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Convocation Address

Health Care and Medical Research

Dr. R. Chidambaram

DAE-Homi Bhabha Professor, BARC, Chairman, Scientific Advisory Committee to the Cabinet
Principal Scientific Advisor, Government of India

It is a privilege to be with the Fellows and Members of the National Academy of Medical Sciences (NAMS) and with so many distinguished doctors and bio-medical scientists. I am very grateful to Prof. J.S. Bajaj, Chairman of your Academic Council, for inviting me to the Convocation Function, which is a part of the Annual Conference of the National Academy of Medical Sciences. I congratulate the award winners and the newly elected Fellows and Members. It was so pleasant to hear about their research achievements in a variety of medical fields

2. Jodhpur has now a special position in the medical scenario of India because AIIMS Jodhpur is one of the six new AIIMS established by the Ministry of Health and Family Welfare. Personally, it has also a special place in my heart because, during the preparations of the nuclear tests in 1974 and 1998, we always went to Pokhran via Jodhpur.

3. The quality of health care in a hospital depends on the quality of the doctors and of other staff. On the other hand, a good hospital must provide excellent and *affordable* health care to the

patients. The late pioneer neurosurgeon, Dr. B. Ramamurthi once told me a few decades back that, when he headed the Madras Medical College, he used to tell his doctors that when they ordered pathology tests, nine out of ten should show an abnormality. This would be the best way of utilizing our limited pathology resources. More so then, compared to now. At the same time, a leading hospital must be quick enough to adopt the latest technologies.

4. We must also remember that most of our high-end diagnostic and therapeutic medical instruments are now imported. There are, of course, outstanding exceptions like the Co-60 radiation therapy unit BHABHATRON, designed by the Bhabha Atomic Research Centre. Doctors and engineers in the country must get together to indigenise more and more such advanced instruments. Doctors should not go by branding alone.

5. If we are to become a Knowledge Economy, India must have a judicious mix of basic research, applied research, technology development, innovation and manufacturing skills. Indigenisation of high-technology hardware and software

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products is essential. This is particularly true of electronics hardware, where we have lagged behind, except in the mission-oriented agencies. As I said, in the different context of advanced defence equipment, if you want to be a global leader *in the long term*, you must be willing to often live in the short term with equipment with lower specifications, as long as it satisfies your critical requirements. This also holds for the 'Medical Devices' field.

6. I understand that, of the approximately 3200 types of medical devices available globally, India manufactures only around 100. Here again we have some excellent initiatives. Starting with the mechanical heart valve of Dr. M.S. Valiathan, designed in the Sree Chitra Tirunal Institute for Medical Sciences and Technology, many other devices and bioproducts have been made in their Bio-Medical Technology Wing. The Institute has continued to strengthen its partnership with industry. Good groups are coming up in IIT Madras and some other institutions in the medical devices field, with links to industry. Incidentally, I have been associated with the Sree Chitra Tirunal Institute as the President of its Governing Body and its Institute Body.

7. A Hospital should also be a Research Centre. Encouragement should be given to both clinical and basic research. Due to the high patient load in India, high quality medical research in India is limited. NAMS should play a pivotal role in enhancing this

substantially. Internationalization of science is growing, as also collaboration among scientific institutions within India. Electronic connectivity is an important facilitator of this collaboration.

8. The National Knowledge Network (NKN), a project being implemented by the National Informatics Centre, is a multi-10 gigabits per sec optical fibre network, which will eventually connect 1500 knowledge institutions in India—1100 are already connected'

9. In order to demonstrate the capabilities of NKN – high bandwidth and low latency – NKN launched a series of Model Projects to showcase its potential across a spectrum of applications, many of them focusing on medical education and health care. Each project is carefully handcrafted to address a specific challenge. In the area of medical education, NKN launched a model project with AIIMS as the Principal Investigator. Eight institutions joined AIIMS in this experiment and have come up with solutions after mutual consultations and actual field trials. It is interesting that they use high-end graphics coupled with animation for “routine” skills' transfer (Blood and urine Sample, Blood Pressure monitoring, etc.) transfer and direct video for classroom interaction, and a combination to share knowledge about surgical skills that are cardiac-oriented.

10. The basic idea in another model project is to use engineering design solutions to solve medical requirements.

Collab CAD platform - originally designed as software capable of three-dimensional structural simulation with all the engineering nuances – was retargeted to solve a personalized dental imaging problem in 3-D. Three leading organizations - NIC, CSIO, and AIIMS Delhi- were brought together. While NIC took care of the ICT part, CSIO concentrated on the imaging part, and AIIMS articulated the end-user requirements, so that multiple 2-D images were used to create a 3-D virtual reality.

10. My Office is funded for what I called 'Synergy Projects', which tries to bring together scientists in different institutions with different competencies to work in synergy on a project. One such was the development of a total knee prosthesis for use in orthopaedic oncology. The institutions involved were IIT Bombay, NFTDC Hyderabad and TMH Mumbai. The 'Total Knee Prosthesis' is now ready for clinical trials. This kind of megaprotheses implants, made essentially from titanium alloys, need to be customized through what is called 'additive manufacturing', an important component of the current 'Third Industrial Revolution' , which is driven by the Internet.

11. When I was in McGill University three years back, one of the projects presented to me was what they called C-Brain or Canada Brain, to bring together all scientists working in Alzheimer's to share MRI images through their network CANARIE. We have had their collaboration in developing what I call I-

Brain or India-Brain, to bring together all scientists working in Alzheimer's or Dementia or maybe Stroke, to share clinical data like MRI Images. This Model Project, established as a research infrastructure layer over NKN, is led by the National Centre for Brain Research, Manesar, near Delhi. ICMR is planning to use it as a general purpose infrastructure for several brain - related research projects that are multi-institutional.

12. Each one of these Model Projects has a theme and a purpose. But these are only for demonstration and I am sure that many more projects will be conceptualized and realized through the NKN by the scientific community, including the medical community.

13. The availability of drugs in a pure and unadulterated form to the patients still remains an issue. This is not only true in developing economies like India, but also in developed economies in the western world. The other issue that has become a major cause of concern is the mushrooming of the so-called diagnostic centres across India, without adequate checks and balances. Given the importance of the problem, and its ramifications in the public health domain, my Office decided, in November, 2008, to constitute a Working Group on possible Scientific and Technological Measures to counter Spurious & Sub-standard Drugs and Diagnostic Centres, primarily in the Indian context. Dr. P.N. Tandon, famed neurosurgeon, very kindly accepted my invitation to be the Chairman of that

Group. While the Secretariat remained my Office, the members were carefully chosen, in consultation with Dr. Tandon, to include medical scientists and professionals of high repute, as well as senior representatives of the Ministry of Health and Family Welfare, Government of India. This Group has brought out an excellent report, in which various scientific and technological measures already available, or those in the pipeline have been collated. An attempt has been made to evaluate their advantages and disadvantages. It may be pointed out that no single technology has yet been approved anywhere in the world to provide a fail-proof measure for this purpose. The Working Group, likewise, had no personal choice of any particular technology included in its Report. It has only provided a comprehensive list of various alternatives, gathered from diverse sources, for the pharmaceutical industry to choose from, according to its own requirements.

14. In early 2004, the attention of my Office was drawn, by some medical professionals, to medical consumables and devices being sometimes not in a sterile form, despite being stamped as sterile. This applies, of course, in varying degrees, to all countries in the world. As a consequence, in October 2004, my Office had, through a working group of medical professionals, a radiation expert and a microbiologist, prepared a report on the “Scientific Evaluation of Sterilization Practices in India”. This report has been well received by the medical fraternity in the country. Later we felt the need for

having what we now call the Scientific Operating Procedures (SOPs) of medical sterilization—all three forms, autoclaving, use of ethylene oxide gas and use of gamma radiation. My Office, therefore constituted another Working Group for that task in October 2008, with largely the same composition as the earlier one, but with the addition of a representative from the Directorate General of Health Services. After enormous work spread over 4 years, the second Working Group has compiled the SOPs as a Report, which, I believe, would be of immense use to practicing medical professionals, the nursing staff and the hospital administrators. My Office will be happy to work with NAMS to run a web-cast Workshop (through NKN) on this subject, which can also be archived and made available on request.

15. Living organisms, including humans, are so wonderfully put together that a great deal of research outside medicine goes to mimicking their compositions and functions. Bones are extraordinary composites. Robotic scientists now have an area called 'soft robotics'; they are trying to build robots that can jump like a hare or slither like a snake! One of the optimization techniques in the solution of physical problems is called “neural networks” which tries to mimic the brain in a somewhat elementary way. On the other hand, in the brain, the network of circuits formed with neurons, each circuit carrying out a specific function but which is able to operate in spite of destruction up to a point and the interchanging functions of these neural

circuits, is the envy of computer designers who are able to build in redundancy and fault tolerance in computers only up to a point.

16. Conversely, among the many major branches of neuroscience, there is also computational neuroscience, which studies the information processing properties of these circuits, borrowing from the concepts of computer science, and is now making some initial attempts to construct such functional neural circuits using electronic chips. There is a 'Gifted Children' programme of our Office - how to identify and nurture gifted children, gifted in science and mathematics. The groups includes an applied psychologist and experts in cognitive science. The question is : are the brains of gifted children recognisably different? If so, in what way?

17. Genotyping an individual may in the future lead to a totally individualised treatment. Interestingly Ayurveda, on the other hand, goes for holistic treatment - phenotyping an individual rather than genotyping him/her. Our Office has supported a very successful project on "A Science Initiative in Ayurveda" under the leadership of Dr. Valiathan. He calls this field 'Ayurvedic Biology'.

18. Let me thank you all and particularly Prof. J.S. Bajaj once again for this wonderful opportunity to be with you. I wish you in the medical fraternity all the best and, selfishly speaking, what is good for the doctors is good for all of us also!

Thank you.

Dr. R. Chidambaram