

have been floating in air with no idea of ground realities. S&T should become a part of the life process, making it ever broader in outlook and subtle in feeling. This is the way the present real men of science are thinking. They want to free S&T from the domination of ambitious politicians and greedy capitalists and put them at the service of the poor and the needy. So efforts should be made to intensify the process of disseminating technology to the field and expose the scientific community to the rural areas so that the learning and unlearning

processes can begin from both sides and should continue on a sustained basis. Only then can the scientists and technologists understand how irrelevant their research work is.

To sum up, it is necessary to change this dismal scenario. A new and comprehensive science culture has to be cultivated – a new science movement where science would work for society and for the common man. The first step is to build a proper work culture where everyone, including students, teachers, scientists, science lovers, popularizers,

professors, research scholars, and so on, begin to understand the importance of hard work. Let us remember that years ago Gandhiji said 'India lives in villages – if villages perish, India perishes'. This is the weakest link in our socio-economic claim of the country and, by and large, we have been oblivious of the needs and aspirations of the villagers.

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NEWS

Jawaharlal Nehru Centre for Advanced Scientific Research – A tribute to the architect of modern Indian science

The Jawaharlal Nehru Centre for Advanced Scientific Research – JNC for short – was established in 1989 by the Government of India as part of the centenary celebrations of Pandit Jawaharlal Nehru. Its campus has been created on a 15 acre plot of land at Jakkur, gifted by the Government of Karnataka, on the northern outskirts of Bangalore. The dedication of the Centre to the nation was performed by Shri K. R. Narayanan, Vice President of India, on Saturday, 4th March 1995.

The objectives of the Centre include promotion of scientific research at the highest level in frontier and interdisciplinary areas of science and engineering, in a selective manner. It had also been planned, at the time of its founding, that the Centre would work in close academic cooperation with the Indian Institute of Science at Bangalore, a renowned institution of higher learning and research with well-established traditions. Thus, while the two institutions are independent and autonomous, they have strengthened each others' activities, and to a considerable extent avoided duplication of efforts.

Thanks to this link, the academic programmes of JNC had begun already during 1989–90, even as the planning

and construction of its own campus got under way. Aided by the advice and guidance of its Honorary Faculty (numbering about 50) drawn from the Indian Institute of Science and from several other leading research and teaching institutions all over the country, a variety of academic activities have been launched. Prominent among them are a series of Discussion Meetings – numbering about 30 a year – where active research workers and students in specialized areas of science and engineering meet to exchange their results, review progress and initiate collaborations; and a Summer Research Fellowship Programme (SRFP). Several of these meetings have involved foreign participation at the level of international conferences, while others have been in the nature of extended schools. Already, approximately 20 volumes as Proceedings of various Discussion Meetings have been published. The SRFP aims at providing talented students in the sciences and engineering, at both senior undergraduate and postgraduate levels, an opportunity to be exposed to a research environment and work on current unsolved problems under the guidance of a faculty member of JNC or any other institution. This programme has become

exceedingly popular and several thousand students apply for the forty odd Fellowships offered each year. In many cases, the skills and training received by students during the two months spent with a guide result in quality scientific publications and act as a great motivating factor determining the students' career and interests.

The Annual Meetings of the Centre, held at Bangalore around November each year, provide a forum for all the Honorary Faculty and Faculty of the Centre to meet and have discussions on topics of current interest. A set of invited lectures by the Honorary Faculty is also arranged on these occasions and they are subsequently published as special issues of the *Journal of the Indian Institute of Science*. Four such issues have already appeared, and the fifth is under publication. To date, about 360 research papers have been published by the Honorary Faculty and others associated with the Centre.

A specialized Library has been created at the Centre, with a unique collection of about 1100 books and reference volumes. Some 35 key journals are also being obtained.

In step with building up its own faculty, the scientific programmes of JNC

are getting established around a series of units devoted to selected broad areas of current interest and importance. Appointments at the levels of Faculty Fellows and Senior Faculty Fellows in various areas have commenced. In addition, several positions at postdoctoral level are also being offered. The units already functioning include those devoted to biodiversity, chemistry and physics of materials, condensed matter theory and fluid dynamics, and laboratories devoted to gene targetting, gene therapy and molecular parasitology, human genome, and computers. Research programmes on surface science and molecular electronics, nanomaterials and carbon structures have also been started. The Centre is taking steps to set up a group working on the newly emerging area of complexity and complex systems. For this purpose, the Centre is in touch with the well-known Santa Fe Institute in the USA, to identify suitable faculty for recruitment. While the total faculty strength of the Centre is intended to be compact, the areas of work are chosen with great care, keeping in mind current international trends and our own ability to contribute at the highest level in terms of quality. In tune with this, a small number of doctoral and masters level students are being selected to work for research degrees under the guidance of the Centre's faculty. For this purpose, recognition of the Centre by the Universities of Poona, Mangalore and Mysore have been obtained.

Even a relatively modestly sized academic institution can contribute a great deal to the society in which it functions, especially through extension activities, and recognizing talent and providing timely and critical support. In this spirit the JNC runs a Visiting Fellowship Programme which enables research scientists in educational institutions and R&D laboratories to collaborate with the Centre's faculty. On an average, some eight to ten such Fellowships are offered each year covering all the major areas of science and engineering.

In cooperation with the Rajiv Gandhi Institute for Contemporary Studies, New Delhi, JNC administers a programme offering research grants to support young Ph D's to try out innovative ideas in science and technology. These are one-time grants, essentially in the manner of providing seed money to encourage those with promise. Around 100 applications are being received each

year for the half dozen or so grants which are available.

In an era of shrinking support and resources, efforts to maximize the effect of each activity and to spread information and knowledge of science are essential. In this spirit, JNC has undertaken a programme of short-term courses at postgraduate and research levels, given at universities by small groups of the Centre's faculty and their colleagues. The intention is to bring the audience rapidly up to date with current trends in specialized subjects, in a manner which saves time and which might otherwise never be achieved. There has been a good response to this programme, with some of the universities showing keen interest; the subjects covered so far include quantum chemistry, organic, bio-organic and photochemistry and cosmology. Subjects for the future include chemical engineering and conservation ecology.

JNC has embarked on a publication programme to produce moderately priced educational monographs aimed at undergraduate as well as more senior students of science and engineering. These monographs try to introduce the reader to important recent areas of interest and activity, giving an overall survey and conveying the key concepts and facts in an easy manner, so that later study in greater depth and detail are facilitated. Monographs have already been published on superconductivity and on supercomputers. In the coming months, plans are underway to produce new ones devoted to chaotic systems, complexity, biodiversity, conservation ecology, genetic engineering, developmental biology, earthquakes, stars, atmospheric phenomena and the monsoon, manufacturing systems, and fluid dynamics. It is hoped that in addition to students, research workers and teachers in one area anxious to learn of other subjects distant from their own will also find these monographs useful. At the same time, there seems to be a great need for literature of this kind, easily available to the academic community and lay persons alike, produced within the country, so that we need not learn of important developments almost exclusively from foreign sources. And it is indeed encouraging that writing in this genre is slowly acquiring quality and respect in the country today.

On the international arena, JNC has taken several initiatives already. In cooperation with the International Centre

for Theoretical Physics (ICTP) at Trieste, Italy, and the Indian Institute of Science, Bangalore, a regional Associateship Programme has been started at Bangalore. This will enable the Associates of the Trieste Centre belonging to this part of the world – India, Pakistan, China, Sri Lanka, Nepal and Bangladesh – totally around 150 of them, to visit Bangalore and initiate collaborative research with the Indian faculty and participate in Discussion Meetings, Schools and related activity. The Centre hosted the first Asia Academic Seminar on Molecular Science with the participation of leading as well as young molecular scientists of Asia. An Israel-India Workshop on Materials is being planned. There will be an international workshop on transition metal oxides with the support of ICTP, Trieste. A UNIDO workshop on organic synthesis had been arranged earlier with participants from many countries.

JNC is endeavouring to strike a balance between its own scientific programmes and activity and the various extension programmes outlined above. Intended to be a relatively small institution, the areas of research to be pursued at the Centre are being chosen after much deliberation. In the course of time, the standing and reputation of the Centre will rest largely upon the quality of work carried out by its own faculty. As a counterpart to this, the Centre tries to act as a wise catalyst and source of selective support to the entire scientific community from which it ultimately has to draw its sustenance. In this role, it is essential to show the capacity for discrimination, the ability to discern quality and the willingness to support it, and to strive always for excellence. The world of science is far more competitive today than ever before in its history, and to be in step with others, given the Indian conditions, is an almost super-human struggle. It surely requires the cooperative and constructive functioning of the gifted, wherever they may be in the country, always looking to the future and to the training of our best young minds.

Pandit Nehru had a deep understanding of the various facets of human existence, of history and of political forces, of economic problems and the need for development. His vision encompassed the whole world and viewed India as an important part of it, with its own particular traditions and strengths. His devotion to science was unquestioned – 'I

too have worshipped at the shrine of science' – and he was sensitive to the character of scientific knowledge both as a part of human culture and as the base for technological applications. Added to all this was a passion for

quality in expression and achievement, an aesthetic sensibility which manifested itself in diverse ways.

To become an institution worthy of such a splendid personality – that is the challenge before the Jawaharlal Nehru

Centre for Advanced Scientific Research.

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COMMENTARY

India 2015: A strategic perspective*

K. Sundarji

There are a number of theories that are being projected about the type of world order that is likely to prevail in the 2000s.

The demographic explosion model

This model is based on the prolific black, brown and yellow races exploding inexorably, AIDS and other pestilences notwithstanding. The expectation is that the demographically high-pressure areas of Asia will expand into the low-pressure areas of the Americas, Australasia and Africa, and that genteel actions like amending immigration laws cannot control this type of influx, and the use of force, including weapons of mass destruction (WMD), might be resorted to. This would lead to revolutionary changes in the world order.

The ecology-based model

The ecology-based model, among other things, assumes that demographic explosion would compound ecological disaster. Following from the aftermath of global warming, the ensuing worldwide drought and the submersion of large areas of coastal and island land mass would lead to a shortage of food, water, etc. These, it is expected, will lead to bizarre partnerships among nations and *water wars*, resulting in a drastic rewriting of the rule book.

*Based on a Lecture delivered at the Diamond Jubilee Meeting of the Indian Academy of Sciences on 2 December 1994

The powershift model

The powershift model that Alvin Toffler describes in his book *Powershift*¹ is postulated on the outcome of a totally new way in which the world produces wealth and the comprehensive reorganization which would be called for. Toffler compares this with the revolutionary changes that accompanied the shift from the hunting society to the agricultural society, and later to the industrial society.

Model based on a clash of civilizations

The model is based on the clash of civilizations, a theory that Huntington postulates²: He says of future conflict, 'My hypothesis is that it will not be primarily ideological nor primarily economic. The great divisions... will be cultural... The clash of civilizations will dominate global politics. The fault lines between civilizations will be the battle lines of the future'² He looks at civilizations as Western Christianity, Orthodox Christianity, Islam, Confucian and Hindu. He anticipates a tactical accommodation between the Confucian and Islamic civilizations. The Hindu is not so drawn to the Confucian-Islamic, and may be drawn towards the Western Christian.

What models determine international relations during the 21st century is not fully relevant for any short-term forecast. We ought to extrapolate from the present, bearing in mind that major changes may occur later. The conclusion drawn by Lind, the Editor of *National*

Interest, appears to be the best one to follow. He writes³, '... the world is not entering an era of harmonious global interdependence and genuinely liberal democracy. While the stakes will be lower, global competition will increase. geo-economic competition between the leading economic powers will interact in complex ways with geo-political competition involving them with less prosperous but militarily significant great powers... In the most advanced industrial nations, the new catalytic state, by its very nature, will encourage the evolution of technocratic elitism, while in the newly marketizing great powers, such as Russia, China and India, authoritarian legacies along with geo-political and developmental imperatives will probably produce variants of plebiscitary or dominant party democracy.'

World order 1995–2015

During the period 1995–2015, the USA would be pre-eminent even in a multipolar world. We will have to assess USA's aims and policies. We have to 'guess-timate' the aims and interests of China, Pakistan and India during the period

US aims and policies

The ideal strategy would be under the leadership of the USA:

- The USA and Russia cut back their nuclear arsenal to 10% or less of their original levels.
- Ukraine, Kazakhstan and Belarus are denuclearized.