSU. On the face of it, these appear to be not so trivial contributions. It is also true that not all of these publications could be considered to

be in depth, erudite reports enhancing the image of the Academy. Furthermore, it is not obvious as to their impact on national policy making, promotion of science in the country or even projecting the image of Indian Science either nationally or internationally.

The Academy should aim at a more systematized, regular publication of such reports of high scientific merit on subjects of national and international relevance by providing well researched and debated views to help inform the scientific community and public at large and wherever possible for influencing Government policies and programmes. Not only should these reports be of the highest scientific merit but should be timely in appearance and made widely available to those they are aimed at.

It needs to be mentioned that inspite of repeated efforts, the Academy Journals have not attained the quality expected from an Academy of such long standing. It is regrettable that its distinguished fellowship still prefers to publish its best work in international journals. Prof. D.V.S. Jain who had been our Editor of Publications commented on the poor standard of our publication, *I am sorry to say that publications of INSA do not bring any glory to the Academy. Barring a few exceptions, they are not even second rate or even third rate publications.*

Special efforts are required to change this mind-set of our Fellows and other scientists in the country even though earlier efforts have not been very successful.

An area where the Academy is consistently producing valuable literature is the Indian Journal of History of Science established in 1965 and other related publications by the Indian National Commission of History of Science. These include, *The Concise History of Indian Science, History of Medicine in India, History of Astronomy in India, History of Technology in India (3 Volumes), History of Metallurgy in India* etc. It has also published *Caraka Samhita* (a scientific synopsis), *Susruta Samhita* (a scientific synopsis), & *The Sulbha Sutra*. More recently it has published a volume on *Sunya* and another on *Growth of Scientific Periodicals in India (1788-1900)*.

It is a matter of concern that inspite of repeated efforts the Academy has not been able to collect archival material related to the development of Indian Science and Technology since Independence. Valuable information is being lost with the passing away of the architects of this development. Though the Academy has initiated a programme during the last two-three years, it has yet to take up this task seriously.

f) To Produce and Maintain Liaison Between Science and Humanities

Dr. L.L. Fermor in his Inaugural Address to NISI stated, "One of our purposes should be to promote and maintain a liaison between men of science and men of letters". Prof. G. Mehta in his Presidential Address in 2001 proposed the creation of a panel of scientists and social scientists to interact. Considering that the Academy from its inception has talked about its responsibilities towards the society (formally discussed in 1992 special symposium) it has strictly maintained its distance from the social scientists. Prof. D.S. Kothari in his Presidential Address (1974), "Human Implications of Science" discussing "Spirit and Youth" concluded, "There is a real need for a philosophy of human implications of science. To this India, in years to come, could and we hope would, make distinct and enduring contributions. To understand the human implications of scientific advances, and to reflect that *understanding* in policies and programmes, it is to bring about a transition from science and technology at the expense of man to science and technology for man: From non-humanistic to humanistic technology. This may perhaps appear a dream today, but then today's dream is often the reality of tomorrow. That is the most inspiring, unforgettable lesson of science". Even though some science academies exclude social scientists from their Fellowship others have social scientists as their integral part, as for example Americal Academy of Arts and Science, Royal Danish Academy of Sciences and Letters, Israel Academy of Sciences and Humanities etc.

I personally feel that the Academy should seriously deliberate on this issue. Not only are there

several disciplines in humanities which use mathematics and scientific approach in their research, but subjects like Ethics in Science or Philosophy of Science should not be left to ethicists or philosophers.

This brings me to a related issue not specifically mentioned in the stated objectives of the Academy but repeatedly mentioned by most Past Presidents and discussed many times in the Academy.

5. SCIENCE AND SOCIETY

Our founding father discussing about, "Science and Nation: Involvement of Science in the Nation's Health" proposed that "..... science and technology are assuming increasing importance in our life. The Academy should try and enable the scientists to play a proper role in the planning, development, propagation and utilization of science in the resuscitation of our struggling economy and the emancipation of our people". Several of our Past Presidents advocated this view (L.L. Fermor 1935, M.N. Saha 1938, J.C. Ghosh 1943 & D.N. Wadia 1946. In this regard I cannot help but to quote from the 1938 Presidential Address by Prof. M.N. Saha:

If we desire to fight successfully the scourge of poverty and want, from which 90% of our country men are suffering, if we wish to remodel our society and renew the springs of our civilization and culture, and lay the foundation of a strong and progressive national life, we must make the fullest use of the power which knowledge of Nature has given us. We must rebuild our economic system by utilizing the resources of our land, harnessing the energy of our rivers, prospecting for the riches hidden under the bowels of the earth, reclaiming the deserts and swamps, conquering the barriers of distance and above all, we must mold anew the nature of man in both its individual and social aspects, so that a richer, more harmonious and happier race may dwell this great and ancient land of ours. Towards the realization of this ideal, we must adapt ourselves to the new philosophy of life and train the coming generation for the service of the community in scientific studies and research. Dr. D.N. Wadia (1946) considered yet another role for the Academy, "Scientific societies

and academies in India have therefore an extra mission to perform of spreading the gospel of science in all the corners of India. They should, besides their legitimate functions towards their avowed branches of specialized science, ungrudgingly take upon themselves the tasks of raising science to the level at which it flourishes amongst all ranks of the people in culturally and industrially advanced nations”. Both M.N. Saha and P.C. Mahalanobis advocated the role of the Academy in economic planning, Dr. Bhabha in his Presidential Address (1963) highlighted his concerns about the problems of human welfare of our people in general and the issues related to population which required the attention of the Academy¹⁶.

Dr. S.S. Bhatnagar in his address (1948) soon after independence reminded the Fellowship, *Although scientific research is a search for truth for its own sake it will be considered an expensive luxury and no exchequer will vote funds for it unless results of practical utility or for reducing suffering or poverty were the outcome of our investigation.* Dr. B.P. Pal (1977), remarked, *But at the sametime the Academy does have the most valuable resources of having within its fold, many of the most able scientists of the country and it should be able to play a catalytic role in seeing that the fruits of research are channelled, without loss of time and in most effective way to the millions in our country who are in need of it.*

Dr. Martin Rees, President of the Royal Society writing on the subject of, “The Royal Society’s Wider Role” at the time of its 350th anniversary stated, “Today’s scientists, like their forebears, probe nature and nature’s laws by observation and experiment, but they should also engage with the needs of society and with public affairs. such engagement is needed more than ever before, and on a global scale”. Harriet Wallberg – Henriksson, President of the

Karolinska Institute, Sweden, expressed that, “It is my firm believe (sic) that we, who represent the scientific community, have a responsibility toward society to utilize our knowledge and our resources in such a way that we can build a healthier, better and safer world”.

Pandit Jawaharlal Nehru, an Honorary Fellow of the Academy, repeatedly emphasized the need to cultivate scientific temper in the country as a whole. Presenting The Scientific Policy Resolution to the Parliament in 1958 he posited, “The dominating feature of the contemporary world is the intense cultivation of science on a larger scale, and its application to meet a country’s requirements. It is this, which, for the first time in man’s history, has given to the common man in countries advanced in science, a standard of living and social and cultural amenities, which were once confined to a very small privileged minority of population”.

The 1999 Declaration on Science (Released at the World Conference on Science, Budapest) proposed, “The scientists should be at the service of humanity as a whole and should contribute to providing everyone with a deeper understanding of nature and society, a better quality of life and a sustainable and healthy environment for present and future generations”. And furthermore, “The practice of scientific research and the use of knowledge from that research should always be aimed at the welfare of human kind, including the reduction of poverty, be respectful of the dignity and rights of the human beings, and of the global environment and take fully into account our responsibility towards the present and future generations”.

In addition to utilizing application of S&T generated in the country (or even acquired from elsewhere) for national welfare, it is equally important to promote public awareness of what science and technology can do for them. Creating scientific temper, as so eloquently advocated by Pandit Jawaharlal Nehru, is an important societal activity which the Academy should participate in. The public attitude against use of S&T advances as observed recently in respect to use of atomic energy for national

¹⁶It is interesting to note that thirty years later in 1993, INSA played a critical role in organising the first ever conference of over 50 science academies of the World to deliberate on the complex problems of population at the Population Summit. Its views were then presented at the UN Conference on Population and Development held at Cairo in 1994 by the present author. This Conference also gave birth to the Inter Academy Panel.

development, introduction of genetically engineered food or even universal immunizations are just a few examples of public concern in need of studied objectives information. Instead of individual scientists it is the Academy whose voice is more likely to remove such fears. Jean Salenson, President of the French Academy recently said, "Academies should make science and scientists better understood", while Peter Lachman of the Royal Society expected the Academies "to tell it as it is". (Concluding Session Platinum Jubilee, INSA, Kolkata 2012). With the proliferation and easy availability of uncontrolled or pseudoscientific information on electronic media, it is important that science academies should provide evidence based information to the society as well as to the government and policy makers.

SAC-PM in its 2010 publication, India as a Global Leader: The Way Forward stated, "What is needed in addition is that first, the science that is generated is of high quality, and second, it helps in tackling the numerous problems of Indian Society and state, and indeed of mankind as a whole ".....".

The Academy has in recent years initiated some activities *vis-a-vis* the society but this needs to be pursued with much greater commitment.

6. ACADEMY AND ITS INTERNATIONAL PROGRAMMES

Although not specifically mentioned as an objective of the Academy, going through the addresses by our Founding Fathers it is evident that they were concerned with projection of Indian science internationally and provide an opportunity to Indian scientists for a greater interaction with those elsewhere. The very first international involvement of NISI was, not surprisingly, with the Royal Society, London. Thus, in 1943, a delegation consisting of Prof. A.V. Hill, Secretary of the Society alongwith Prof. J.D. Barnal and Dr. Zuckerman participated in a symposium on "Post – War Organization of Scientific Research In India". The President of the Royal Society sent a message to NISI as follows:

"I am asking Prof. Hill to transmit, through you, Mr. President (Prof. J.C. Ghosh¹⁷), the cordial greetings and friendly sentiments of the Fellows of the Royal Society of London to the Fellows of the National Institute of Sciences of India. We have the confident hope that one of the results of Professor Hill's visit will be to strengthen the bonds of understanding and true comradeship between our Indian colleagues and the men of science of this country".

Prof. Hill, who stayed back in the country for nearly an year as Advisor to the Government of India "recommended to the Government that statutory recognition be given to our Institute as the body best suited by constitution and membership to assume the role of a national academy of sciences such as the Royal Society, the National Academy of Sciences (Washington), the Academy of Sciences of USSR (Moscow)". As a result the Government in 1945, decided to recognize the NISI as the premier society representing all branches of sciences in India.

In 1945, an Indian delegation led by Prof. Ghosh visited UK on the invitation of the Royal Society. The Government of India decided that, "the Indian Scientific Mission could, with advantage, also visit the United States of America and Canada so that their experience might become more useful for the post-war planning of scientific training and research in India".

(a) INSA and ICSU

ICSU the oldest body representing world's scientists established in 1899, later revived after the First World-War (1918-19), had one of its objectives to facilitate scientific interaction among the various countries. In 1930, the Government of India formally joined the International Research Council (as it was then known) and its five associated unions. This programme was then transferred to INSA in 1968 which became the adhering body for ICSU. Currently INSA is a Member of 19 ICSU unions and 7 interdisciplinary bodies (see Science in India:

¹⁷The name added by the author. It may be mentioned that it was the period of intense discussions between the British Government and the Indian political leaders regarding the future status of India as an independent nation.

Achievements and Aspirations 2010 for details). INSA, through its National Committees plays an active role in ICSU activities. It participated in the International Geophysical Year of 1957-58 and the International Conference on the Peaceful Uses of Atomic Energy.

INSA annually sends nearly 100+ delegates to various ICSU organized Conferences, Symposia, Workshops etc. In addition INSA itself organizes ICSU programmes in India. Distinguished Fellows of INSA are elected to the office of various unions as Presidents, Vice Presidents and Members. INSA had the privilege to have two of its Past Presidents – Prof. M.G.K. Menon and Prof. G. Mehta as Presidents of ICSU.

INSA took the responsibility of executing the COSTED (Committee on Science Technology and Engineering for Development) programme of ICSU from its inception. However in 2002, ICSU discontinued this programme. In 2005, INSA decided to revive this programme and established CCSTDS (Centre for International Cooperation in S&T among Developing Societies) to promote interaction with other developing countries. This has since been renamed as Centre for International Co-operation in Science (CICS). The programme of the Centre involves organizing training/workshops on topics of emerging importance including Science Policy, encouraging exchange of information, science communication. A variety of programmes conducted in recent years are:

- INSA-CSIR-DAE/BRMS-ISRO-Microsoft Research GMDC-CCSTD Travel Fellowship.
- JNCASR-CCSTD Fellowships for Developing Countries
- INSA-JRD Tata Fellowship Programme for Researchers/Scientists from Developing Countries
- DST sponsored Research Training Fellowship for Developing Country Scientists (RFTDCS)
- DBT-TWAS Post-graduate and Post-doctorate Biotechnology Fellowship for researchers from developing countries.

Over the years INSA has established bilateral programmes of co-operation with 57 science academies/organizations in 49 countries – the oldest one being the Royal Society, London¹⁸. Many of these programmes promote exchange of scientists – both senior and young – on reciprocal basis. In addition with several of these academies joint seminars, symposia and workshops are organized in India and the country of the collaborating academy. In some cases even joint research projects are undertaken. Such activities in recent years are listed in **Annexure VIII**.

On the initiative of INSA a regional Inter-Academy Body – Federation of Asian Scientific Academies and Societies (FASAS) was established in 1984. The Federation included 14 scientific academies/societies of the Asian region. It provided a platform to discuss and collaborate on S&T programmes of regional interest. In the year 2012 FASAS merged with AASA (Association of Academies of Sciences in Asia). The body is now known as AASSA (Association of Academies and Societies of Sciences in Asia). INSA played an important role in the establishment and programmes of TWAS – the Academy of Sciences for the Developing World (formerly known as the Third World Academy of Sciences). It was established in 1983 to promote South-South and South-North Co-operation for promotion of S&T in the developing world. Prof. Menon was its founding Vice-President, Prof. C.N.R. Rao has been its President and Dr. D. Balasubramaniam its General Secretary. INSA has during the last decade hosted its General Assembly twice.

As mentioned elsewhere the Inter Academy Panel on International Issues (IAP) now known as the Global Network of Science Academies had its birth at INSA, as a follow-up of the Population Summit in 1993. It is a global network of more than 100 merit based science academies for mutual consultation and joint action on S&T issues of global or regional concern. Prof. P.N. Tandon along with Prof. Sherwood Rowland of US National Academy

¹⁸See Year Book of the Indian National Science Academy 2013

of Sciences were its Founding Co-Chairs. INSA actively participates in all its programmes and has been a Member of its Executive Board since its inception. To act as its executive arm and to provide scientific advice to international organizations, the Inter Academy Council was established. Prof. Tandon was a Member of the committee which drafted its constitution. Prof. G. Mehta and Prof. Bruce Alberts were its Founder Co-chair. INSA through its Fellowship contributed significantly to four of its initial major studies – “Inventing a Better Future – A Strategy for Building Worldwide Capacities in Science and Technology”; “Realizing the Promise and Potential of African Agriculture”; “Women for Science”; and “Lighting the Way: Towards a Sustainable Energy Future”.

(b) Comments Regarding Fellowship

At its inception the founders of NISI laid down the guidelines for the election to its fellowship thus, “After full discussion, the Academic Committee decided that our new body should have a membership sufficiently restricted to make it a distinction to belong there to, but at the sametime not so limited as to prevent us having at our disposal a useful volume of scientific experience and ability” (Fermor 1935). Beginning with 125 Founding Fellows, the Academy today has 868 Fellows. The Guidelines for Selection of Fellows are provided in the Regulations, “The primary criteria for election to the fellowship which is restricted to Indian citizens will be scientific and technological achievements of the nominee (e.g. contributions to new knowledge, new discoveries, development of new technologies, substantial improvements in existing technologies etc.)”. In addition “Persons, who, in the opinion of the Council, have either rendered conspicuous service to the cause of science or whose election would be of signal benefit to the Academy could also be elected to the Fellowship”.

There is another category of Fellowship that is Foreign Fellows, restricted to foreign citizens. This includes Non-resident Indians holding dual passports. As a rule, to qualify for election to the Foreign Fellowship the scientist should be a Fellow of the Academy of his/her Country.

The Academy has maintained high standards for election to its Fellowship. It has come to be recognized as the highest mark of distinction for an Indian scientist. Notwithstanding a rare controversy, by and large the selection process is objective, transparent and based on a rigorous process.

SOME FACTS ABOUT THE ACADEMY IN THE LAST DECADE (2005-2014)

Fellows Elected:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number	26	21	25	21	29	30	34	32	35	34
Average Age	54	54	53	53	55	53	54	55	55	57

There are, however, some concerns as expected for any such highly selective body, which remain under constant review. As mentioned earlier, Dr. H.J. Bhabha in his Presidential Address (1963) pointed out, *While it is said that the National Institute has in its Fellowship some of the best scientists in India, the fact remains that there is a very considerable number of very good young scientists who are not among its Fellows.*

It is a matter of concern, that from a S&T pool as large as we have in the country, the Academy during 2004-2009 was unable to elect the maximum numbers (30) permitted for a given year. Furthermore the average age at the time of election still remains above 50 years (52.54 years). It is therefore not surprising that the average age of our current Fellows is 65.77 years and nearly 17.2 per cent of them are 80 years or more in the age (150 out of 868). This no doubt has its own consequences for the Academy, if its Fellowship was not to remain an Honorific entity but is expected to contribute actively towards its stated objectives.

Dr. V.G. Bhide¹⁹, at the 1992 Discussion Meeting on the Role of Academy pointed out, “The increase in the age at which a fellow is inducted is growing faster than the rate at which longevity is increasing. The

¹⁹V. G. Bhide: Comments in “Role of the Academy: Agenda for Next Decade Indian National Science Academy, New Delhi, 1993 pp 18-24

curves will intersect in 2025. At that time a scientist will be elected as the Fellow of the Academy when he is on death bed. This has very serious implications, chief among them is that the Academy will be increasingly representing science of the past rather than science of the day or the future”.

There is also concern about the poor representation of scientists from our universities among the Fellowship. Thus during the last decade, among the 287 Fellows elected there were only 60 from the universities. As mentioned earlier Prof. B.R. Seshachar (1973) in his Presidential Address mostly devoted to “Science and the Universities” remarked, *The picture that emerges from this analysis is a dismal one, and the only institutions in the country, devoted to the great mission of transmission of knowledge lie in disarray, and not only science, but all scholarship is at a discount in the country because the fountain head of the knowledge, the Universities, are suffering from neglect and decay.* It is a matter of shame that, four decades later instead of improvement the condition seems to have deteriorated.

The role Academy could and should play in remedying this situation needs serious discussion. Prime Minister Dr. Manmohan Singh in his Address at the inauguration of the Platinum Jubilee of the Academy on 10 January, 2009 advised, *I expect institutions like INSA to reflect on ways to combine expansion with excellence. At the same time it is important that we raise the standards of science teaching and research uniformly so that we are not left with islands of excellence in vast sea of mediocrity.*

There is another group which is poorly represented in our Fellowship that is the women scientists. Among 868 Fellows, there are only 52 women scientists. This inspite of the fact that the Science Policy Resolution 1958 advocated, “To ensure that creative talent of men and women is encouraged and finds full scope in scientific activity”. There are several sectional committees which do not have even a single woman scientist.

As per the guidelines for election mentioned above the major emphasis during selection for

Fellowship continues to be quality of S&T contributions. This has led to an overemphasis on publications in journals with high impact factor, citation index, H-index etc. This tends to overlook the societal relevance of the research contributions. Scientists and technologists working in organizations concerned with national security e.g. defence research or space organization who may not be able to publish or patent their research contributions for security reasons tend to be overlooked owing to the selection process dominated by these two parameters. Similarly scientists working in professional fields like medicine, engineering, agriculture, who devote considerable time for service delivery are unable to devote as much time to basic research as those working in laboratory based disciplines. Thus researchers working in the field of biochemistry, biophysics, molecular biology, biotechnology, proteomics or nanotechnology etc, even with little obvious practical application, often unable to compete in the parent disciplines, get preference over those with much more valuable clinical, epidemiological or field studies in sections like medicine or agriculture sciences. Eventhough in recent years efforts have been made to provide for scientists working in interdisciplinary areas by creating separate sectional committees somehow they continue to face difficulty in being elected.

Undeniably election to the Fellowship of INSA, the most coveted recognition by scientists, remains one of the most important functions of the Academy. While recognition of excellence remains the professed goal, the measures to assess it primarily based on research publications, the impact factor of the journals and their citations index have become fashionable. There is enough evidence to say that these cannot be and should not be the sole criteria for election to the Fellowship²⁰⁻²³.

²⁰⁻²³Adler R *et al.* (2008) A report from the International Mathematical Union (www.mathunion.org/publications/report/citationstatistics)

Seglen PO (1997): BMJ 15;314,418-502

Editorial: *Nature* 2005,435,1003-1004

San Francisco Declaration on Research Assessment: ASCB (2012)

William James once remarked, *Many persons now a days think that any condition must be scientific, if the arguments in favour of it are derived from the twitching of frog's leg – especially if the frogs are decapitated and that – on the other hand – any doctrine chiefly vouched for by the feelings of human beings – with heads on their shoulders must be benighted and superstitious.*

While the number of research publications and their quality are useful parameters, solely relying on them cannot be justified. It is often observed that those utilizing latest technologies or working in fashionable new areas are instinctively considered better than those dealing with taxonomy, phenomenology, classical physiology, behavioural science etc. It may be pointed out that relevance of research for societal needs or national development can in itself imply excellence rather than repetitive science using fashionable sophisticated technology.

No doubt these issues have been discussed in the Council from time to time but need to be studied in depth to arrive at a rational solution.

(c) Role of the Fellows

Election as a Fellow of the Academy has come to be regarded as an end in itself – an honorific title rather than a means to serve the objectives of the Academy. Frankly speaking from personal experience a majority of Fellows, after election hardly ever participate in the activities and programmes of the Academy. In a city like Delhi which can boast of nearly one hundred Fellows, there are only a handful to be seen even at important lectures, seminars, symposia. Similarly only a minority of Fellows, (even those extensively publishing abroad) contribute to the Academy publications. Requests for contributions to special multidisciplinary books, monographs, reports fail to receive any enthusiastic response. While most of them would blaim the low impact factor or visibility of our publications as the reason for not contributing to these little realizing their own responsibility to remedy the situation.

7. POINTS TO PONDER (GENERAL COMMENTS)

The important question that needs to be considered in the changing national and global milieu is whether we need to *redefine our ultimate goal* as the apex science academy of the country supported and financed by the people of the country. I consider that the ultimate goal of an academy like ours no doubt remains to promote and recognise excellence in S&T in the overall interest of the country, providing for its security, its economy, its development, its cultural values, safeguarding its environment and promote and protect the health of its people. In this endeavour it should aim to enhance its standing among the *comity* of nations. This should not be interpreted to imply any less importance for high quality ‘fundamentals’, ‘basic’, or ‘Blue-Sky’ research.

The context in which we do our science has changed. As former Secretary General of the United Nations Kofi Annan inaugurating the World Science Congress (1999) exhorted the scientists, *to keep in touch with Society to attend to its hopes, needs and concerns*. Fredric Mayor, a former Secretary General of UNESCO remarked, *“Science can no longer avoid – and nor can we – the basic question of what and who it is for. Science today has acquired the ability to shape our lives, even to change life itself”*. The Science Declaration (1999), following the World Science Congress at Budapest, reiterated that, *The practice of scientific research and the use of knowledge from that research should always aim at welfare of human kind, including reduction of poverty, be respectful of the dignity and rights of human beings, and of the global environment, and take fully into account our responsibility towards the present and the future generations.*

INSA has often been blamed to function as an inward looking, closed door, elite club primarily for recognizing excellence, not even for promoting it. Those who succeed ‘entering’ it themselves become an impediment for others to enter. This may be too harsh a criticism, nevertheless this image needs to be countered as far as possible. It is becoming obvious

that science can no longer be viewed as a pleasant pursuit of an intellectual elite, busy in satisfying their curiosity supported by public fund, unmindful of its social relevance. If this is true for individual scientists it is even more so for a corporate body of scientists like an Academy. While search for fundamental principles or purely curiosity driven research is often assumed to be real science, researches to solve difficult developmental or societal needs, often entailing high intellectual rigour, should not be devalued.

One of the stated objectives of the Academy was Promotion of scientific knowledge in India including its practical application to problems of national welfare. In practice recognition rather than promotion of scientific knowledge seems to have received greater attention. Special efforts are required for promotion and recognition of science particularly the kind required for its practical applications to solve problems of national development and societal welfare and where possible to participate in efforts to meet the emerging global concerns.

The Academy from its inception was presumed to play an important role in respect to S&T activities (policies, programmes, expert advice) – of the Government. Most well established Academies include this function as one of their important objectives. INSA from time to time has performed this function either on the request of the government or on its own initiative. It must, however, be recognized that these efforts at best have been sporadic and half-hearted. Compared to the role the Royal Society or the US National Academy of Sciences play in this regard, INSA has played only a limited role. Prof. M.G.K. Menon in his presentation at the 1992 meeting on Role of the Academy summarized the situation succinctly, *There is no impact of the Academy or its activities on Government, on society, or the way science develops or is nurtured in the country.* Prof. G. Mehta (2000) referred to our *lack of success in respect to interaction with the government* even though during his term as President a couple of reports – Animal Experimentation, Compulsory iodination of salt – were sent to the Government. More recently Prof.

M. Vijayan (2009) while acknowledging that *The Academy enjoyed considerable prestige (But) The Prestige needs to be converted into influence we would like to strengthen our role as a think – tank in the service of the nation on science-related issues.* It is important for the academy to provide evidence based information to the society in general and policy makers and administrators in particular. Academies should “tell it as it is”, the burden for decision no doubt rests with the policy makers. On the other hand, if strong evidence exists the academies should not hesitate to pronounce it even if it is against the common belief or the stated policy of the state. In 2010, as a part of the Platinum Jubilee initiatives Prof. Vijayan commissioned a group of comparatively young scientists to prepare a draft vision document for Indian science with Prof. L.S. Shashidhara as the Convener.

A few years ago, the Academy established a Science Policy Study Cell under the supervision of a senior distinguished Fellow. However, in my considered opinion this requires not just “a cell” but a properly endowed, structured body with specially trained and committed “Policy Group” prepared to provide promptly policy alternatives and scientific solutions for critical national or international S&T related issues. At the sametime it should be forward looking, anticipating future developments of relevance to the country. The Academy thus has to be a “watch dog”, a “crystal gazer” and a “think tank” in respect to S&T related matters.

To achieve the above goals, one of the biggest challenges is to overcome the sea of indifference of our Fellows to participate in the programmes of the Academy and contribute to its objectives. It is a matter of concern that after their election to the Fellowship only a few Fellows participate, leave aside actively contribute to the programmes of the Academy. A *serious study is required to ascertain the cause of this apathy in sharp contrast to the eagerness to be elected.* As mentioned earlier the average age of the time of election is 50+, and the average age of the Fellowship is 65+. This may be one of the reasons of this indifferent attitude.

The ways and means of involving younger scientists in the activities of the Academy is vital – may be by creating a class of Associate Fellowship or better utilization of our Young-Scientist Awardees. It may be pointed out that such programmes have recently been initiated by the German Academy of Natural Scientists, Leopoldina by catalyzing the establishment of the “Young Academy” under its guidance but not supervision. Recently an International “Young Scientists Programme” has been initiated with the participation of several academies”. India is represented in this programme but without a formal involvement of our Academy.

There is an urgent need to consider if our criteria for election to Fellowship need to be revisited. There are a large number of NRI’s contributing to outstanding S&T abroad. The Academy need to reconsider its policy for involving more of them in its programmes specially those related to promotion of science in frontier areas. The present policy of the Academy is rather restricted in this regard. Likewise the Academy may like to review its existing, rather restrictive policy with regards to Foreign Fellowship. It may consider if another category i.e. Corresponding Membership would enhance our interaction with scientists abroad.

With the opening up of our S&T enterprise to foreign scientists it may be desirable to consider those who work in the country, for say ten years or more, to be considered for Fellowship. Currently the Fellowship is open only for Indian Nationals working in India. It may, however, be reiterated that none of this should dilute the criteria regarding the quality of S&T contribution.

The Academy in collaboration with other academies, has in recent years enhanced its activities in respect to promoting science education and research. It is a matter of concern that a career in science is not attracting enough numbers of bright young students. The attraction to professional and management courses is understandable, but the scientific community including the Academies, need to make special effort to encourage the young and

convince their guardians of the “excitement of science” as a career choice.

The Academy could review such programmes initiated by the USNAS and the French Academy to formulate one suitable for our needs. Increasing use of ICT including electronic media could be very valuable for this purpose. Instead of the ritual observed by many of our national laboratories to organize an “Open-House” once a year on their Annual Day or National Science Day, a better structured and somewhat longer visit to expose the young ones to the exciting work being conducted in these institutions will serve this purposes better. The Academy, through its Fellows, can play a catalytic role. The NCERT Science Talent awardees provide a preselected national pool for this purpose.

One of the urgent tasks for the Academy would be explore all possibilities to improve the existing deplorable state of most of our Universities. No doubt this is not going to be an easy task, yet in view of its national importance it cannot be left to its own fate.

An equally important, and may be even more difficult task is to attract and retain talented young individuals to science. This is no doubt a global problem but some of the advanced countries partly remedy this situation by attracting talent from countries like India, China, Philippines, Mexico etc. Efforts should be made to attract the large Indian diaspora abroad to contribute to our University system. Programmes like Visiting Professorship, Adjunct Appointments, Fellowships for delivering short-term courses could be formulated for this purpose.

One of the stated objectives of the Academy is, “promotion and safeguarding of interests of scientists in India”. Regrettably the Academy has done very little in this regard. This is a complex socio-cultural-economic problem which requires Academy’s wider interaction with social scientists, educationists, administrators and policy makers. Academy, with some justification, has always been shy of such interaction. There is a need to take a well considered view on this subject.

As discussed several times earlier the quality of Academy Journals needs serious efforts to improve. It lacks the stamp of an Academy's publications. Collectively the Fellows contribute to quite impressive number of publications in journals abroad. Given a commitment to the Academy, the Fellowship can certainly raise the standard of our own journals.

Hardly any effort has been made towards implementing its stated objective "to promote and maintain liaison between science and humanities". Considered a desirable objective by our founding fathers it is even more relevant today. Science today pervades all aspects of life, hence it is important to keep in mind its social impact. This alone is enough justification for our interaction with societal scientists. In addition their inputs regarding science policy, philosophy of science, history of science, ethical-legal and socio-economic (ELSI) implications of science, would help us in broadening the horizon of Academy's activities.

One of the objectives of the Academy is to secure and manage funds and endowments for promotion of science. Currently the Academy receives majority of its funds from the Government. It is true that so far the Government has been quite liberal and has not interfered with the policies and programmes of the Academy permitting it the desirable autonomy. It would still be desirable to work towards financial independence. This would be even more necessary if the Academy decides to enhance its participation in Government's S&T related policies and programmes which may entail a critical appraisal of the same. If not fully financially self-sufficient, we should have a sizeable endowment fund.

One area in which the Academy has done reasonably well in recent years is its international outreach. The number of foreign academies with which the Academy has programmes of co-operation – now 46 – provide valuable opportunities, not only to project Indian science internationally, but also to add value to it through bilateral and multilateral seminars, symposia and collaborative research. In addition, the Academy continues to play important role in the activities of ICSU, Third World

Academy (now The Academy of Sciences for the Developing World), IAP (now The Global Networks of Science Academies), IAC (now Inter Academy), FASAS-AASA (merged as AASSA (Association of Academy and Societies of Sciences in Asia), G8+5 (now G Science) etc. These programmes need to be strengthened and made more focused and directed to solve issues of national, regional or global concern where S&T can play a significant role.

INSA has been given the responsibility of managing the National Commission on History of Science. Over the years it has contributed valuable literature on the subject. In addition it supports scholarly studies by researchers from all across the country. However, these studies are primarily devoted to medieval period and that too mostly compiling primary source material. In spite of repeated efforts, it has failed to collect and study material concerned with evolution of Indian science in the twentieth century and even more so since Independence, which will no doubt be "History" tomorrow. A great opportunity has been lost in collecting archival material from the founders of science in India since Independence. We failed to collect historically valuable material from some of the free-India's science leaders – Bhabha, Sarabhai, Bhatnagar, Pal, Kothari, Ramalingaswami to name a few. There are others who fortunately are still with us, who are a store house of such material but notwithstanding expression of intent to initiate such activity – nothing worthwhile has resulted so – far. It is a pity that 75 years after the birth of the Academy, we still do not have its authentic and informative history till today. Hopefully as a result of some recent initiatives we shall soon remedy this deficiency. No doubt an archival cell has been established but this needs to be energized.

8. LOOKING AHEAD

Having its birth in an environment of Indian renaissance in the early years of the twentieth century it is no mean achievement that towards the end of the century when many, if not most, institutions, cultural, educational, scientific, were struggling to retain their

standards, INSA continued its journey not only unscathed but energised. It will be no exaggeration to say that the Fellowship of INSA to-day remains a cherished goal of most Indian scientists and INSA is recognised as the voice of Indian science globally. At the same time an honest introspection reveals that we have miles to go to achieve the status and standard of some of the most prestigious academies of the world.

The major tasks our founding fathers had envisaged, besides promoting and recognising excellence in the science, publishing high quality science, were its role in coordinating the activities of all science bodies in the country, provide inputs to Government for its programmes and policies for national development, project Indian science abroad, safeguard the interest of Indian scientists. As would be apparent from the foregoing account our success in achieving these objectives has been mixed.

The important question that needs to be considered in the changing national and global milieu is how to meet the challenges of the changing milieu. No doubt the primary objectives will remain unaltered but to meet the new challenges we may have to critically redefine our role. In the light of the foregoing review I consider that the ultimate goal of an academy like ours remains to promote excellence in S&T in the overall interest of the country, providing for its security, its economy, its development, its cultural values, safeguarding its environment and to promote and protect the health of its people.

In this endeavor it should aim to enhance its standing among the comity of nations. In addition keeping in mind the global problems facing mankind, it should contribute towards their mitigation, be it global warming or meeting the challenges to provide safe drinking water, nutritional security or provision of clean energy. In short the Academy should tailor its programmes to enhance our S&T capabilities to ensure the health, wealth, security and honour of the country.

Many academies, old and young, are redirecting their programmes beyond promotion of excellence

in S&T both for its inherent cultural value as well as its societal commitment. As mentioned by several of our Founding Fathers while removal of ignorance and exploring the nature and its underlying phenomena remain the primary objective of science and hence of the science academies, the fight against poverty, the worst social scourge, is its moral responsibility.

No doubt all academies have a tendency to be elitist, nevertheless they cannot flourish, nor discharge their responsibilities, by functioning in isolation. It is heartening to note that in recent years efforts have been made to have better interaction between the three science academies of the country which have similar, if not identical, objectives. This needs to be strengthened further. It is important that the Academy should seriously review its stand regarding greater interaction with social scientists and public on one hand and policy makers and administrators on the other.

The Declaration of Science (1999) following the World Conference on Science held at Budapest advocated, "A new relationship needs to be built between those who create and use scientific knowledge and those who support and finance it and those concerned with its application and impacts, such are the essence and the spirit of the new commitment". Most well established academies play an important role in providing inputs to their governments regarding S&T activities (policies, programmes expert advice).

With the proliferation of sources of information – scientific and pseudoscientific – often confusing and contradictory, not supported by objective data, specially on electronic media, it is important for the academies to provide evidence based information to the society in general and policy makers and administrators in particular. Academies are organizations which exert influence rather than power. While providing information the academies must not hesitate to indicate if existing knowledge is unable to provide an unequivocal advice. Academies should "tell it as it is", the burden of decision no doubt rests with the policy makers. On the other hand, if strong evidence exists the academies should not hesitate to pronounce it even if it is against the

common belief or the stated policy of the state.

With the establishment of various science departments, commissions, advisory structures directly providing inputs to the Government, the Academy should decide as to its niche role in this respect. Nevertheless it has been generally felt by most Fellows and Past Presidents that the Academy can and must play an important independent role for providing objective, impartial, well researched inputs on S&T issues of national importance. Ultimately it would be the quality of such inputs which would enhance the trust in the Academy both by the society and the government. The Science Policy Cell recently established by the Academy needs to be strengthened for this purpose. The Academy should have the competence, intellectual strength and a responsive machinery to provide timely well studied views on behalf of the S&T community on policies and programmes of the Government and inform public accordingly.

To achieve the above goals, one of the biggest challenges is to overcome the sea of indifference of our Fellows to participate in the programmes of the Academy and contribute to its objectives. It is a matter of concern that after their election to the Fellowship very few Fellows participate, leave aside actively contribute to the programmes of the Academy. A serious study is required to ascertain the cause of this apathy in sharp contrast to the eagerness to be elected. Ways and means must be found to encourage greater participation of younger scientists in achieving the objectives of the Academy. At the same time, those selected for “Senior Scientists” Programmes may be requested to spare some time to contribute to the broader objectives of the Academy while pursuing their scientific activities.

There is an urgent need to consider if our criteria for election to Fellowship should be revisited. There are a large number of NRI's contributing to outstanding S&T abroad. The Academy need to revise its policy for involving more of them in its programmes specially those related to promotion of science in frontier areas. The present policy of the Academy is rather restricted in this regard. The

Academy may like to review its existing, rather restrictive policy with regards to Foreign Fellowship. It may consider if another category i.e. Corresponding Membership needs to be created.

One area in which the Academy has done reasonably well in recent years is its international outreach. The number of foreign academies with which the Academy has programmes of co-operation – now 46 – provide valuable opportunities, not only to project Indian science internationally, but also to add value to it through bilateral and multilateral seminars, symposia and collaborative research. In addition, the Academy continues to play important role in the activities of ICSU, Third World Academy, IAP, IAC, FASAS, G8+5 etc. These programmes need to be strengthened and made more focused and directed to solve issues of national, regional or global concern where S&T can play a significant role. Recently there has been an increasing realization of the importance of this type of collaboration even among the scientifically well advanced societies. Thus one of the five strategic priorities of the Royal Society (2007-2011) was “to increase access to the best science internationally”. Discussing “The Royal Society's Wider Role”. Among the overall objectives of the Royal Swedish Academy of Sciences is to arrange international scientific contacts. Similarly the Australian Academy of Sciences considered “Creating opportunities for international scientific exchange”.

Neil Lane (2011) former Science Advisor to the US President felt, “our policies for managing science are in need of refurbishment, largely having been designed for a world that existed over a half-century ago”. Caroline Wagner (2011) elaborated it further. She pointed out, “Recognition of an important and undeniable trend; globalization of S&T affairs resulting in shift from a reliance on so-called ‘national systems in innovation’ to an emphasis on a series of new globally net-worked systems of knowledge creation and exploitation. She concluded that, “Tapping the best and brightest minds in S&T and gathering the most useful information anywhere in the world would greatly serve the economy and social welfare. Looking for the opportunity to collaborate

with the best place in any field is prudent, since the expansion of research capacity around the globe seems likely to continue". John Beddington, UK Government's Chief Scientific Advisor advocated a need for international networks that enable science advisers from different countries to learn from each others. One such forum established in 1991 is the Carnegie Group of Science Advisors from G8 nations which has recently expanded to include Brazil, China, India, Mexico and South Africa. INSA is represented in this group. In addition IAP and IAC represent another such networks at the level of the Academies. If INSA wishes to play an important role in such networks it requires to have a better internal setup for this purpose. It is obvious that if countries like the USA and UK now consider the need for such networking we in India require it even more. Academy should therefore prepare itself to play this role fruitfully.

INSA has been given the responsibility of managing the National Commission on History of Science needs to strengthen its capability to acquire interesting archival material with a futuristic outlook.

9. CONCLUDING REMARKS

The opportunity provided by the Academy to deliver this prestigious lecture prompted me to take a broader look of its objectives, its evolution, its current directions. These have been reviewed in the light of the aspirations of our Past Presidents. The Academy has undoubtedly travelled an eventful journey and has attained an enviable status both nationally and internationally. Yet like any dynamic institution it must review its objectives and activities to remain relevant in the changing milieu. Great deal has been achieved but undeniably much more needs to be done. Attempt has been made to highlight the achievements at the same time opportunity has been taken to point out some future directions, taking into account the role some of the other well respected academies elsewhere in the World play.

While I have quoted our Past Presidents frequently, it is not to imply that all the progress the Academy has made is solely because of them. Undeniable many have contributed in this colossal task. However the Past Presidents's lectures (published and unpublished) provided a rich source of information.

INSA has an opportunity to take-up new challenges. It has the capacity and resources to revisit its objectives, policies and programmes to meet the expectations of the people of the country who have unhesitatingly supported it. This will, however, be possible only if the whole of its Fellowship contributes to this goal.

Needless to say many of the suggestions and views expressed in this lecture are based on personal perceptions and informal discussions with other friends interested in the prestige of the Academy. However, it is hoped that this would promote a wider introspection and possibly discussion by the Fellowship to help the Academy achieve greater heights.

10. ACKNOWLEDGEMENTS

First and foremost, I would like to express my grateful thanks to the President and Council of the Academy to give me the honour to deliver this prestigious lecture. My special thanks to Prof. Krishan Lal for encouraging me to prepare this expanded version of my talk.

Thanks are due to several friends, Professors M.M. Sharma, M.G.K. Menon, S.K. Joshi, R.A. Mashelkar, G. Mehta and H.Y. Mohan Ram who pursued the initial draft of this talk and made valuable suggestions.

Mr. S.K. Sahni and Dr. Alok Moitra provided valuable help in providing necessary documents and statistics for this presentation. Thanks are also due to Shri Upendra S. Rawat for producing this final document.

Annexure I

Science in the Service of Society : The Indian Paradigm – An Open Letter to the President, INSA – Only Excerpts

By

PROF. V RAMALINGASWAMI

Past President, INSA

Dear Mr. President :

There is much to praise in India's scientific development since independence. The story has been told many times. The pay-offs from investments in science have been considerable.

I simply draw attention in this letter to some issues that had struck me as deserving of attention at this time, which reflect upon India's science policy to facilitate discovery and its application for individual and collective betterment of the quality of life of her people. India's greatest problem is not only facing the challenge of discovery but also in exploiting the opportunities of applying the fruits of science with equity and access to the people.

Science Policy Resolution

The Science Policy Resolution is a testament of faith of the Indian Parliament in the promise of science and technology as a lever of development. Generation of "scientific temper" amongst the people is its ethos.

Public Understanding of Science and Technology

The brighter side of science we witness in India today is due, at least in part, to past investments and past nurturing, driven by the spirit of Jawaharlal Nehru. We are in fact living on our past, so to say, in this regard. Maintaining and enhancing this advantage now and in the future before it fades away will require not only, vastly increased commitment and investment in science both fundamental and applied but also new and innovative ways of organization, management and nurturing of science. Literally a new paradigm of Science Policy will be needed. I believe that the promotion of Public Understanding of

Science and Technology is crucial at this time. This is the issue I wish to raise in this letter and ask whether INSA and other academies in the country are doing enough.

COPUS

Describing the COPUS initiatives in 1986 in UK he stated, "My idea is not to suggest xerox-copying these initiatives slavishly but rather to initiate thinking within the Academy and more widely outside as to how we in India can promote public understanding of science and the understanding by Parliamentarians and Administrators of prevailing science and technology issues that confront our society today".

"..... the question arises as to what extent these Government Departments and the Science Academies are addressing the issues related to public understanding of science and to generation of scientific temper as reflected in the two preceding paragraphs".

Government-Industry-Academy Round Tables

As for Industry-Science nexus, an issue of critical importance, Government-Industry-Academy Round-Tables of the type in existence in Australia and U.K. for example, might be worth looking into. Such Round-Tables provide opportunities for scanning the frontier sciences and for picking out promising areas that may have a future applicability and investment in which at an early stage would give an edge in technology generation and application.

India's planners are conscious that such growth, necessary as it is, must be accompanied by the fulfilment of basic human needs. How can the

economy be spurred through industrial development without trampling upon principles of social justice and endangering the environment?

The Greatest Need of Academies is to be Needed

Are Academies wanted or redundant in our country? Our Government supports them fairly liberally but does it use them purposefully? The academies are most suited for a reconnaissance of the developments at the cutting edge of science and their possible potential for industrial exploitation and advancement of human well-being. Academies have also the ability to mobilize at short notice the finest talent in the country to address any outstanding issue and to suggest possible solutions. They are our sources of most thorough and independent analysis, keeping national interest in view. To what extent the INSA and other Academies in India are being used by Government and their services requisitioned to provide objective information, rational analysis and suggestions on problems of import to national development?

There are, of course, considerable resources within Government, as I said earlier, with access to the scientific community but there is a distinct advantage to be gained by involving Academies with

their freedom and flexibility to render advice to Government. If the Academies wait for invitation from Government, they may have to wait for long before their usefulness can be demonstrated. Academies can take initiatives themselves.

To Foresee is to Govern

How to advance science in each of its numerous disciplines and components is a legitimate activity of scientific establishments, in particular of Academies. That will, of course, have to go on. The reductionist approach of science is a well tested method of advancing knowledge in a given special area in the shortest possible time, but there are those wider national issues of applicability, contextual appropriateness, public safety and economic advance which are also proper topics for Academies to reflect and advice upon. The wonder about India is that every conceivable issue would have been discussed at some time or the other! My intention in writing this letter is to stir discussion within the Academies and elsewhere for a fresh look; certainly not to paint an insensitive portrait of Indian Science, but rather to ask: how can science better serve Indian society?

With regards,

Yours sincerely

December 2010

Sd/-
(V. Ramalingaswami)
All India Institute of Medical Science
Ansari Nagar, New Delhi

Annexure II

Dr. N K NOTANI, F.N.A., F.A.Sc., F.N.A. Sc
Senior Scientist
Medical Group
Babha Atomic Research Centre
Trombay, Bombay 400 085

Tel.: Office : 551 03 23
Res. : 812 46 64

7th March 1991

Dear Dr. Tandon,

It was nice seeing you yesterday at the NII, New Delhi. I thought, there was fair amount of material in the presentations with potential for applications.

Switching gears, I was going to suggest that a **Small Committee is constituted by INSA which will keep a Watch on the Progress and Directions in Science to include initially Mathematics (including Computer Sciences), Engineering, Physics, Chemistry and Biology.** At the end of the calender year, compiler of each section would give a report which can then be edited by the Chairman of the Committee and presented to INSA President/Council. Its use could be made **of to orient and suppor the research directions in which the world may be moving.** Also, in a general way it may be good to know **what are the mainstreams of science.** May be something like the **Survey of Science that appeared recently in The Economist** (Copy enclosed).

With best personal regards.

Dr. P. N. Tandon
President, INSA
New Delhi 110 002

Yours sincerely,
Sd/-
(N.K. Notani)

Annexure III

UNIVERSITY OF POONA

PROF. V G BHIDE
F.N.A., F.A.SC.
Senior Scientist

DEPARTMENT OF PHYSICS
PUNE-411 007 (INDIA)
Gram : UNIPUNA
Phone : Office : 56061

Dte : 15th March, 1991

Dear Professor Tandon :

I am enclosing for your kind perusal a copy of the Presidential Address I delivered at the Annual General Meeting of the Maharashtra Academy of Sciences. In that address, I have made a few suggestions such as (a) to **explore the possibility of involving younger scientists** in the activities of the INSA by instituting either corresponding member of the Academy or some such suitable nomenclature, (b) **establishing and promoting state academies**, (c) INSA providing umbrella by adhering the State Academies and professional societies, (d) greater participation in the **formulation of public policies** on all issues relating to science in the country, (e) **organizing and expressing collective scientific opinion on all matters concerning science and scientists** etc. I will be glad to discuss some of these issues with you. Indeed, I would like that the Academy discusses these issues and take suitable action in the matter.

I have been concerned by the passive attitude of the Academy on various issues. The instance in point is the controversy concerning Leprosy vaccine, affairs in the Raman Research Institute etc. I do not know who is right or who is wrong in the Leprosy vaccine controversy but a lot is being written in newspapers. It is on such issues, I feel, **the Academy should take a stand by objectively and dispassionately going through the details of the issue.**

I am not sure whether I am transgressing my limit but I know a number of fellows are concerned about many a things I have mentioned. I am quite confident that under your enlightened leadership, the Academy will well and truly reflect the collective scientific opinion on all matters concerning science and scientists and become a true apex and premier scientific body actively participating in **policy formulations concerning science and technology, science and society, science education etc.**

With kindest regards,

Prof. P. N. Tandon
President
Indian National Science Academy
Bahadur Shah Zafar Marg
New Delhi 110 002

Yours sincerely,

Sd/
(V. G. BHIDE)

Annexure IV

भारतीय राष्ट्रीय विज्ञान अकादमी
INDIAN NATIONAL SCIENCE ACADEMY

प्रोफेसर जे. सी. अहलुवालिया

सचिव

Professor J. C. Ahluwalia

Secretary

बहादुरशाह जफर मार्ग

नई दिल्ली-110 002

Bahadur Shah Zafar Marg

New Delhi-110 002

No. CC/105/562

the 24 April 1991

Dear Sir :

As you are aware, the members of the Council will overstay in Kodaikanal on May 18, 1991. In this regard, I had already written a letter to all of you. The President, INSA, is keen to discuss the following items during our stay at Kodaikanal on May 18, 1991:

1. To consider the steps required to further the implementation of the Objectives of the Academy. (See Appendix I and II at pp. 1-13).
2. To consider an open letter received from Professor V. Ramalingaswami, Past President, INSA addressed to President, INSA. (See Appendix III at pp. 15-26).
3. To consider a letter dated 15th March 1991 **from Professor V G Bhide, FNA regarding the suggestions (See Appendix IV at pp. 27).**
4. To consider a letter dated 7th March 1991 regarding institution of Committees to keep a watch on the progress and directions in Science. **(See Appendix V at pp. 29).**

I shall be thankful if you could go through these documents and participate in the discussion on May 18, 1991 at Kodaikanal.

With best regards,

Yours sincerely,

Sd/-

(J.C. Ahluwalia)

Annexure V

भारतीय राष्ट्रीय विज्ञान अकादमी
INDIAN NATIONAL SCIENCE ACADEMY

Professor P.N. Tandon

President

बहादुरशाह जफर मार्ग

नई दिल्ली-110 002

Bahadur Shah Zafar Marg

New Delhi-110 002

No. CC/

the 22nd June 1991

Fellows of the
 Indian National Science Academy

Dear Fellow:

For past few years, there has been a growing concern “about the role of the Academy in the overall Science & Technology scenario of the country. In past, I have had discussions with a large number of Fellows at a personal level (a couple of times at a formal platform) on this issue. Very recently, I have received letters from Professor V Ramalingaswami, one of our Past-Presidents, Professor VG Bhide and Dr NK Notani expressing their concern, broadly, on the above issue and certain other related matters.

The Council at its meeting held at Kodaikanal devoted one full day on May 18, 1991 to review the steps taken by the Academy to fulfill the Objectives of the Academy as enshrined in our Constitution. The Objects of the Academy as formulated at the time of its Constitution are as follows:

- a) The promotion of natural knowledge in India including its practical application to problems of national welfare,
- b) To effect co-ordination between scientific academies, societies, institutions and government scientific departments and services,
- c) To act as a body of scientists of eminence for the promotion and safeguarding of the interest of scientists in India, and to present internationally the scientific work of India,
- d) To act through/properly constituted National Committees in which other learned academies and societies will be associated, such as the National Research Council of India for undertaking such scientific work of national and international importance as the Council may be called upon to perform by the public and by the Government,
- e) To publish such proceedings, journals, memoirs and other publications as may be found desirable,

- f) To promote and maintain a liaison between Science and Letters,
- g) To secure and manage funds and endowments for the promotion of science, and
- h) To do and perform all other acts, matters, and things that may assist in, conduce to, or be necessary for the fulfilment of the above-mentioned aims and objects of the Academy.

It was noted that

- (a) The Academy has not even attempted to have a debate, leave aside initiating actions, to implement several objectives assigned by itself in its Constitution,
- (b) The Academy has no mechanism to interact or provide considered view of the scientific community to those, at the helm of the affairs of the country and the parliamentarians involved in guiding the policies,
- (c) The Academy has never expressed considered opinion or views on any policy decisions taken by the Government in the area of Science and Technology. It has never taken any step to analyse the policy decisions or any issues related to S&T and how the particular issue/subject will affect the scientists and the people. It is true that Fellows of the Academy, have contributed significantly to and influenced the various policy making and implementing bodies of the Government in their individual capacity but the Academy as a body of eminent scientists has seldom been given this privilege to be represented in such bodies,
- (d) The activities of the Academy are totally funded by the public money and in return the society expects the contributions from such a large body of scientists towards development. Yet the Academy has done little in this direction.

The Council Members were requested to express their views on the following:

- a) Is there any need for the Academy to venture in these areas?
- b) If yes, what should be the specific areas in which the Academy should involve itself from now on.
- c) What mechanisms should the Academy follow for this purpose?

I am writing to you to seek your considered opinion on the above issues which will help the Academy in planning the future course of action.

With personal regards,

Your's sincerely,

Sd/-

(P.N. Tandon)

(Annexure VI)

Some Thoughts and Concerns of our Past Presidents*

Dr. L.L. Fermor (1935-1936) in his inaugural address to National Institute of Sciences of India (NISI – the forerunner of INSA) in 1935, highlighting the objectives of the Institute stated that, one of the aims of our Institute “is to provide a reservoir of knowledge and experience in all branches of science available for application in the study of scientific problems connected with general welfare of the country This means that, should the Government or any other organization require advice upon problems of scientific interest, they will be able to rely upon securing the best opinion available in India”.

Dr. Fermor considered that “one of the functions of our National Institute should be to act as the organising body like National Research Council of India”. He envisaged the Institute to “have as one of its major activities, the coordination of the labours of the various Academies”. (This referred to Asiatic Society and academies already existing at Allahabad and Bangalore). In addition he felt, “One of our purposes should be to promote and maintain a liaison between men of science and men of letters”.

Prof. M.N. Saha (1937-1938) was deeply concerned with application of S&T to address larger societal problems. He argued, “If we desire to fight successfully the scourge of poverty and want, from which 90% of our country men are suffering; if we wish to remodel our society and renew the springs of our civilization and culture, and lay the foundation of a strong and progressive life, we must make the fullest use of the power which knowledge of Nature has given us.

We must rebuild our economic system by utilizing the resources of our land, harnessing the energy of our rivers, prospecting for the riches hidden

under the bowls of the earth, reclaiming deserts and swamps, conquering the barriers of distance and above all, we must mould anew the nature of man in both its individual and social aspects, so that a richer, more harmonious and happier race may dwell on this great and ancient land of ours. Towards the realization of this deal, we must adapt ourselves to the new philosophy of life and train the coming generations for the service of the community in scientific studies and research”.

Dr. R.N. Chopra (1939-1940) considered the role of the Institute for “organization of Science and Technology Research in the Country”. Like Dr. Fermor he also advocated “Establishment of Research Council for India on the line of UK, USA, Australia, Canada etc. to plan and coordinate research so as to avoid wastage both of talent and funds, preclude duplication, employ the available scientific personnel to the best advantage, and finally, to arrange for training of a much larger number of personnel to supply the needs of the developing industry”.

Prof. B. Prasad (1941-1942) persuing Dr. Chopra’s address supported the establishment of a “Board of Scientific and Industrial Research” under the directorship of Sir S.S. Bhatnagar and the future development and necessity for a National Research Council”. He referred to the origin of NISI, “in response to the keenly felt need for a body which could coordinate the work of all scientific societies, institutions, Government Scientific Departments and Services and cognate agencies throughout the country”. He regretted that, “unfortunately all efforts of the Institute for the establishment of a National Research Council for India has been unsuccessful and the Institute will be failing in its duty if it does not continue to press for the constitution of such a Council at an early date”.

Prof. J.C. Ghosh (1943-1944) During his Annual Address, while welcoming a delegation from the Royal Society, London, (consisting of Profs.. Hill,

*These excerpts have been taken from the INSA publication “Addresses by the Presidents 1935-1984” and the unpublished records of Presidential Address 1985-2010.

Bernal and Zuckerman)²⁴. Prof. Ghosh mentioned, “that most men of science in India work and live in the hope that the common man in this land will soon come to his own; and this symposium on Post-war Organization of Scientific Research in India is inspired by the hope that modern developments in science and technology, if utilised to their fullest extent, can give him a fuller and more satisfying life”. Prof. Ghosh goes on to point out that, “The Council adopted a resolution that the NISI be authorised to take necessary steps for the organization of National Research Council constituted under the statutory authority of the Government of India”.

Dr. D.N. Wadia (1945-46) advocated the role of NISI for spreading the gospel of science to all corners of India and fulfilling both the social as well as technical obligations to the Indian Society. He was concerned with developing the basic sources of wealth. He also advocated the establishment of a National Research Council. Consequent upon the announcement by the Education Department of the Government of India recognising NISI as the premier scientific organization of the country, the Council under his Presidentship accepted new duties and responsibilities. These included, “To act as advisers to Government on all scientific matters. And to coordinate the activities of scientific academies, societies, institutions” among others. While handing over the Presidentship to Sir S.S. Bhatnagar in 1947, he concluded, “It is my firm conviction that the National Institute of Sciences of India is going to play an increasingly helpful role in the scientific progress of the country and will give the correct lead to the rapidly multiplying institutions and associations in

fulfilling both their social as well as technical obligations to the Indian Society”.

Prof. S.S. Bhatnagar (1947-1948) emphasised the role of the Academy “in building new India” in addition to “Contribution to new knowledge” and developing Indian Scientific talent. He was concerned with “developing science and industry for defence purposes, if she is to maintain her freedom and to pursue an independent foreign policy”. He pleaded for the Academy to “help rehabilitation of displaced scientists”. In his address Bhatnagar argued the need for utility directed science in addition to the importance of scientific research for its own sake. He stated, “Although scientific research is a search for truth for its own sake it will be considered an expensive luxury and no exchequer will vote funds for it unless results of practical utility or for reducing suffering or poverty were the outcome of our investigations and while I should not like to minimize the importance of scientific research for its own sake”. He observed that, “New opportunities and new responsibilities offer themselves to us and the National Institute of Sciences has to play an important part in building the New India”.

Prof. P.C. Mahalanobis (1957-1958) devoted both his Presidential addresses to details of status of India’s development in diverse fields and the role of science in National Planning. He briefly referred to “Functions and responsibilities of National Institute of Sciences in India”. He wished for a “greater response of NISI for national planning and national development”. He felt that NISI was not very active in advising Government. He was concerned that “we ourselves have not been sufficiently serious regarding our own responsibilities”.

Dr. A.N. Khosla (1961-1962) considered recommending policies to the Government, directing research towards concrete achievements, supporting science and engineering education as some of the important areas for the Academy to pursue. Speaking soon after the Chinese invasion he felt that the Academy should offer its service to the Government and advised creating an Advisory Body for this purpose clearly spelling out its responsibilities. He dealt with the implications of the

²⁴It is interesting to note that this visit by the delegation of the Royal Society was the beginning of bilateral relationship between NISI and the Royal Society (London). The message from the President of Royal Society stated, “We have the confident hope that one of the results of Professor Hill’s visit will be to strengthen the bonds of understanding and true comradeship between our Indian Colleagues and the men of science of this country”. This delegation also “expressed fully the opinion that NISI is the nearest equivalent in India of the Royal Society and recommended to the Government that statutory recognition be given to our Institute to assume the role of a national academy such as the Royal Society (London), The National Academy of Sciences (Washington), The Academy of Science (USSR)”.

Scientific Policy Resolution (1958). He observed that, "The National Institute of Sciences is presumed to be the nerve centre of science in India. It can and must play a positive role in recommending policies and directing research towards concrete achievement in the shortest possible time The Institute has to ensure up-to-dateness in everything relating to science and engineering education, and in basic and applied research, through a carefully planned programme".

Prof. H.J. Bhabha (1963-64) in his Presidential Address in 1963 recalled the efforts made by Professors J.C. Ghosh, M.N. Saha, S.S. Bhatnagar, D.N. Wadia and himself in getting the recognition of the Institute in 1945, as the premier society representing in all branches of science in India. He commented that, "This alone should have given the National Institute a great impetus, but we find twenty years after this recognition that the Institute has not earned for itself the position in the life of the country which it should have". His address, true to his character, consisted of expression of frank opinion on the status of the Institute and its fellowship. Bhabha was also concerned about the selection of Fellowship of the Academy, "While it is said that the National Institute has in its Fellowship some of the best scientists in India, the fact remains that there is a very considerable number of very good young scientists who are not among Fellows". He urged upon the members of the Institute "to think carefully upon the problems of developing science in India and of developing the National Institute".

Prof. T.R. Seshadri (1967-1968) whose address was primarily devoted to his research also emphasised the role of Academy *vis-a-vis* Government. He pointed out, "Although as early as 1945, the Government declared NISI as premier Science Academy in the country, consultation of the Institute by the Government has been sporadic and half hearted". In his Address, "Government and the Science Academies", delivered at Bombay in 1969, Prof. Seshadri discussing the election to Fellowship stated, "The National Institute will cease to be a science academy of repute, if considerations other than scientific achievements and standing come into

play in election of Fellows". He appealed to all Fellows of the Institute who are holding responsible positions in scientific organizations in the country and in Government to carry with them the interest of the National Institute in their organizations by associating it with their activities".

Dr. Atma Ram (1969-1970) expressed the need for formulating and communicating views to the Government. He mentioned commissioning 30 odd studies towards this end. Again in his Presidential Address next year (1971), "Nature and Scope of a Science Academy" he highlighted the need for providing independent opinion to Government. In addition in both these addresses he reiterated the dynamic role of the Academy to influence public opinion. He referred to "the new interfaces which are developing between the Academy and the Society on one hand and Academy and the Government on the other". He also emphasised the importance of international contact through ICSU and other national academies and involvement of young scientists by the Institute. He felt that, "There is no substitute for an active well organised National Academy enjoying the confidence and support of the scientific community, the Government and the public generally". He advocated the creation of Local Chapters and their utilization as foci for organising programmes to discuss, alongwith young scientists, current scientific and also socio-economic problems with distinct scientific content e.g. environment and R&D for small and medium industry. Discussing Science Policy Dr. Atma Ram referred to the Science Policy Resolution (1958) and stated, "It is a valuable statement of objectives, of good intentions well stated in as few words as possible at a general national level. But I think to make the policy statement operative, the major scientific organizations must frame their own policies on basis of and as integral part of Science Policy Resolution".

Prof. D.S. Kothari (1973-1974) in his Presidential Address in 1974 discussed the question of bringing about certain important changes in structure and function of INSA so that it can promote more effectively scientific research in the country and promote the role of science in national development.

He advocated the “Need for Science and Technology Act” which “Apart from other things, it would be an expression of nation’s determination to harness science and technology for national development”. He felt that INSA has a special role in “Strengthening of Scientific Societies” in the country. Similarly he was concerned about University Research. He pointed out that, “Research in the universities has as yet not received the high national priority which it should for the country’s advancement. His concern for the young was obvious. He catalysed the institution of Academy Medal for Young Scientists. His comments on ‘Human Implications of Science’ are revealing of his humanism. Thus, he emphatically stated, “No longer science and humanism survive in isolation. Ignorance and disregard of human implications of scientific and technological innovation is not only a grave environment hazard but it puts man’s survival in jeopardy”. He advocated that “There is a real need for a philosophy of human implication of science. To this India, in the years to come, could and we hope would, make distinct and enduring contributions”. The expression of these thoughts, no doubt were intended to prompt the Academy to think beyond science. The second Presidential Address by Prof. Kothari was even more philosophical, “Some Thoughts on Truth”.

Dr. B.P. Pal (1975-1977) in his inimitable style, quoting a number of distinguished scholars “provide the background against which the Academy has to function” went on to highlight that, “The Academy does have a most valuable resource of having within its fold, many of the most able scientists of the country and it should be able to play a catalytic role in seeing that the fruits of research are channelled, without loss of time, in the most effective way, to the millions in our country who are in dire need of this”. And furthermore, “There seems to be no reason why it cannot develop itself to perform the functions of a small but inspired brain trust in science”. Like his predecessors he was concerned with the broader role of the Academy thus, “The Academy will no doubt build up close relationship with the State Academies of Sciences and other learned bodies so that there may be an integrated overall endeavour to

apply science for solving the many pressing problems of our country”.

One of the problems with the Academy was, “how to obtain the increased participation of the Fellows of the Academies for preparing authoritative status reports and special reports especially on topics which have been relatively neglected because they fall between the boundaries of the major scientific organization or for any other reason”.

Dr. R. Ramanna (1977-1978) considered involvement in Science Policy as one of the important functions of the Academy. Highlighting the special need for a close examination of these issues (functions and organization of science in India). He felt that while Indian science is on the threshold of great achievements, its organization as things stand today, may prove to be a hindrance to its early and effective application to the solution of national problems. In spite of him being a part of a Government Institution (BARC) he emphasized, “In a democracy, no set of scientists, however carefully they may be chosen, can replace the collective wisdom of a body like INSA I would therefore, like to make a plea for the effective utilization of the potentials of the Academy for the benefit of the country much in the way the USSR Academy, the Academy of Sciences, USA and Royal Society of UK are given a pride of place in their respective countries”. He advised, “If in this context, INSA had to play an important role in the promotion of science, it has itself to undergo many changes”. Concluding his 1978 Presidential Address he reiterated, “that in the interest of science in India, scientific bodies like INSA must strongly express their views in formulation of Science Policy and the organization and administration of science, otherwise the very need for their existence will only be a very minor one”.

Prof. M.G.K. Menon (1981-82): As mentioned earlier his keen concern about the role of the Academy *vis-a-vis* the Government and the Society in general prompted him to call an extraordinary meeting of the Council soon after taking over as the President. In his 1982 Presidential Address he, expressed concern

about the unsatisfactory “Health and Climate of Science” in the country and the failure of the Academy to provide “excitement of science” to school and college students. He mentioned that, “we do not have today a climate in which the most brilliant are attracted to science”. Among other matters he reiterated the need to “bring much greater interaction (among scientists from different disciplines), develop not only a cohesion here in the scientific community in the country, but also produce new ideas, new capabilities to transform something you are doing from being ordinary to bring a break-through”.

Prof. A.K. Sharma (1983-1984) in his Presidential Address (1983), once more expressed the lack of desirable relationship with the Government policy making machinery. He described the creation of working groups for publishing state-of-art documents dealing with a variety of subjects “which will serve as guidelines for the policy makers at the national level”. He pointed out another area of concern regarding the role of the Academy in respect to status of scientists thus, “One of the important issue in which I hope you will all agree with me is that the Academy as a body of scientists, has not yet looked into the problem of the status of scientists in the Country, particularly safeguarding their interest. This is a vital issue to which the Fellowship should give serious thoughts”.

Prof. C.N.R. Rao (1985-1986) devoted his 1985 address to discuss the health of science in the country and expressed his special concern for “the status of higher education and research in our universities. There is urgent need to do something about this matter”. He regretted, “The total scenario with respect to higher education in science and technology is discouraging”. He advocated, the need “to build better institutions for under-graduate science education so that graduates from our institutions are as good as those in advanced countries”. Both he and his successor Prof. A.S. Paintal (1987-1988) highlighted the need to make scientific profession more attractive by providing the right challenges and by improving the perks and amenities for scientists. Scientists of India need the professional and personal facilities available to Western scientists.

Prof. M.M. Sharma (1989-1990) in his Presidential Address in 1989 cautioned that “While we could be self congratulating for what has been achieved we must, at the sametime, prepare for the problems of the future. We in the Academy should zealously protect the interests of science and scientists”. He introduced the programme of day long symposia alongwith the Council meetings and visits by the Council Members to neighbouring scientific institutions for lectures/seminars. During his Presidentship of the Academy the Rules and Regulations were revised in the context of new developments. A new scheme of INSA-Visiting Fellowship was initiated to support younger scientists from less endowed institutions to work in well established labs in the country for a period upto one year.

Prof. P.N. Tandon (1991-92): Most of the thoughts expressed in these addresses have been reflected in the text of this document.

Prof. S.K. Joshi (1993-95). In his Address in October 1993, Prof. Joshi informed the Academy about starting a new programme, “Traditions, Values, Excellence in S&T and Service to Society” for promotion of interactions between several disciplines in science and technology. He requested Prof. C.N.R. Rao to be the Chairman of a Committee on Science Education in India. A small cell was established to promote publication of books for classes VI-X. During the Diamond Jubilee Year, a number of special publications and reports e.g., Energy Options in India; Intellectual Property Rights in Biology; Sunya; Immunity and Disease Control; History of Development of Biochemistry and Molecular Biology etc were published (Details in **Annexure X**). A major event in 1993 was the first ever meeting of Science Academies of the World to discuss the complex issue of population – The Population Summit, which laid the seeds for the establishment of Inter-Academy Panel (IAP) in 1996.

Dr. S. Varadarajan (1996-1998) Besides strengthening the activities of the Academy in respect to organizing lectures by the fellows, workshops and symposia in different parts of the country and its programmes with academies of other countries

including IAP, Dr. Varadarajan made a lasting contribution to the academy in providing it its new building – The INSA Jubilee Centre, upgradation of the existing Administration block into a Convention Centre and proper face-lifting of the whole INSA complex.

Prof. G. Mehta (1999-2001) reorganized the Council by changing the nine-member Board of Officers to seven members i.e. the President and six Vice-Presidents one of whom was specially given the responsibility of Science and Society programme of the Academy. In doing so he pointed out, “..... in INSA we have been living in somewhat of an isolation, that there is an arrangement of ivory tower approach which suits the academic that we are, but the society also expects something in return from us”. He tried to revive the monthly lectures in INSA specifically targeted towards school students as also a lecture series for the public on the interface of science and society. Similarly he reorganised the sectional committees, adding three interdisciplinary committees.

He took the initiative to organise a meeting of the Presidents of all the Science Academies in the country including those of Medicine, Agriculture and Engineering to identify areas of cooperation specially to prepare scholarly reports and to collaborate in Science Education Programmes. Recognising that INSA has not succeeded much in respect to interaction with the Government he catalysed preparation of reports on “Withdrawal of compulsory iodination of salt”, “Revision of the INSA Guidelines for Care of Experimental Animal” which were sent to the Government. INSA actively participated in preparation of the seven international academy’s report on “GM Technology and World Agriculture”. INSA-JRD Tata Fellowship was established in 2001 to provide an opportunity for young scientists from developing countries to work in Indian laboratories. A informative book on Pursuit and Promotion of Science: India Experience was published in preparation of the forthcoming TWAS General Assembly.

Prof. M.V.S. Valiathan (2002-2004): One of the major events during Prof. Valiathan’s Presidentship

was a very successful organization of the 8th General Meeting of the Third World Academy of Sciences (TWAS) and the 7th General Meeting of the Third World Network of Scientific Organization (TWNISO) at New Delhi during October 19-23, 2002. Taking the advantage of a large gathering of national and international scientists the Academy organised a number of Seminars. These included seminars “Science Education: Role of Academies”, “Science Education Programme – Trends and Future”. In addition a number of Indo-Russian, Indo-German, Indo-Finnish, seminars were held”. The Royal Society organised the “India Day” in London to provide an opportunity to show case the Indian Science, in particular, the new India – UK Scientific Network scheme. INSA – K.K. Birla Foundation Asia Science Lecture was initiated. The first one to be delivered by Dr. B.C. Sekhar, a distinguished scientific from Malaysia. The second one was delivered by Prof. Yuan T. Lee, NL, President of the Academia Sinica. A project on Indian Science Report was initiated. This was finally published only in 2005.

Prof. R.A. Mashelkar (2005-2007): Following the discontinuation of the COSTED (Committee on Science and Technology in Developing Countries) by ICSU, the Academy decided to establish a Centre for Cooperation in S&T among Developing Societies (CCSTDS), at Chennai.

The Academy as an invited member of the National Academies of G 8 countries was a signatory to the Statement of Scientific Aspects of Climate Change entitled Global Response to Climate Change. A UNESCO-CSIR-MHRD-INSA seminar was organised on “Building the Scientific Mind”. There was continuing concern regarding the state of Universities and Higher Education in the country. A white-paper was prepared on the subject. Presentation was made to the Planning Committee on Higher Education in Science and Technologies: Challenges and Road Ahead. A panel was created for Science Education in 2006. INSA joined with IASc & NASI to promote programmes for strengthening higher education. This scheme included a very successful programme of Summer Research Fellowship for students and teachers. A two week Refresher Course

for school teachers was held. Under the aegis of CCSTDS (now CICS), a series of training programmes were organised with support from DST, CSIR, DAE, JNCASR etc. Digitization of INSA Journals since its inception was carried out and this was placed on the INSA website. The Academy brought out two special reports: Science Career for Indian Women and Strategies and a Road-Map for Development of Instrumentation in India. At the request of the Government of India, INSA conveyed its views on the Draft Manual of Patentability Criteria. Indo-French Etienne Wolf-Ramanujam Lecture was established.

Prof. M. Vijayan (2008-2010): To meet the increasing demands the activities of the Science Education Panel established in 2006 were further strengthened with greater involvement of the Fellowship. Similarly the INSA-JRD Tata Fellowship and other programmes under the aegis of CCSTDS (now CICS, Centre for International Cooperation in Science) were further enhanced. A series of bilateral symposia – Indo-German, INSA-Chinese Academy, INSA-Polish Academy, INSA-Korean, as also INSA-UK Frontier of Science Symposium – further promoted Inter-Academy activities. INSA's participation in IAP and IAC programme, FASAS, as also in G8+5 Science Meetings which provided important platforms for projecting Indian Science

abroad. The Platinum Jubilee of the Academy was inaugurated by Dr. Manmohan Singh, Prime Minister on January 10, 2009 at New Delhi. The concluding function was held at Kolkata (Calcutta) the place of birth of the Academy, on December 7, 2010. Smt. Pratibha Devisingh Patil, Hon'ble President of India graced the Function. The year was full of academic activities, a series of symposia and lectures with participation of a number of officers of the collaborating academies. Nearly a dozen books/monographs were released. These included "A Concise History of Science in India", "Science in India: Aspiration and Achievement", "Collected Works of V. Ramalingaswami" (former President of INSA), "Sustainable Management of Water Resources – Emerging S&T Issues in South Asia", "Bright Sparks – Inspiring Indian Scientists from the Past" among others). A group of Young Indian scientists along with Prof. Shashidhara, FNA prepared INSA's Vision Document. On the request of Hon'ble Minister of Environment and Forest, Shri Jairam Ramesh, a joint working group with representation from all science academies including Medical, Agriculture and Engineering, prepared a Report on GM Crops. On the request from Secretary, Science and Technology, Government of India an Inter Academy Advisory Panel was constituted to help implementation of DST- INSPIRE Programme.

Annexure VII(a)**Opinion and Views Sought by the Government and Other Scientific Bodies**

Year	Opinion/views sought by the Govt./other Scientific bodies
1935	Sir George Anderson, Educational Commissioner, India Office (London) - Collection of Information which may help in development of Scientific methods of crime detection.
1936	To coordinate the Investigations on Natural Illumination on Various times of the day in different part of India through Secretary, Department of Education, Health and Lands - Illumination Research Committee of DSIR (London).
1943	GOI proposed preparation of National Roster of Scientists/Personnel.
1944	GOI asked views on policy and set up of the Industrial Research Planning Committee to Coordinate and Centralized all type of Scientific and Industrial Research and recommendations for the persons to be sent abroad for further training.
1945	Referred and asked NISI recommendations for grants to various Scientific Societies and Institutions in the country.
1946	President, National Planning Committee (Pt. Jawaharlal Nehru) invited, NISI to be Member of the National Planning Committee.
1947	GOI sought opinion and guidance to recognize and to support Scientific Societies in Agriculture. GOI sought opinion on draft Indian Petroleum and Mining Rules.
1948	Prepared a report on Working Scientific Institutions and Societies (1948-49).
1940-56	All-ways sought opinion/view on practically all matters concerning Scientific Societies, International Scientific Unions and even setting up of new laboratories.
1956	Invited NISI to be Member of the Indian Parliamentary and Scientific Committee.
1963	Invited NISI to be a full Member of Indian National Commission for UNESCO and Science Sub Commission and Indian Board for Wild-life.
1968	Estimate Committee sought recommendations for efficient working of GSI.
1975	NCST sought opinion on Science Policy Resolution.
2009	GOI, MoEF sought expert advice' on Transgenic Crops'.

*Annexure VII(b)***Reports and Policy Issues Produced and Submitted to the Government and Other Scientific Bodies**

Year	Initiatives taken by the Academy
1935	Supported the efforts of GSI in installation of Seismographs at various locations in India by setting up a Sub-Committee on Seismological questions.
—	Expressed opinion on fixation of subscription rates of International Unions of ICSU on the basis of system adopted by Universal Postal Union or IMO rather than on the basis of population.
1943	Discussion meeting for creation, preparation of broad outline and frame work of NRC.
1944	Approached GOI with suggestions regarding difficulties of obtaining Scientific and Technical Journals and Books from abroad.
1945	Supported setting up of Anthropological Survey of India and its collaboration with the Anthropological Departments in Universities.
—	Expressed views on injudicious exploitation of fishes under Military Chilka Fish Procurement Scheme, Construction of multipurpose dams and Indian Fisheries Bill 1944.
1947	Forwarded recommendations of the NISI Committee on Pay Structure and Service Conditions of Chemists to Central, State Governments and Chamber of Commerce.
—	Invited attention to the necessary steps required to recover all biological material that had gone out of country.
—	Supported creation of Central Board of Geophysics.
1948	Expressed opinion on 'Custom Duties' on import of Scientific Instruments/Equipment for Scientific Research.
—	Compiled Who-is-Who in Indian Science.
1962	Opinion on Medium of Instructions in teaching in the country.
—	Scientific Terminologies for Teaching of Science in High School and Higher Secondary and adoption of CGS System of Matric Units for Physics Text Books.
1964	Suggested steps for acceleration the tempo of Scientific Research and Technical Development in the country.
—	Provided inputs to the SACC on scheme/projects to be undertaken for the development in the country, Foreign Exchange requirement and resources, Utilization of country's environment and natural resources and creation of Research positions like Professorships, Readerships and Visiting Professorship through three small committees.
—	Provided inputs to meet Scientific needs pertaining to defense, import substitution, Export Promotion and Food Production during the emergency.

1968	Investigation on Koyana Earthquake/set up Science Policy and Planning Group and a Committee for study of Science Councils. Policy Group prepared a position papers on Impact of Science on National Life, Population Control and Popularisation of Science and Science Council Committee reviewed the number of Laboratories/Centre attached to CSIR & ICMR.
1970	Opinion with regard to pay scale and service conditions of Scientists were communicated to the Central Pay Commission.
1978	Provided inputs as a non-government initiative inputs for the UN Conference on S &T for development in Vienna.
—	Formulated guidelines for Recombinant DNA Molecules Research in India.
1979	Assessment of ecological damage done to the Silent Valley and to examine the feasibility and Soundness of Garland Canal Projects.
1991	Requested GOI for continued availability of Kolar Gold Mines for Research in Non Accelerator Particle Physics.
—	Provided inputs to Government on Compulsory Iodination of Common Salt.
—	A Position paper on Transgenic Plants and World Agriculture' in the collaboration of Academies of UK, US, China/Mexico, and TWAS.
2002	A position paper on 'Open Access to Knowledge in the Science; Report on Problems of Instrumentation in India, Women in Science.
2005	First India Science Report.
2006	Inputs for the 11 th Five Year Plan through an Inter Academy report on Higher Education Research and Development.
2009	Position paper on 'Micro-Nutrient Security for India - Priorities for Research and Action.

*Annexure VIII***List of the Foreign Academies having Bilateral Relationship with INSA**

1) Afghanistan	Academy of Sciences of Afghanistan
2) Argentina	Academia Nacional De Ciencias Exactas, Fisicas Y Naturales
3) Armenia	National Academy of Sciences of the Republic of Armenia
4) Australia	Australian Academy of Sciences, Canberra
5) Bangladesh	Bangladesh Academy of Sciences, Dhaka
6) Belarus	The Academy of Sciences of Belarus, Minsk
7) Brazil	Brazilian Academy of Sciences National Council for Scientific and Technological Development (CNPq)
8) Canada	The Royal Society of Canada, Ottawa
9) China	The Chinese Academy of Sciences (GAS), Beijing
10) Cuba	Academia De Ciencias De Cuba
11) Czech Republic	Academy of Sciences of the Czech Republic (ASCR), Prague
12) Finland	The Delegation of the Finnish Academies of Science and letters
13) France	The French Academy of Sciences (Academie des sciences), Paris
14) Germany	Deutsche Forschungsgemeinschaft (DFG), Bonn The Berlin-Brandenburg Academy of Sciences and Humanities The German Academy of Sciences, Leopoldina
15) Hungary	The Hungarian Academy of Sciences (HAS), Budapest
15a) Iran	The Academy of Sciences of the Islamic Republic of Iran
16) Ireland	Science Foundation Ireland (SFI)
17) Israel	The Israel Academy of Sciences & Humanities
18) Japan	Japan Society for the Promotion of Science (JSPS), Tokyo
19) Jordan	The Royal Scientific Society (RSS)
20) Kenya	The African Academy of Sciences, Nairobi, Kenya
21) Korea (South)	The Korea Science and Engineering Foundation (NRF), Daejeon The Korea Academy of Science & Technology (KAST), Seoul Korea Research Foundation (KRF), Seoul

22) Korea (North)	The State Academy of the DPR Korea, Pyongyang
23) Kyrgyz Republic	The National Academy of Sciences of the Kyrgyz Republic
24) Malaysia	The Academy of Sciences, Malaysia
25) Mauritius	The Mauritius Academy of Science and Technology (MAST)
26) Mexico	The Mexican Academy of Sciences
27) Morocco	The Hassan II Academy of Science and Technology, Rabat
28) Nepal	Nepal Academy of Science & Technology (NAST), Kathmandu
29) Netherlands	The Royal Netherlands Academy of Arts & Sciences, Amsterdam
29a) Norway	The Norwegian Academy of Science and Letters
30) Pakistan	The Pakistan Academy of Sciences, Islamabad
31) Philippines	The National Academy of Science and Technology of the Philippines (NAST), Manila
32) Poland	The Polish Academy of Sciences (PAS), Warsaw
33) Russia	The Russian Academy of Sciences (RAS), Moscow
34) Slovak	The Slovak Academy of Sciences, Bratislava
35) Slovenia	The Slovenian Academy of Arts & Sciences The Slovenian Science Foundation
35a) South Africa	The Academy of Science of South Africa
36) Sri Lanka	The National Academy of Sciences of Sri Lanka (NASSL) Colombo
37) Sweden	The Royal Swedish Academy of Sciences The Royal Institute of Technology (KTH)
38) Taiwan	The China Academia Sinica, Taiwan
39) Turkey	The Turkish Academy of Sciences (TUBA), Ankara
40) U K	The Royal Society (RS), London The Royal Society of Edinburgh, Scotland
41) Ukraine	The Ukrainian Academy of Sciences
42) U S A	The US National Academy of Sciences, Washington (Only for Joint Research Projects)
43) Uzbekistan	The Uzbekistan Academy of Sciences, Tashkent
44) Vietnam	National Centre for the Scientific Research

*Annexure IX***No. of Indian and Foreign Scientists Exchanged during the last 11 years from 2002-2013**

S.No.	Year	No. of Scientists	
		Indian	Foreign
1	2002-2003	91	65
2	2003-2004	96	67
3	2004-2005	86	75
4	2005-2006	102	62
5	2006-2007	71	54
6	2007-2008	118	84
7	2008-2009	97	67
8	2009-2010	100	39
9	2010-2011	65	21
10	2011-2012	103	56
11	2012-2013	66	26