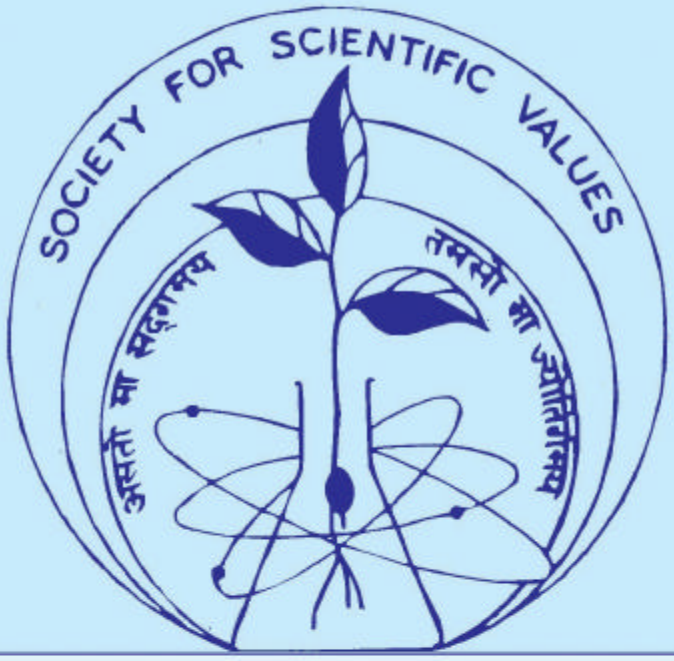
Society for Scientific Values

Ethics in Scientific Research Development and Management

News And Views

Volume 3 August 2005 No. 1



Lead us from unreal to real

Regd. Office : DST Centre for Visceral Mechanisms
V.P. Chest institute
University of Delhi, Delhi

Editor

Dr. P.N. Tiwari
Ex-Project Director, NRL,
IARI, New Delhi
Block B-65, SFS Qrts.,
Sheikh Sarai, Phase - I,
New Delhi - 110 017
Tel.: 011-26012615

Co-Editor

Dr. G. Govil
Ex-Senior Prof. & Dean (Physics)
Tata Instt. of Fundamental Research
Homi Bhabha Road, Nebi Nagar,
Mumbai-400 005
Ph.: 022-26301816
E-mail: govil@tifr.res.in

Associate Editors

Dr. P.S. Datta
Project Director & Professor
Nuclear Research Laboratory
IARI, New Delhi - 110012
Email: psdatta@iari.res.in

Dr. Indra Mani
Senior Scientist
Divn. of Agricultural Engineering
IARI, New Delhi - 110012
Email: maniindra99@yahoo.com

Editorial Advisory Committee

Dr. A.R. Verma (New Delhi)
Dr. P.N. Srivastava (Gurgaon)
Dr. P.M. Bhargava (Hyderabad)
Dr. (Mrs.) Indira Nath (New Delhi)
Dr. S.R. Valluri (Bangalore)

Office Bearers of the Society
(August 1, 2005 - July 31, 2008)

President

Dr. K.L. Chopra
(Ex-Director, IIT Kharagpur)
M-70, Kirti Nagar
New Delhi-110 015
Ph: (011) 25154114
Email: choprakl@yahoo.com

Vice President

Dr. Vikram Kumar
Director, National
Physical Laboratory
K.S. Krishnan Marg,
New Delhi-110012

Secretary

Dr. Nandula Raghuram
School of Biotechnology,
GGS Indraprastha University,
Kashmiri Gate, Delhi -110006
Ph: (011) 26112065

Joint Secretary

Dr. Ashima Anand
Principal Scientific Officer
DST Centrefor Visceral
Mechanisms, V.P. Chest
Institute, New Delhi-110 007
Ph: (011) 27667749
Email: visc.mechs@mail.com

Treasurer

Dr. Indra Mani
Senior Scientist
Divn. of Agricultural Enginering
IARI, New Delhi-110 012
E-mail : maniindra99@yahoo.com

Main objectives of the 'Society for Scientific Values

1. To promote objectivity, integrity and ethical values in pursuit of scientific research, education and management, and
2. To discourage the unethical acts in these areas.

Prof. Autar Singh Paintal

(24th Sept., 1925 – 25th Dec., 2004)

Founder President, Society for Scientific Values

Prof. Autar Singh Paintal in keen observation

OBITUARY

In Professor Autar Singh Paintal's untimely death, the country has lost one of its most eminent and active scientists. Till the end he was engaged in research on high altitude problems and the responses and reflex effects of J-receptors, which produce breathlessness and muscle weakness.

Professor Paintal was born in 1925. He graduated at King George Medical College, Lucknow and later on received his D. Sc. degree from Edinburgh in 1960. He had also been recipient of D.Sc. (*h.c*.) from a number of universities. He had held several very important positions such as Director and Professor of Physiology at Vallabhbhai Patel Chest Institute, Delhi University, Delhi (1964-90), Professor of Physiology, All India Institute of Medical Sciences, New Delhi (1958-64) and Director-General of the Indian Council of Medical Research, Government of India (1985-90). After his retirement, he continued his active research as Programme Director, D.S.T. Centre for Visceral Mechanisms, V. P. Chest Institute, Delhi till his death. He had held several important visiting professorial appointments at Albert Einstein College of Medicine, New York, University of Utah, U.S.A., Physiologisch Institute, and University of Gottingen, Gottingen, Germany etc.

Professor Paintal had been a Fellow of all the major academies of the country including National Academy of Medical Sciences, Indian National Science Academy, as well as the Third World Academy of Sciences, Physiological Society (U. K.), Royal Society of Edinburgh and Royal Society of London. Amongst the numerous recognitions and awards, mention may be made of the Shakuntala Devi Amir Chand Prize, Basanti Devi Amir Chand Prize, and Silver Jubilee Award of the Medical Council of India, B. C. Roy Oration, Sharpey-Schafer Lecturership, Edinburgh, Rameshwardas Birla National Award, Barclay Medal of the Asiatic Society, J. C. Bose Award, First Jawaharlal Nehru Science Award of the Government of Madhya Pradesh, C. V. Raman Medal of the Indian National Science Academy. He had been General President of the Indian Science Congress Association and President of the Indian National Science Academy. He had also been the recipient of second highest civilian honour of Padma Vibhushan by the Government of India.

Professor Paintal made significant contributions to the understanding of visceral sensory mechanisms and their reflex effects, mechanism of stimulation of aortic chemoreceptors. He is particularly known internationally for the discovery of the volume receptors of the atria and J-receptors of the lungs and showed that the natural stimulus for the aortic chemoreceptors was 'oxygen availability'. In his most important contribution, Professor had named the receptor as 'juxta-pulmonary capillary receptor' but had agreed to the suggestion of the referee of the paper to call it 'J-receptor' since the long name would almost fill a line every time it was used.

In Edinburgh, Professor Paintal was always called Monty, which in English means a mountain, an appropriate name for one who had scaled such heights. He had been an absolutely transparent person and never hesitated to call spade a spade. Quite often he had not been appreciated because of this but he never meant ill-will to any. He was a strong believer and follower of ethics in science and in the fitness of things; he was the Founder President of the Society of Scientific Values of India. The greatest tribute that this country could pay to him would be in supporting, following and promoting the values and ethics of science.

Dr. P. N. Srivastava, Former Vice Chancellor, Jawaharlal Nehru University, New Delhi and Former Member, Planning Commission, Govt. of India and Former President, Society for Scientific Values.

Prof. Autar Singh Paintal at research

Dr. A. S. Paintal — A Memoir

Dr. P.N. Tiwari*

My tendency to follow only the first part of the advice of the wise people, to speak truth but only pleasant truth, brought me in contact with Dr. A. S. Paintal in 1983 turning deeper with time. Some of us working in Delhi, concerned with the breach of ethics and norms of teaching, research and management in many scientific institutions of the country formed a group in 1981 to promote integrity, objectivity and ethical value in pursuit of science. The group could not do much except hold small meetings and discussions, and an article by me on 'Creating Healthy Environment of Research' that was published and discussed. We were looking for a well known scientist of high integrity to lead us. We approached Dr.A.N. Verma, the then Director, NPL who advised us to meet Dr. A. S. Paintal the then Director, Patel Chest Institute, Delhi, a highly reputed scientist known for integrity and outspokenness in scientific matters. Four of us who decided to go to him had not met him before. Therefore we requested a well known very senior botanist to come with us to give weight age to our request. When we entered Dr. Paintal's room, he was sitting behind a study table loaded with journals and books. He greeted us and made us sit around a low lying small table full of latest issues of scientific journals. He removed some of them and went for a minute or two in the side room. After talking for a while with us, he again went in the side room for somewhat longer time and brought tea for us. Later I learnt that first he had gone to switch on the water heating and second time to make the tea for us. We were with him for about one hour but did not see any so called class four employees. Though he was quite informal, we had to do most of the speaking. He listened to us keenly but did not commit anything except saying that he will consider our suggestion. He took almost a year to accept our request. We were happy and did not mind the delay because no man of repute will agree to such a request of a few unknown persons without knowing them fully.

The activities of the group took a quantum leap within one month of Dr. Paintal agreeing to lead it. Several scientists of repute and integrity joined the group. It got transformed into The Society for Scientific Values with Dr. Paintal as President and me as secretary. He set specific criteria of high integrity in research and publication for membership to the society. Many such scientists became its members. The idea was to create awareness among scientific community, from a sound moral base, about the need to strictly follow the ethics and norms without which excellence in science cannot be achieved. Accordingly, the first symposium of the society was on 'Scientific Values and Excellence in Science'. NATURE (vol.326, April 9, 1987) published a three-fourth page news about the formation of the society under the title 'Healthy Scientific Environment Promoted by Society in India', with a photograph of Dr. Paintal. The society was the first of its kind in the world at that time.

* Former Project Director, Nuclear Research Laboratory, IARI and Founder Secretary, Society for Scientific Values, B 65 SFS, Sheik Sarai, Phase I, New Delhi 110017

Looking into the specific cases of breach was not a priority. However, it was so pervasive that a specific case of breach of the norms of publication was brought to the notice of the society in its first General Body meeting itself by a senior professor of TIFR. He said that a group working at IISc has published four papers in a very competitive area in the late issues of three journals, without the date of receipt and acceptance, published by the Indian Academy of Sciences. Such an exception has been made only for these four papers. Several members knew this case and the group head who had considerable influence on the Academy. The papers were so published to get undue priority. Everybody in the meeting looked at Dr. Paintal who, without any hesitation said that he will do all that which should be done in the matter, and saw to it that all three journals corrected the mistake. He set up very objective and transparent method of examining such cases. Several cases of large scale plagiarism and outright fraud were brought to his notice in quick succession by well known scientists. He took pains to take appropriate action in each case including the well known case published both in Nature and Science, of paleontological fraud by a professor of Punjab University.

Dr. Paintal was a very simple person, free from ego. He never imposed his will on the society. A high level of objectivity was apparent in all the discussions of the society. He insisted that the society should not have much funds, and no one without high integrity should be made its member. He was perhaps, the only scientist in the country who worked up to the last days of his life in his laboratory with a complex instrumental setup made or assembled by him. He was so unassuming that a few times when he came to my residence, the other visitors did not realize, unless they had known him before, that they are talking to a great scientist whose discoveries are forming the basis of national and international seminars and symposia and that he has been holding several high positions and that he has been conferred many honors and awards including the General President Science Congress, President of Indian National Science Academy, Fellow of Royal Society and Padma Vibhushan.

Autar Singh Paintal (1925-2004)*

Dr. Indira Nath**

The country lost Autar Singh Paintal, one of India's insightful scientists on 21 December 2004 in Delhi. He was not only a towering figure in the field of physiology, but also a colourful and uncompromising personality in Indian science. He was born on 24 September 1925 in Mogok, in the then British Burma, where his father Man Singh was serving in the British Medical Service. He came to Lahore at the age of fourteen to complete his Matriculation. He studied for the Intermediate Examination at the Forman Christian College and later joined his parents who chose to settle in Lucknow. He joined King George's Medical College in 1943, with financial help from the Burmese Government.

That Paintal had an extraordinary intellect became evident even during his undergraduate days when he was recipient of distinctions and gold medals, including the much coveted Hewitt Gold medal given to the best graduate of the class. He was also unique in that he chose to pursue research in a basic subject like physiology instead of equipping himself to become a clinician. Those were the days when a 'proper doctor' meant one who treated patients and who did not 'dabble' with test tubes or equipment in the laboratories. Paintal started his research career during the M D course by studying the 'electrical resistance of the skin in normals and psychotics'. He not only built the equipment to measure skin resistance himself, but also went on to collect 400 psychotic patients, which required even greater ingenuity. He introduced a new index for evaluation of galvanic responses in man, which came to be known as the Paintal index (1951) and was used by clinicians to diagnose psychosis at a time when objective methods were not available. He continued in his alma mater, where he was appointed as Lecturer to the Department of Physiology.

The next stage of his career began when he chose to join Whitteridge for a Ph D programme in the Department of Physiology in the Medical School at Edinburgh. Interestingly, he was supported by a fellowship from the Rockefeller Foundation, which is usually given to pursue research in the United States and not in other countries. It was in Edinburgh that the foundations for the later discovery of J-receptors were laid. At a time when dissection of single nerve fibres was difficult, his innovative use of liquid paraffin to embed the whole nerve and isolate the single fibres without impairing their activity, was a tremendous boost for the measurement of single-fibre conduction velocities. At that time he also made a discovery that is now considered an established fact. He showed that the receptors (type B atrial receptors) which are now known to have a major role in fluid volume regulation were located in the atrium (1953) and not in the great veins/pulmonary veins as his mentor

* Reproduced from Current Science Vol. 88 No. 3, 10 February, 2005

** School of Medicine, Asian Institute of Medicine, Science and Technology, 2 Persiaran Cempaka, Amanjaya, 08000 Sungai Petani, Kedah Darul Aman, Malaysia. e-mail: indiran@hotmail.com and former Secretary, Society for Scientific Values

Whitteridge had thought. Thus began his legendary journey into the world of visceral receptors.

He returned to India in 1953 and joined the Defence Laboratories in Kanpur as a Technical Officer. His innovativeness once again helped locate visceral receptors (1954) by injecting chemicals to discover these 'silent' receptors. Soon after, he described the location of ventricular pressure receptors (1955).

In 1958 he moved to New Delhi as Research Professor in the Physiology Department of the All India Institute of Medical Sciences (AIIMS). Six years later he became the Director of V. P. Chest Hospital, a post he held till 1990. He later became the Director General of the Indian Council for Medical Research even while continuing his research at the V. P. Chest Institute. He continued his intellectual quest with support from the Department of Science and Technology, New Delhi in modest surroundings in a two-roomed laboratory in his favourite institute till his death.

Paintal is best known for the discovery of J-receptors (1955), which he went on to study in great depth. He coined the name J-receptors to indicate their location in 'juxta' pulmonary capillaries in the lung. He introduced the concept of viscerosomatic inhibition by showing that these receptors were responsible for the J-reflex, which acted as a feedback mechanism to limit muscle activity during exercise.

Physiologists for long had sought to identify a particular event which would have direct effect on the termination of exercise brought about by muscle fatigue. An intriguing quest had been to find out which signals in cardiovascular, respiratory, neural or metabolic pathways would determine continuation of exercise or its stoppage. The intracellular changes that occur in muscles during exercise were well known; however, it was difficult to identify a single or combination of events that would explain how muscle activity is terminated during physical exercise. The lungs and the heart are richly supplied with unmyelinated fibres which are capable of sending signals following chemical or mechanical changes in the local surroundings. Paintal showed that the J-reflex is elicited when pulmonary flow increases as a result of exercise, and this in turn sends a negative feedback signal to the muscles to limit further activity. Some scientists believe that such a negative control is necessary for protecting the muscles from toxic damage caused by the metabolites produced during physical activity. It appears to be one of the earliest evolutionary reflexes as even fish appear to have a similar mechanism. Paintal went on to also show that the J-reflex explained the tachypnoea (fast heart rate), breathlessness (1969, 1970), dry cough and throat sensations (1986) that are associated with such activity. The J-receptor activity would also explain some of the symptoms associated with disease conditions as in left heart failure, some lung diseases and blockage of major lung vessels due to blood clots (pulmonary embolism), as these are associated with increase in pulmonary capillary pressure. He also showed that J-receptor stimulation signalled increase in the permeability of pulmonary capillaries, thus introducing a new method for measuring the *in vivo* concentration of J-receptor excitants (1991, 1993).

The J-receptors elicited worldwide excitement, whose impact is being felt even today. As often happens in the history of science, Paintal's initial discovery was temporarily mired

in controversy. Many workers, including his own earlier students, investigated the J-receptors giving rise to a period of debate regarding their functions, the neural level at which the negative control took place, etc. It was also debated as to whether these receptors existed in a modified form in man compared to the cat, the animal used by Paintal in his studies. Later workers even gave another name to this phenomenon and the current literature uses the newer terminology of pulmonary C-fibres and J-receptors synonymously. But Paintal's name became inextricably linked to the J-receptors. He viewed the respiratory effect from the one associated with muscle activity as two different functions of these receptors. Moreover, he felt that chemical stimulation of these receptors by drugs, etc. was not physiological.

Thus the versatility of Paintal's intellect combined with his technical innovativeness made measurement of single nerve fibre conduction velocities possible, and led to the discovery of visceral receptors such as atrial receptors (1953), ventricular pressure receptors (1955), stretch receptors in the stomach which explain the sensation of satiation after food (1954) and pressurepain receptors of muscle (1960). His classic discovery that non-medullated fibres are blocked at lower temperatures, has now become a routine tool to distinguish medullated nerve fibres from non-medullated ones. Till his death, Paintal along with A. Anand continued to pursue the varied dimensions of J-receptors, including in later years, high altitude physiology and exertional breathlessness. The latter had implications for the better acclimatization of Indian soldiers posted in the Himalayas.

Paintal's interest in science went beyond the esoteric. He became concerned with ethical issues in the practice of science and founded the Society for Scientific Values (SSV). In his opinion, his major contribution was the SSV. That it was the need of the day was evidenced by the large number of young and old scientists who were attracted to it. He set high standards for membership to the Society, which in itself antagonized some. Moreover, as cases of malpractice were brought to his attention, the moral power of the Society became one with his personal reputation. He and his team investigated such cases with vigour and spent their time and often their own money in the pursuit of truth. Newsletters were brought out and symposia held on important themes, with little finances and support. Today, the SSV addresses both positive and negative aspects of the practice of science and is often called upon both by agencies and individuals to provide advice. Paintal's idealistic standards were sometimes misunderstood by his peers. He believed that science meetings should not be held in five-star hotels, but in the simple academic environs of the university. He refused to attend inaugurations or meetings in hotels. When malpractice was proved and the relevant institute did not take appropriate action, he never visited the institution again when invited for having an honour bestowed on him. This did not make him popular and in an era of changing value systems, he was considered an eccentric.

It is difficult to describe what made Paintal an inspirational teacher. Though I was not formally taught by him as I had completed the physiology course by the time he joined AIIMS, I consider him to be one among those who helped shape my thoughts. My first glimpse of him was in his shorts, repairing the electrical circuit of his equipment. This was not the usual behaviour of an Indian professor. Later on, when I became associated with him at various stages of my life, I became aware of even more peculiarities! Absorption in

his work to the exclusion of all else was itself inspirational. His high standard of integrity was difficult to emulate. His advice to students was that work undertaken should contribute to the 'body of knowledge' and not be imitative or superficial. As one of his students P. S. Rao quotes, Paintal believed that 'dependence on other people's labours is doing research by piracy'. He also believed in defending one's research findings (not to be confused with advertising) and used to say,'dang ladna seekho' (learn to fight battles). His lectures were not didactic, but more in a narrative form replete with his own experiences in the field, including anecdotes and descriptions of scientific debates. This was exasperating to the more conventional student who required information that was well classified and orderly. It was, however, informative to those who saw it as real time emergence of knowledge, as and when it happened. The excitement of discovery was never far away when he was in his narrative mode. He was a difficult person to work with, as he was uncompromising in his standards and unwavering on what constituted right and wrong. He was not an opportunist and saw no reason to change his views in the interests of pragmatism or societal approval.

It is customary to list the various honours that a man like him would have acquired over his extraordinary career. There are not many that he missed acquiring and listing them would be monotonous and not worthy of a man like him. They can be found on the websites of academies and the V. P. Chest Institute. He was elected to the Fellowship of the Royal Society of London (1981) and Edinburgh (1996). He was President of the Indian National Science Academy and General President of the Indian Science Congress. He was a Founder Member of the Third World Academy, whose cause he espoused rigorously. The country honoured him with Padma Vibhushan in 1986. He is survived by his wife and partner in science Anand, two daughters, one son, many students and admirers. It has been my privilege to know him.

An Approach to Ethical Morality

Dr. Narendra Nath*

What is ethical morality? Variable answers are being provided. Everyone feels it needs to be practiced by individuals constituting the society. The objective test lies in the choice between the overall good of the society versus that of an individual in particular. It should not be something we speak or write about. The dire need is to put it in practice in all our actions, professional and personal.

Our current predicaments arise on account of being overburdened with "ritualistic" practices, rather than the "realistic" ones. The former need to be offloaded substantially, so that one feels free and fresh to innovate scientific methodologies after in depth and long term planning. National goals and objectives can be realized as we can define them unambiguously.

Leading persons need to realize that the ones among them will prove to be truly great who have the courage to renounce their "acquisitions" without regret or hesitation, in order to preserve ethical standards. SSV can build strong authority in propagating ethical practices if it considers a suitable scheme of voluntary confessions by its members/office bearers. The latter may also undertake to respond openly to any unethical act as and when the same is pointed out.

Positions of leadership in the administration of science/technology, including concerned ethical institutions should be occupied through invitation based on objective procedure of pre selection (free of lobbying/personal seeking). Such persons need to commit to inspire their juniors, rather than aspire for self glory and fame. The letter should follow in a natural manner.

The three elements of transparency, objectivity and accountability should be built in administrative structure and procedures. The letter is open to scrutiny as and when a complaint/accusation is made. Simultaneously, punishment should be in built for false accusation made.

To ensure democratic functioning of an institution/lab, open brain storming/creative thinking discussion groups, among specific/relevant team members should be organized from time to time. There should be a built in commitment to back the eventual consensus decision so arrived at. Any attempts to sabotage the implementation process should be take as an act of serious indiscipline with prescribed punishments duly laid down.

*Ex Prof & Head, Physics Dept, Kurukshetra University, Kurukshetra

Research Integrity and Scientific Values: A comparison of American and Indian models

Dr. N. Raghuram*

The 2004 ORI Research conference on Research Integrity (November 12-14, 2004, San Diego, California, USA) provided a unique opportunity to understand the American government model of promoting scientific values and compare it with the Indian system. This was the first time that the organisers decided to invite a few international participants to an otherwise primarily US activity. Being the only Indian delegate at the conference, I was able to present some Indian case studies and the pioneering role of the Society for Scientific Values to deter misconduct and promote integrity in Indian science. The following report is intended to share some crucial insights into the working of the American system and its relevance to India, if any.

The main organiser of the conference was the Office of Research Integrity (ORI) under the US Department of Health and Human Services (HHS), which oversees adherence to scientific values in the U.S. biomedical research. It spends about $ 2 million per annum (2004 data) to support research about ways to foster integrity and deter misconduct in research. One of the major activities of ORI is to develop a knowledgebase for making responsible decisions about the best ways to promote and ensure high integrity in the nearly $30 billion annual federal funding (2004 data) for biomedical and behaviour research supported by HHS (See box for a history of the ORI and its limited scope). The ORI Research Conferences on Research Integrity bring together ORI-funded researchers and other scholars interested in integrity in research to discuss crucial research problems, explore different research methods, and share research results. The latest conference was held at the Paradise Point Resort and Spa, San Diego, California during November 12-14, 2004. It was Co-Sponsored by the University of California - San Diego, Association of American Medical Colleges, American Association for the Advancement of Science and Merck Research Laboratories.

One of the most striking revelations about the US system is that unlike the Society for Scientific Values, which was started by Indian Scientists who believed that self-regulation is the best regulation, ORI was instituted by the US government, concerned over fraud in US science. This could either be a credit to the concern of Indian scientists, or the Indian government's lack of it. There is no evidence of any US society comparable to the Indian SSV, nor such a prominent involvement of other US professional academies and societies with issues of scientific values.

Advantages of the ORI model: The advantage of a strong government involvement in the US is obvious: it attracted a lot of social scientists, psychologists and concerned

*School of Biotechnology, Guru Gobind Singh Indraprastha University, Kashmiri Gate, Delhi - 110006. E-mail: nandula.raghuram@gmail.com

biomedical scientists to get into the whole issue of research integrity with rigorous scientific analysis in project mode, with funding upto $1,75,000 per year per project. Other advantages of government involvement include uniform procedures, guidelines, incentives/disincentives, administrative teeth and some sort of public accountability through the US congress. A cursory glance at the titles of papers presented at the conference reveals the range and scope of the issues being investigated, the methodologies being used, and even attempts to put together common standards, terminology and definitions.

Some of the research questions that are being investigated include: How much misconduct is happening and what is the level of variations among institutions? What types of misconduct are being reported? Are they increasing or decreasing with time, training, funding or career security? What is the cost of sloppy or fraudulent research to the American exchequer? When and how do researchers learn about good research practices? What are the factors that encourage or discourage researchers from following these practices? How serious is the role of source of funding or conflict of interest in determining the outcome of research? Which levels of the research hierarchy indulge most in misconduct? Which sections of the research community blow the whistle most often, and which sections make the most successful allegations (as proven by subsequent enquiries)? How critical is the need to protect the whistle blowers? To what extent do ethnic or past cultural backgrounds influence the researcher's conduct? What is the role of education/training in promoting responsible conduct of research? How critical is the role of the mentor? What policies do research journals need to prevent/ reject publication of manipulated data or just questionable research results?

While these questions may be just as relevant for us here in India, over a decade of research in the US has not yielded definitive answers to most of these questions. However, some trends are revealing: The most funded and the best-ranked institutions also have some of the most frequent reports of misconduct cases. Higher educational institutions such as universities rank highest in terms of misconduct, as compared to other research institutions. Falsification, fabrication and plagiarism (FFP) constitute the most reported types of misconduct. At least half of the misconduct cases are due to bad record keeping. The rate of misconduct decreases with increasing career mobility. Larger panels or durations of enquiry don't necessarily lead to more convictions. The most frequent whistle blowers are from the faculty, but the most successful whistle blowers are students/post-docs. Whistle blowers are not often encouraged by reward or discouraged by victimisation. Mentoring does much more to research integrity than rules, regulations and education/training, but absentee mentoring is a major problem; many good mentors were not mentored themselves.

Most of the above generalisations have been arrived at using survey methodologies, with their attendant limitations. Very few studies provided deeper insight through detailed case studies. Interestingly, while scientists make most of the noises about authorships and plagiarism, the final outcome of research (and therefore the common man) is most adversely affected by falsification and fabrication. Similarly, there are other questionable research practices (QRP) that are probably more frequent than FFP but not very well defined or understood. Similarly there are wider issues of responsible conduct of research (RCR), which are not addressed adequately. There are also issues of terminology and standard

vocabulary that need attention. Most importantly, there is not clarity yet on the causes for misconduct, or the most effective means for prevention. The SSV could benefit greatly from these experiences.

Disadvantages of the ORI model: ORI is concerned with integrity only in biomedical research, that too only those programs/institutions funded by federal PHS grants. This means that adherence to scientific values in other areas of science, or even in biomedical research supported by private agencies or other non-PHS sources, are not necessarily the responsibility of ORI. Every institution that seeks/receives PHS grants is required to have its own institutional ORI, to provide training in research integrity, as well as to investigate complaints and report to the federal ORI. Again, these institutional ORIs, may or may not cover other areas of science, or even biomedical research supported by private agencies or other non-PHS sources. It is expected that depending on the level of concerns on research integrity that emerge in other areas of science or for that matter even social science, ORI-like bodies or other suitable mechanisms will be instituted by the concerned federal and/or state agencies. This will lead to unnecessary bureaucracy with either tremendous redundancies or multiplicities in regulatory mechanisms to deal with what seems to be an essentially common problem of research integrity and scientific values.

One of the main pillars of the ORI model for fostering integrity is to make the employers have institutional ORIs, policies and training programs in place. This works on the assumption that the government, employers or heads of institutions are keen to promote integrity, anxious to enquire into allegations of misconduct and prompt to take action to deter misconduct. For us in India, the experience of SSV as well as that of this author shows that none of the above assumptions are true. Therefore, institutional ORI model does not work in India, even if we avoid redundancies and have a single ORI in each institution to deal with all areas of science and technology under its ambit. What we need is a mechanism to provide more teeth to SSV or other such scientific Academies/societies that are completely independent from government or individual research institutions.

How do Indians fare in the US in terms of their record of research integrity? It is difficult to get a very satisfactory answer to this straight but sensitive question. Some say Indians in the US are just as bad or perhaps worse in terms of their research integrity record. Others say that there is no clear basis for such generalisation, as collecting ethnic data on issues of research integrity is considered politically incorrect. But it is generally acknowledged that in an increasingly globalising world depending on overseas scholarships and collaborations, mentoring and research practices in one country tend to influence the research outcomes in other countries, and therefore every country needs to be cautious about the reputation of its students and scientists on issues of integrity. To that extent, ORI seems to be open to having joint conferences/exchanges with similar bodies in other countries. What is most heartening to note is that there are many Indian names conducting studies and co-authoring publications on research integrity in the US, some of them even working with ORI funds! Perhaps SSV should approach them for membership and improve our international outreach.

Box: The History of ORI (USA)

The Office of Research Integrity under the US Department of Health and Human Services (HHS), which oversees adherence to scientific values in the U.S. biomedical research, has its origins in the US Congressional hearings on fraud in science. The process began in 1981 when then Representative Albert Gore, Jr., chairman of the Investigations and Oversight Subcommittee of the House Science and Technology Committee, held the first hearing on the emerging problem. The hearing was prompted by the public disclosure of scientific misconduct cases at four major research centers in 1980. There were at least 12 cases of scientific misconduct disclosed between 1974-1981, and additional allegations involving researchers from National Institutes of Health (NIH), universities, and other research institutions in the US throughout the 1980s continued to attract Congressional attention.

In order to address the emerging problems, a series of regulatory measures were initiated by the US government, especially the Rule concerning "Responsibilities of Awardee and Applicant Institutions for Dealing With and Reporting Possible Misconduct in Science", for NIH and others funded by the US Public Health Service (PHS), such as The Centers for Disease Control and Prevention, The Food and Drug Administration (FDA), The Substance Abuse and Mental Health Services Administration, The Health Resources and Services Administration, The Agency for Healthcare Research and Quality, The Agency for Toxic Substances and Disease Registry and The (Red) Indian Health Service. The regulatory activities of the FDA have been exempted from the responsibilities of research integrity.

Before 1986, reports of scientific misconduct were received by funding institutes within Public Health Service (PHS) agencies. In 1986, the NIH assigned responsibility for receiving and responding to reports of scientific misconduct to its Institutional Liaison Office. This was the first step taken to create a central locus of responsibility for scientific misconduct within the US Department of Health and Human Services. In March 1989, the PHS created the Office of Scientific Integrity (OSI) in the Office of the Director, NIH, and the Office of Scientific Integrity Review (OSIR) in the Office of the Assistant Secretary for Health (OASH). The sole purpose of these offices was to deal with scientific misconduct and relieve the funding agencies from carrying out this responsibility. In May 1992, OSI and OSIR were consolidated into the Office of Research Integrity (ORI) in the OASH. Later that year, HHS established a hearing opportunity for all scientists formally charged with research misconduct. Next year, President Clinton signed the NIH Revitalization Act of 1993, which established the ORI as an independent entity within the Department of Health and Human Services (HHS). The Act also mandated that a Commission on Research Integrity be created to review the system for protecting against scientific misconduct. The Commission delivered its report to the Secretary of Health and Human Services in November 1995. The Commission made 33 recommendations including the development of a regulation on the protection of whistleblowers in research misconduct cases and the extension of the misconduct in science assurance that required institutions to establish educational programs on the responsible conduct of research (RCR). Based on the subsequent review of these

recommendations, HHS announced several changes in 1999 to promote research integrity, which include:

1. The HHS adopted the proposed governmentwide definition of research misconduct developed by the National Science and Technology Council that was published in the *Federal Register* on October 13, 1999. The final definition was published in the *Federal Register* on December 6, 2000.

2. The primary responsibility of extramural institutions and intramural research programs for responding to allegations of scientific misconduct was reaffirmed. The Office of Inspector General, HHS, rather than ORI was given the authority to conduct any fact-finding for the federal government. ORI continued to conduct oversight reviews of all investigations.

3. The Assistant Secretary for Health, upon recommendations from ORI, was delegated the authority to make final decisions regarding scientific misconduct and administrative actions, subject to appeal.

4. The role, mission and structure of the ORI was focused on preventing misconduct and promoting research integrity principally through oversight, education, and review of institutional findings and recommendations.

5. The HHS Departmental Appeals Board continued to hear appeals, but the hearing panels were to include two scientists rather than one or none.

6. All extramural research institutions were required to provide training in the responsible conduct of research to all research staff who have direct and substantive involvement in proposing, performing, reviewing, or reporting research, or who receive research training, support by PHS funds or who otherwise work on PHS-supported research projects even if the individual did not receive PHS support. The *PHS Policy on Instruction in the Responsible Conduct of Research* was published in the *Federal Register* on December 1, 2000, and suspended on February 20, 2001, pending review of the substance of the policy and whether the document should have been issued as a regulation rather than a policy. The policy remains suspended.

7. The HHS published a notice of proposed rulemaking on the protection of whistleblowers in research misconduct cases in the *Federal Register* on November 28, 2000; the comment period ended on January 29, 2001. A final rule on the protection of whistleblowers is pending.

ORI carries out its responsibility by: developing policies, procedures and regulations related to the detection, investigation, and prevention of research misconduct and the responsible conduct of research; reviewing and monitoring research misconduct investigations conducted by applicant and awardee institutions, intramural research programs, and the Office of Inspector General in the Department of Health and Human Services (HHS); recommending research misconduct findings and administrative actions to the Assistant Secretary for Health for decision, subject to appeal; implementing activities

and programs to teach the responsible conduct of research, promote research integrity, prevent research misconduct, and improve the handling of allegations of research misconduct; providing technical assistance to institutions that respond to allegations of research misconduct; conducting policy analyses, evaluations and research to build the knowledge base in research misconduct, research integrity, and prevention and to improve HHS research integrity policies and procedures; assisting the Office of the General Counsel (OGC) to present cases before the HHS Departmental Appeals Board; administering programs for: maintaining institutional assurances, responding to allegations of retaliation against whistleblowers, approving intramural and extramural policies and procedures, and responding to Freedom of Information Act and Privacy Act requests.

The three phases of the (Indian) scientist

Prof. V. Sitaramam*

Summary

When it comes to evaluating values, the question is not so much as to how deep we dig, but whether we dig deep enough. It would be futile to consider scientific values outside the realm of social values in which the scientists and their activities are embedded. Here I examine the antecedents to scientific values considering the pack behavior of scientists. Every working scientist has contributed to this as well as experienced it. Surprisingly most are usually unclear about why the state of affairs is far less than satisfactory.

The problem in looking at scientific values in isolation is in missing the motive forces. The tendency is to identify only the patently negative aspects like plagiarism and false data. These 'evil' things surface ever so once in while and draw more attention, side tracking more pernicious problems affecting the day to day lives of scientists, teachers and administrators. The problems start right there; the remedy also has to be right there.

Things often go wrong. When left unheeded, they get worse. The perception of a scientist of these happenstances is not constant but varies with age, attitudes and goals. It occurs in three stages, depending on the stage of his career: Stage 1. I don't know; Stage 2. I don't want to know. Stage 3. Why has everything going/gone wrong? Psychologists have names for these stages, e.g., the stage of denial, the stage of apathy and the stage of self-pity. Are these abnormal states, as psychological analysis may tend to conclude? Or, are these normal states of every one?

Events, good or bad, are the tip of the iceberg. Though the events are few and far between, the causal factors are deterministic and stay with us. This distinction is often lost on those who are all gung-ho on doing something about the events.

Starting the career

You are thirty or thirty-five when you join an institute or a department. You have spent 3-4 years abroad as some one's workhorse and would like to have some freedom and settle down and what do you walk into? The same story of postdoctoral life, except that it could continue for life.

A major deviation comes in at the time of appointment itself. Specializations are often make-believe. In some major institutes in the country, the Head screens the application and 'places' the 'selected and relevant' applications before the selection committee. In another major institute, when asked why new appointments are from their own old students, the glib reply was "our clone is the best'! Thus the stage for a new entrant is set long

*Professor, Dept of Biotechnology, University of Pune, Pune - 411 007

before the person joins the establishment. The mantra is: don't rock the boat!

When one gains entry to a permanent job, the pressure is to stabilize. Social forces require that one remains aloof from the internal squabbles that define any new place of work (some more some less, but all, nevertheless). Most of these arise from wrongs done in promotions, recognition, work allocation, groupism (caste, colour, creed, gender and genealogy…anything can be and is brought in) etc.. To weave one's way through, the normal and correct thing is to follow the middle path. Except that, often there is no middle path.

The middle path of non-committal approach isolates you from pre-existing groups and therefore, soon one realizes that one is a loner. That is not comfortable since one needs some one to interact with. The alternative is more problematic. There would be clear power groups that control topics, money, instruments, students, access to the boss or what have you. There is a price to be paid to be part of the establishment, the most common being the authorship or project investigatorship. The pressure comes in two forms: one is subtle where the workers make a peace offering sensing the mood and the other more direct: the publication/grant proposals must be approved by the director!

Social responsibility: where it begins

Now what is important is not your reaction to what happens to you. What is important is what is happening to the new entrant who joined **after** you. In the event of a mishap, everybody looks in the other direction. If I had to slog for some one else for so many years, why should not the new entrant? Once the trend emerges, regardless what goes wrong, no one will open their mouth not because they do not recognize what is wrong, but because that is the rule than the exception.

What starts as a young person's individual journey slowly consolidates into looking after ones own skin. This brings to fruition the apt remark in Doctor Zhivago about Komorovsky: the most beloved in the community is its greatest villain.

Success in the establishment

When it became difficult to evaluate every collaborating industry, the ISO series have come into being. Evaluate yourself and get certified. A standard, accepted route for self promotion. The scientist on the make also has to go through peer review, to which he should attend if he wants recognition. So there are specific features that spell the success of a scientific yuppie: it requires the fine art of ignoring ones ambience and pursue with mindless devotion the furthering of ones own career. The next mantra is: I don't want to know! It is the case three monkeys, not to see, not to hear, not to talk. The deaf, dumb and blind will not perceive that the critical monkey is missing, not to **do** evil!

Politeness is the best garb for social hypocrisy. Scientific establishments are no less. The basic features that defend the quality are often the source of undoing scientific identity. One is institutional loyalty; the second is subject loyalty and the third is personal loyalty. Everything else, we don't want to know. It takes guts to challenge these.

Imagine there is two grant proposals, one from a major institute with routine data acquisition and the other with an idea, new and bold from a lesser place. Once the committee sits, the scientists from major institutes will either argue for their own institute or make a pack and put down the new idea. That is something very peculiar to new ideas, they are hard to defend and are extremely vulnerable. It is easy to make mince meat of any one with a new idea. Here comes the role of the apathetic yuppie. He/she would keep quiet as the drama unfolds. Even if the new idea is appreciated, one is not clear how the pack would move and therefore one keeps quiet… as a safe bet! The idea is killed. And the lesson is learnt. When Polonius advised his son "neither a borrower nor a lender be', he could have meant new ideas, if he were a scientist!

Plagiarism of thought

In fact, since much of Indian science is controlled by the *western ideology and practices*… we need their citation indices, their journals, their impact factors, collaborations with the west, visits and meetings. The simplest solution is to work on their problems. You belong to the crowd! Few if any develop their own problems in this country. Bigger the 'stature of the institute' more are the borrowed problems. Bigger places borrow big problems and current problems and smaller places borrow smaller and older problems. In this morass of duplicate research unencumbered by ideas and insights, could plagiarism and false data be even lesser sins?! After all, plagiarism is copying *some one else's* physical data, while entire careers were made by supplying samples to and duplicating others' results. Usually false publications do not wish to draw attention to themselves since the purpose would be some token improvement of biodata, a degree to a student etc..

Double standards and looking the other side are quite common. When an Indian was accused of plagiarism at Yale, the journals made noise about whether the pure American research values are getting diluted by lower strata of intellectual life, whose social and moral antecedent are not known. In case any body missed, we Indians are of that lower category. A little latter, when a prospective MD in Racker's lab used a fluorescent marker to generate gels to mimic (32-P)phosphate incorporation, same journals waxed eloquent about the pressures on the students whose obsession with doing well leads them astray, a social problem of forward societies like the USA and not the moral fault of the student! No one protested! In fact success also is tainted by ones background. The obituaries for Yellapragada Subbarow in the American newspapers sadly reflected on the naked ambition that led this foreigner to their shores driving him to do better than his betters! He did not know his place and had the hubris to do better. People did not want to know.

So there has been talk about lower ethical standards in developing countries. If some Arab published some 20 plagiarized papers, it has to do with their feudal structures that do not permit percolation of clear Anglo Saxon/Western value systems. The west is very silent about citation. In fact, they do not cite work outside their own clubs. The credit for the only systematic attempt to unravel the psyche and the modus operandi behind this 'idea stealing', to my knowledge, belongs Raja Amphora of the Infinity Foundation.

All this goes to show that there is a highly tilted system that we borrowed from the West and the operational structure of science itself is embedded in it and is not free of bias.

On things going wrong

There were several articles in Current Science about how bad was the Pokhran explosion and how India should steer clear of the Nuclear weapon policy. Of course it reads good to have a view about how nuclear war is bad for us. There was not a single remark about how some one next door could get away with selling blue prints to other countries. There was not a single remark about how justified as the USA and Great Britain occupy Iraq in search of WMD for which no evidence existed. As many people died there as they have in the recent tsunami. Yes, there is not much we could have done for a natural disaster. If we are so socially conscious about nuclear warfare, why are we not about international vigilantism or genocides in African and Asian countries? If these are not our business, how is it that nuclear disarmament is?

It is very clear that much of our psyche is dominated by the Western ideology and the value system designed and defined by them. The reason why we cannot remedy our wrongs is that these values have been systematically embraced by us. Much of our problems arises from a single faulty definition… rather a hypothesis…called merit.

I am jealous about Haldane. When asked how would they select a candidate for their major Universities, in terms of degrees, affiliations, publications, he replied that they are sure that they can make the right decision whether these are spelt out or not. An arrogance that only an idea-moved person can have.

Are mediocrity and merit synonymous?

There is no surprise element in this argument. What do we mean by merit? We take it that it is intelligence. Intelligence reflects usually ones academic performance and occasionally in some virtuosity such as in music. Having intelligence and using it are two different things. One speaks of emotional intelligence in day-to-day life rather than intelligence alone.

There are three aspects to ones performance and intelligence is only one of them. The other two are efficiency and commitment. Any operative has to be evaluated in terms of all the three. A bright student does doctoral research in a major institute, spends abroad a number of years and comes back and becomes non-productive. The very first block is in the transition between intelligence and insight. Those who trained abroad try to transplant the problems/technologies here. I heard that C.V.Raman thanked his stars that he did not train abroad. Year after year, institute after institute (read department where required), we have installed these totems with the ‘latest techniques’ only to find them obsolete even before their confirmation. It is amazing how we get fantastic recommendations from the west for these technicians. I had an occasion to ask why and the reply was, though these are not highly rated, at least they would be value addition for smaller places like India and other developing countries. We must rehabilitate their residues.

A senior scientist, (himself foreign-trained and returned) in this country remarked in an open meeting that the only worthwhile scientists remain abroad and those who are not worth it alone return. He should know.

Most 'better'scientists that I know swear by 'good'journals. I remember a long argument with Lehninger in the early eighties. He was persuading me to look at the mechanism of mitochondrial swelling from the osmotic techniques that we developed in India (to show that mitochondrial stoichiometry (ATP made per oxygen consumed) varies with the physical state (osmotic stretch) of the mitochondrial membrane). I asked: why should I spend my time on a problem on which he published some twenty papers in J.Biol.Chem. alone not to mention major reviews? His reply was succinct: if he knew the mechanism, where was the need to publish 20 papers? Duly chastened, we finished the work in the next 6 months and published a paper in Biophys. Biochem. Acta that the swelling was no simple swelling at all, it was actually a serial disruption of first, the outer membrane, followed by unfolding and then the rupture, of the inner membrane. The problem was solved and Lehninger and a few insiders were happy and the smaller (impact-wise) BBA paper was never cited.

Over years, I have not seen attention to detail of what was actually said in assessing the publications, but only to peripheral details. A senior scientist approached me the other day to ask about x's work. I told him that I had a fair idea. Fortunately, before I could utter another word, he told me that he was sure that it is fabulous work because he spoke very nicely and very vehemently (in that order of importance). I hastily agreed and terminated the conversation, since, after all, grants are evaluated no better.

So when we speak of merit, we really mean short goals such as exams and degrees and we have no way to assess ones performance in the country. Thus, efficiency would tend to rock the boat and ideas would tend to embarrass the establishment. Commitment would soon evaporate as it would mean fighting the establishment.

Are there solutions?

A bad thing cannot necessarily have 'good' solutions. Cancer requires ablation. If we dispense with merit, there is nothing new. We have many criteria for selection and awards all of which seek conformity with regionality, gender, caste etc., so much so that any notion of merit or commitment has taken the backseat. What is bad is that the residual notion of merit also has limited use if any. So we have to simplify the procedures without throwing the baby with the bath water.

Academic affairs today is run like the days of permit raj. We were afraid of a country without controls such that it did not go the way of fascists, communists, capitalists, fundamentlists…list of these deadly guys was large. Given some liberalization, the economy actually shot up. We are learning but that is still better than staying static. Similarly, we cannot undo all the evils of dependence on the West. We can at least remove biases. Should we simply fund research based on publications? Task force approach as the so-called thrust areas has become extremely suspect since a given set of people give themselves the projects. I sat through earlier meetings on biotechnology curriculum and industry/academia interactions. Typically, the chairperson for the group introduced the topic

to us in 20 min, outlined the topic in 50 min, summarized in another 15 min. Time was up and this followed a group discussion. The show was repeated for another hour except that three such group leaders spoke. At the end, they all congratulated DBT for a very advanced brain storming session and left the meeting with thoroughly stormed brains. On the other hand, DST had special PACs like Interface between Chemistry and Biology and invited projects nationwide. These were, though very successful, wound up very soon.

Sooner or later, we have to take a firm view of national laboratories and goal-directed research. Despite several slogans periodically raised, we remained successful in numbers and not quality. Economic criteria for successful research will be very tough to achieve in any country. Patents, though raised as a mantra, in developing countries it has become a defensive game rather than a force. It is still not clear whether research makes countries rich or rich countries do research. Probably, latter is true. However since much productivity rests in smaller and cheaper goods in larger volumes (the reason why drug discovery is going bust, due to unaffordable pricing), higher assimilation capacity requires higher education and that forms the basis of larger home markets…not front line research.

Actually we have very interesting challenges and problems in gathering momentum for our own growth and development. The list is endless. To support good work, we need some pride of association and a respect for self will. Till then much that we talk about scientific values will remain just talk. It also harms generations of students who live an ambience of non-authentic academic atmospheres where originality becomes a sin.

Science Content in Engineering Education

Prof. A.W. Joshi*

How much basic science such as physics and chemistry should be taught in the four years of the first degree course in engineering? How much applied science should be taught? Which teachers should teach these courses, science teachers or engineering teachers? These issues are bothering most engineering and technology institutions in the country, particularly institutions at the lower rung of the ladder, and different bodies and committees are coming out with different proposals.

A survey shows that all the prestigious engineering institutions of the country, among which the Indian Institutes of Technology are the pioneering ones, do have a very large content of science in their engineering curricula. However, in a vast majority of engineering institutions spread across the country, the science content is found to be abysmally low, only about 5%, and confined to the first year of the course.

Thus you start with colleges affiliated to the State Universities, where you find only one course each in physics and chemistry, those too with the prefix 'applied', and none in biology - except nowadays in biotechnology departments. The physics and chemistry faculty is put together in what is known as the applied science department. It seems now the engineering faculty in these colleges is questioning the necessity of the science faculty teachers, and the thinking is that all these courses could very well be taught by engineering faculty.

Upward on the ladder, we see better engineering institutions, such as BIT, BITS, Delhi Engg College, Bengal Engg College, Thapar Inst in Patiala, National Institutes of Technology (NITs), and some others, more and more of which are becoming autonomous and even turning into deemed universities. The science content in the four-year engineering and technology course increases in this case. Among Indian institutions, it is fairly high in IITs.

When one compares the better institutions with the not-so-good ones, what strikes one is that there are some clear similarities and differences among them. For one, institutions of the former category, which teach a fair amount of science in the curriculum, are autonomous, while the latter group consists mostly of affiliated colleges. The former group has separate departments of physics, chemistry, mathematics, materials science, etc, and even humanities, which itself is an indicator of the importance they attach to basic sciences. The teaching load in terms of number of contact hours per week for the teachers of the two categories also differs significantly, with the former category requiring less teaching than the latter. Finally, the former institutions have a better research atmosphere with various projects, programmes, consultancy, etc, in all their departments, engineering as well as science. On the contrary, the latter category has no research atmosphere in their engineering departments, although there could be some R & D activity in their applied

*D-2 Ayodhyanagari, Bhau Patil Road, Bopodi, Pune 411 020, Email: awj_ayodhya@yahoo.co.in

science departments. This also becomes clear from the fact that in the latter institutions, most engineering faculty would be only BE/BTech while science faculty would have MPhils and PhDs.

These correlations are very revealing - revealing about the state of engineering education as a whole and science content in it, about the way universities and institutes frame their courses and syllabi, and about the prestige they attach to science vis-à-vis engineering. Another aspect that needs to be emphasized is that when a student enters our institutions, our job is not only to teach him for four years of BE or three years of BSc or two years of MSc, as the case may be, but it is also to motivate him, enthuse him, to show him the frontiers and the emerging horizons, whether with a view of a research career or any other career out in the world, including banking or management. A student in an institution devoid of any R & D activity is unlikely to develop any interest in his courses. He would be unable to understand the why and how of the emerging trends in his area, the new processes and methods, the new technologies and materials, and the latest discoveries and inventions.

For some reason or the other - blame the British if you like - most Indian universities have only arts and science faculties and departments, and then probably commerce, education and others. There are very few universities where we find engineering and medical faculties as part of the university. But simply blaming the British would also not do, because even the new universities were started only with the 'conventional' departments or, at the other extreme, were started as technical university or medical university! Engineering and medicine is taught in colleges, and a university generously gives them affiliation. In a sense, we are responsible for never trying to integrate areas like science, engineering, and even arts.

By establishing private engineering colleges, and now even universities of technology, we have suddenly increased the number of seats available to engineering aspirants. But I have a feeling that unless these colleges and universities have a dash of R & D activity, which they do not seem to have presently, they will simply be degree-giving institutions. And there is the catch. Establishing a research department requires financial inputs and long-term investments which the private bodies here are not willing to do. These institutions are meant only for short-term gains. While it is generally felt that they are dragging science students to engineering, I feel that they are doing a disservice not only to science, they are also doing a disservice to engineering and technology.

What has been said above about engineering education also applies to science education, or in fact, to education in any area. In this context, the situation in medical colleges and medical institutions seems to be better. For as far back as I remember, it has always been mandatory for a medical college to have a hospital attached to it. This provides actual work experience to the student-trainee and brings them in contact with the real world right from the beginning. While the institutions of the first category mentioned above have their own R & D activity, those of the second category have none of it. It would be like comparing a student coming out of these institutions with one coming out of a medical institution who has not been exposed to any patient care during his medical education.

When one goes beyond the country to the developed world, one finds that the dividing line between science and engineering becomes very fuzzy. The engineering curriculum contains a tremendous lot of basic science courses. There is also a whole lot of flexibility in the choice of courses, which a student can choose for his degree. It is much easier to switch between science and engineering. A student could take his first degree in engineering, then take up some science-oriented courses for his MS, and become a scientist or a mathematician. On the other hand, a person could begin as a physicist, chemist or biologist, and turn to engineering at some point of time. A project such as mathematical modeling of electrical control systems could equally well be carried out in a developed country in the electrical engineering department, physics department or mathematics department.

There are a few engineer-turned-scientists in India but all of them have made the transition via USA. Recently some institutions have opened up such possibilities. University of Pune is one such State university which admits students who have done their BE/BTech to its MSc (Physics) programme. This transition is also possible in some IITs and national institutes like Tata Institute of Fundamental Research and some others, who admit BE students for MSc or PhD in science subjects. Going from science to engineering is now almost impossible in India, though one could do that a few decades ago.

Going out into the real world, one sees that an employable person must have a broad understanding and must have developed skills in more areas than one. Even talking of our own country, one can think of recent milestones in the past decade such as Pokhran explosions, ISRO's ever-ambitious satellite launching programmes, remote sensing, oil exploration and extraction, and the sudden spurge in biotech activities and the corresponding industry. A worker in any of these areas requires a combination of physics, chemistry, biology, materials science, geography, geology, and all this aided by electronics, instrumentation, mathematics, statistics, software and hardware. The nuclear tests have to be carried out underground, so apart from science,one needs to know the type of rock and soil there, decide how deep one should go, how the waves would travel through the rocks to the surface, how far the radiation would spread, the farms and the villages on the ground above, etc. The area of oil exploration is a highly complex combination of physics, chemistry, coupled with a lot of electronics, sensors of all kinds, instrumentation, and all that. The same thing is obviously true for satellite launching, rockets, fuels, etc. And all this of course has to backed by high degree of mathematics, software and hardware.

We coined the word 'biotechnology' or biotech for short. Is what I have described in the above paragraph not *scitechnology*? I don't see the need to separate out biology from other branches of science. Technology requires biology as much as it requires physics and chemistry. But we never made conscious efforts to bring science and technology together. On the other hand, we always kept them apart.

Proposal for a "National Science & Technology Ethics Committee"

(Presented before the 'Scientific Advisory Committee to the Cabinet
by Dr. K.L. Chopra, President, SSV in February, 2005)

Ethics are fundamental to a civilized society. Quoting Swami Bodhinanda: "History of world civilizations shows that societies have risen to higher levels not through mechanical and technological efficiencies but by practicing sound moral and ethical values". In the emerging era of internationalized science & technology and tech-nomic-globalization, related ethical issues are coming to the center stage of development processes. In recognition of the important role of ethical conduct, most academic and R & D institutions in the developed world have introduced formal and informal studies on ethical values in their curricula and training programmes. Some premier institutions in India have also evolved such courses. Most science & technology based professional societies in developed countries have also adopted appropriate codes of conduct and, in some cases, also Boards of Ethical Review. An Office of Research Integrity has also been set up in the US during Clinton presidency. In India, ICMR and CEHAT have evolved ethical guidelines for Biomedical Research and Social Science research on humans, respectively. The CSIR has adopted a code of conduct evolved by the Max Planck Society, FRG. The Union of All European Academies has circulated a Code of Conduct and has also advised its 48 members to set up Science Integrity Committees in their respective Academies. Spurred by these developments, ICSU has advised its member academies globally to prepare country specific documents on science & technology ethics. An inter academy committee chaired by Prof M G K Menon has been set up by the INSA for the purpose.

Concern created by the cases of unethical practices in the country led several Fellows of INSA and other scientist to register a Society for Scientific Values (SSV) during 1986 to promote integrity, objectivity, and ethical values in the pursuit of science & technology. Led initially by the Founder President, Dr A S Paintal, the SSV has organized a number of local and national seminars and discussions on the subject for the purpose of sensitization of knowledge workers and for developing a code of conduct. As a normal watchdog, the SSV has also investigated a number of cases of unethical practices in the country and has applied moral pressure, with limited success, to make the unethical accountable. The activities of SSV have been carried without any infrastructure and on voluntary basis by the members of the Society.

Now that Ethical Issues are a global concern for knowledge economies, the SSV proposes that a National Science & Technology Ethics Committee, consisting of scientists and engineers of high credibility, be set up be MHRD, DST, or INSA to function as a national think tank as also a watchdog on evolving and emerging ethical issues. Such a committee should be non governmental and autonomous, with some quasi legal powers, so that it can be effective in its objectives.

SSV Seminar on Bioethics: A Report

The Annual General Meeting of the Society for Scientific Values was preceded by a Seminar on Bioethics on 29th April 2005, held in collaboration with the Indian Agricultural Research Institute (IARI), New Delhi, which is celebrating its centennial year. The half-day seminar in the seminar hall of the Nuclear Research Laboratory of IARI was attended by scores of SSV members as well as students and faculty from Delhi and elsewhere. The President of SSV, Prof. K.L. Chopra, welcomed the distinguished speakers and the gathering, and underscored the importance of bioethics for India today and its relevance to the activities of SSV. In his introductory remarks, Prof. Nagarajan, Director of IARI, drew the attention of the gathering to the importance of ethics in the transfer/exchange of biological materials, especially between countries. He also lamented on the unethical violation of geographical indications in the case of products such as Darjeeling tea, Mysore silk etc. The inaugural address was delivered by Dr. V.L. Chopra, distinguished agricultural scientist and former DG, ICAR & Secretary to GOI and currently Member, Planning Commission. He eloquently diffrerentiated the concepts of morality and ethics on the basis of faith vs. reason, private vs. public, and local vs. universal. He argued that ethics is based on rational principles and therefore enjoys far more uniform and universal appeal than morality.

The next speaker, Dr. S. Natesh, Advisor, Department of Biotechnology, Govt. of India, gave an excellent overview of the growing prospects of biotechnology in India and elsewhere and the ethical concerns that they generate. He underscored the importance of public perception in the acceptance of any technology and the need for criticism and debate as its safety valve in any democracy. He presented ethics as a dillemma, citing gene therapy, stem cells, cloning, designer babies, organ transplatation and molecular pharming as examples. He also dwelt briefly on the linkages between ethics and equity, access, intellectual property rights, plant variety protection, biodiversity and indigenous knowledge. He cited the example of Arogyapacha as an ethical case of biosprospecting using indigenous knowledge of the Kani tribe in Kerala, who received a share of the commercial benefit through their tribal cooperative.

This was followed by a PowerPoint presentation on the topic “Bioethics, Biosafety and Scientific Values” by Dr. N. Raghuram, Reader, School of Biotechnology, Guru Gobind Singh Indraprastha University, Delhi. He listed the basic principles of bioethics and characterized the bioethics debates into three levels: philosophical, professional and regulatory levels. He argued that in India, the professional and regulatory ethics need more urgent attention as they affect public interest in a more direct and immediate sense. He listed some contentious issues of biosafety in the context of regulatory ethics and quoted examples of clinical trials of unapproved drugs, stem cell therapies, questionable environmental impact assessments etc. He also dwelt on issues of biopiracy and traditional knowledge, and the link between globalisation, biotechnology and private monopoly. He urged the Society for Scientific Values to take up issues of professional and regulatory ethics in biotechnology in public interest.

The seminar provoked some lively discussions and ended with vote of thanks by Dr. P.S. Datta, Secretary, SSV.

Newly constituted Executive Council of SSV
(August 1, 2005 - July 31, 2008)

President	:	**K.L. Chopra** (Former Director, IIT Kharagpur)
Vice-President	:	**Vikram Kumar** (Director, NPL)
Secretary	:	**Nandula Raghuram** (Faculty, GGS Indraprastha University, Delhi)
Joint Secretary	:	**Ashima Anand** (Scientist, Patel Chest Institute, Delhi University)
Treasurer	:	**Indra Mani** (Senior Scientist, IARI, New Delhi)
Former Secretary	:	**P.S. Datta** (Project Director, NRL, New Delhi)
Editor (News & Views)	:	**P.N. Tiwari** (Former Project Director, NRL, New Delhi)
Members	:	**R. Kochhar** (Director, NISTADS)
		Bimla Buti (Former Professor, PRL, Ahmedabad)
		V.D. Vankar (Professor, IIT Delhi)
		R.K. Kotnala (Scientist, NPL)
		K Satyanaryana (DDG, ICMR, Delhi)
		B.B.C. Tilak (Library of Congress, American Centre, Delhi)
Special Invitees	:	**P.N. Srivastava** (Former Member, Planning Commision & Former VC, JNU)
		A.R. Verma (Former Director, NPL)

Membership of the Society for Scientific Values

Scientists who wish to join the efforts of the Society to promote ethics (support right and oppose wrong) in scientific research, development and management and, who meet the following requirements are welcome to become the member of the society :

1. He/she should have allowed his name to appear as an author in only those publications in which he/she was actively involved, in data collection, theoretical formulation, design and construction of apparatus, field trips, mathematical derivation and calculations, statistical analysis and interpretation of results, as distinct from administrative support and providing funds or facilities.
2. He/she should have never plagiarized or made false claims or indulged in or supported and encouraged any kind of unethical activity in science.
3. He/she should agree to withdraw from the Society if he/she ceases to adhere to the requirements 1 and 2 above.

A scientist who wishes to become member should send his brief biodata to the President or Secretary of the Society. A member of the Society may also send biodata of such scientist for the membership. Non-scientists who have promoted ethics in their profession can also become member of the Society.