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Reason and irrationality

Academician Kapitza's article on reason to irrationality (*Curr. Sci.*) was extracted in *The Economic Times*, 14 and 21, March 1992. My comments are based on these extracted articles.

Kapitza's commentary on the policy of *perestroika*, particularly about socio-political forces triggered off by Gorbachev and relating to science, has ignored the historical experience of scientific movements of reason and rationality. Kapitza, for example, believes that the Gorbachevian policy of *perestroika* 'unleashed manifest expression of antiscientific and antitechnological feelings. These public attitudes have found a powerful expression in the rejection of nuclear energy in the aftermath of Chernobyl, in the general reaction against technological progress, and in numerous other manifestations of irrationality and interest in the supernatural.'

This is a rather sweeping judgement on pro-environmental assessment of science and technology. Kapitza ignores the historical background that preceded *perestroika* and also the opposition to nuclear energy. In fact the critical view of science and opposition to the misuse of scientific and technological systems was raised by J. D. Bernal, the founder of science policy studies, as early as the thirties. A strong scientific opposition and questioning of nuclear technology had appeared immediately after the Second World War, in the testament of the Russell–Einstein manifesto of 1955. Within the Soviet Union caution against nuclear energy was advanced by Andrei Sakharov long before the Chernobyl disaster. Therefore criticism of science or questioning political application of big science and high technology and asking for accountability and assessment of technology systems should not be considered as antiscience or manifestation of irrationality.

In fact, no head of any faith or religion, or fundamentalist has raised the question of critical evaluation of S&T. Even the Green movement and other pro-environmentalist movements around the world have not been supported by traditionally superstitious people. I consider that the role of the critical science movement has its beginning in the declaration of the Russell–Einstein manifesto. Historically, most sociopolitical forces that have taken up the issue of nuclear disarmament, or warned against acid rain, or industrial and radiation pollution, and all those who opposed ecological destruction of the planet, began after the declaration of the manifesto, which, for the first time, raised the question of the fallibility of scientists. All these expressions of critical assessment of the consequences of S&T, e.g. nuclear power, cannot be credited to a tradition of supernatural fundamentalism.

Many legislative reforms and international treaties have come to govern international scientific activities. Many national and international agencies have been established to regulate and monitor scientific research and S&T public policies. But sociologists of science have overlooked the impact of the critical science movements that have emerged in recent years. The critical sciences, including environmental sciences, deserve serious academic consideration. Such critical-science studies, made by the Union of Concerned Scientists, the Society for Social Studies of Science, the *Bulletin of Atomic Scientists*, Pugwash, Greenpeace, CND, the Committee for Sane Nuclear Policy and Sierra Club, have contributed to critical assessment of science and technology. The important role played by critical science movements in the advancement of science must be recognized in all serious studies of the sociology of science.

Unfortunately social relevance of scientific research is still measured in terms of its direct relevance to military purposes. Big funds for big sciences are allocated not on the basis of the cognitive importance of the research, but on the basis of avowed relevance to war science systems. Scientific knowledge, instead of leading to a brave new world, has now led to greater suppression, and is a potential threat to our ecosystem.

In a later section Kapitza rightly criticizes the increase in violence and pornography following liberalization in the former USSR. He also points out that 'the number of popular science magazines and TV programmes on S&T has declined' in the new open political system. Further, he states: 'There is a strong correlation of anti-science and antitechnological trends with those towards violence and extreme social ideas, such as rampant nationalism and fascism. The traditional links between anti-Semitism and anti-intellectual tendencies are also present in post-*perestroika* society.'

But Kapitza again has ignored the historical experiences of the Russian peoples, and also the realities of Western advanced countries. For example, those very nations that have placed scientific research at the highest priority have pursued strong anti-Semitic and anti-Asian policies. Many high-rank scientists in the US and elsewhere in the West have been known to support Western racist imperialist policies. It may appear to be a scientific paradox but the higher a nation rose in science and technological research and the higher the standards it achieved in technological advancement, the greater was sociopolitical repression. This was the bitter experience and social contradiction of the great Germany in the thirties, which gave birth to scientific and technological revolutions of our age and produced no lesser a scientist than Einstein.

In the eighteenth and nineteenth

centuries the European industrial revolution continued hand-in-hand with colonial empire building. In recent times, the scientific and technological commitment of the US is very much rooted in its anti-intellectualism and narrow nationalistic tendencies as reflected *in its* aggressive imperialistic policies. Social unrest, crimes, violence, and extreme self-destructive tendencies are comparatively high among technologically advanced countries and in American society. One wonders if there is a direct correlation between advancement in techno-science and social violence. It is, however, known now that activities in high-tech fields lead to high tension.

In the post-World War decade it was the period of scientific breakthroughs and revolutionary discoveries when researchers were engaged in nuclear explosions and in outer space research. But in the late seventies, the early enchantment with the wonders of science gave way to concern about social responsibility and environmental hazards. In the eighties and nineties, our attention has been shifted from the traditional *conquest* to the *consequences* of science; from the preoccupation with progress to a more critical reflection about accountability and assessment of science and technology. Long-term consequences of nuclear power, especially relating to dismantling of nuclear reactors and waste management, in terms of biological effects and also in terms of cost of long-term-waste management, are quite serious. But it is only the scientists who can assess the long-term hazards of nuclear waste. No spiritual head of a religion is, therefore, concerned about it.

In social interpretation of science and in the process of transferring generic technology to industry, there is scope for social accountability, which must counterbalance open-ended support for scientific research. The critical science movement raises science policy issues and thus plays an important role in the advancement of S&T systems. It must not be confused with fundamentalist or religious antiscience or anti-intellectualism, as Kapitza appears to have presumed.

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NEWS

Is organic chemistry undergoing a metamorphosis?

Leading Indian organic chemists were pondering over this very question during a meeting held in Bangalore in February this year, under the auspices of the Jawaharlal Nehru Centre for Advanced Scientific Research, Indian Institute of Science (IISc), Bangalore. The organizers, S. Chandrasekaran (IISc), G. S. R. Subba Rao (IISc) and Goverdhan Mehta (University of Hyderabad), brought together both seasoned organic chemists and younger practitioners in the field to express their views and deliberate on the 'Future directions in organic chemistry'.

The meeting had several talks in emerging areas that are likely to have a major impact in steering the field. T. P. Radhakrishnan (University of Hyderabad) started the session with a review of the current status of the search for molecular magnets. Citing several attempts to prepare organic ferromagnets, success, he said, was achieved only very recently (*Science*, 1991, **252**, 1415). He described the problem of designing organic magnets as being two-fold; one is the molecular level control of the topological distribution of spin sites and the second is the control of solid state packing motifs that would bring about ferromagnetic coupling in two and three dimensions. Although the former challenge is being rationally addressed by the synthetic chemists, the latter remains largely fortuitous in nature. The latter problem, he emphasized, must be handled through a symbiotic interaction with physicists and material scientists.

In yet another interface area with material science, Suresh Das (Regional Research Laboratory, Thiruvananthapuram) discussed a subject currently very much in vogue, namely, nonlinear optical materials. Explaining some of the basic molecular criteria for nonlinear optical activity, he stressed the importance of the right molecular assembly in bulk in order that useful NLO properties may be observed and exploited. Here again, as in the case of organic magnets, the difficulty lies in the unpredictability of packing motifs even in the case of simple molecules. Methods to obviate this situation by the use of polymeric hosts and covalently bound side-chain NLO polymers, in conjunction with poling techniques to orient molecules, were highlighted.

The second main theme of the session, the interface with biology, received due attention with several talks covering topics ranging from neurochemistry to self-assembling systems. M. Nagarajan (University of Hyderabad) made a presentation on the various aspects of DNA-cleavage systems, specifically those that are initiated at the sugar residues. The mode of action of a variety of potent anti-cancer antibiotics is believed to occur by the cleavage of DNA. In antibiotics such as esperamicin, dyenamicin, etc., a strained ene-diyne moiety that is activated by the opening of an epoxide ring generates a diradical species by Bergman cyclization which then goes on to abstract a proton from either the 5′ or the 1′-carbon of the deoxyribose and initiates DNA cleavage. Highlighting some of the synthetic models based on the ene-diyne mechanism, he went on to discuss transition-metal-complex-based systems, with selective intercalating ligands, which are capable of site-specific DNA-cleavage based on a similar H-abstraction mechanism.

With AIDS predicted to take on epidemic proportions, the presentation by T. K. Chakraborty (Indian Institute of Chemical Technology, Hyderabad)