

Herbal petrol, milk-sipping idols ... what's next?

If recent newspaper reports are to be taken seriously, Ramar Pillai now plans to go commercial with his 'herbal petrol'. Is Indian science so inadequate that we stand by as silent spectators to such a brazen attempt to hoodwink the public?

The eventual exposure of this hoax is certain, but will that be consolation enough for our collective scientific conscience? Pillai should have been prosecuted without delay after his deception at IIT, Chennai. Instead, he went scot-free to continue exploiting the gullible people. Our concern here, however, is the larger issue of the influence the episode had on the masses. The common man is left with a nagging doubt about the facts of the case. Common perception seems to imply that this was a case of a destitute amateur inventor from the village who for want of adequate support from the well-entrenched scientists and technocrats, had to run from pillar to post for a chance to demonstrate his invention and had to eventually quit in

frustration. The general disdain that people have about the Indian scientific community is embarrassing.

Admittedly, we are a nation of zealots where even, in this enlightened age quacks, godmen, astrologers and the like, still hold sway. It reveals an abysmal lack of rational ethos in our society and more importantly the inability of scientists to reach out to people and offer lucid explanation for esoteric but natural phenomena. Most distressing is the fact that even professionals in scientific fraternity do not seem to be immune to the allure of the unscientific and the irrational. Take the instance of the other big hoax, when all over the country frenzied devotees rushed to temples to witness idols drinking milk. I know of some very educated people who still believe that it was a miracle – surface tension and capillarity notwithstanding. Do we lack rational persons in the media, that the incipient rumours could not be quashed? When the herbal petrol story first made news,

some scientists came up with absurd explanations (some so naive, like the one in which carbon dioxide reacts with water to form the hydrocarbons in Pillai's brew). They apparently had forgotten whatever physics and chemistry they had learnt at school!

As scientists, we cannot afford to remain complacent about the issue. Rationality at the pragmatic level needs to be nurtured and we perhaps would have to begin at the primary school level. We need to work together to infuse into every citizen, a scientific temper which will reflect in all aspects of day to day life – in matters of health and hygiene, protection of environment, civic behaviour and an improvement of quality of life in general. Isn't this what progress is all about?

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Need to vitalize, not preserve, India's culture and environment

If Radhakrishna had not let out the source, the translation of the verses from Rigveda could easily pass off as a modern concern for our culture and environment¹. It is, therefore, a distinct possibility that our past environment was sufficiently bad to invite similar alarms and we have not changed for the better.

We are probably rightly proud of certain intellectual achievements of our past. It would be surprising if our ancestors did not make some significant contributions to natural science in light of the finding of Chattopadhyaya who concluded that in the written history of mankind, Uddalaka Aruni should be considered the first natural scientist². It has, in the process, also exposed a painful hollowness in our belief of a glorious past for we lost this lead to

others for ever and could not sustain a prolonged scientific activity. This sobering revelation along with an honest admission of the weaknesses of our society may sooner than not pave the way for elimination of many of its ills both recently acquired from other cultures and inherited from the past.

It is a very common euphoric claim as Radhakrishna makes – 'India indeed was a land of plenty...', surely suggestive of a target to look forward to. However, he bemoans a little later that every student '... after qualifying rushes to the gates of American embassy...' and 'the land of opportunity and wealth attracts him like a magnet.' Should we not leave the students to decide their future and try in the first place to rid ourselves of the contradictions that we so happily nurture with a straight face? Why do we

not accept that our students cannot be faulted for trying to live by precisely what we (exceptions apart), the older generation, have always valued and longed for? The American society does not pamper them, students have to struggle to compete with the Americans as well as those from all over the globe to survive in a foreign land with dignity which deserves, if anything, our wholehearted appreciation; it cannot and should not be considered merely a lure of wealth at least in the case of students proceeding for higher studies.

We are proud that 'Universities of India's past... once attracted seekers of knowledge...' (ref. 1). We should concede with humility that it is our failure that universities like Harvard and institutions like MIT are no more here and that students deserve praise for seeking

advanced knowledge wherever it is being imparted. Instead, what we elders managing the universities and scientific institutions should be concerned about is the following: if some students after receiving higher education and some experience did try to get back home very frequently, we make their life miserable till they depart on their own or at times even dismissed from services at the behest of our own colleagues who may be uncomfortable due to the newcomer's competence, and that happens simply because of a lack of effective protection from the scientific community. Sympathy is abundant only in private because of the fear of attracting the ire of some of the superiors who may be a party to the unfair treatment, but the decisive protests so essential for protection are wanting. It is not uncommon even to see such seniors being rewarded with tenure extensions, or fixed elsewhere after superannuation, again because of pathological silence of our scientific community. Should we be proud of such culture?

There is also considerable misunderstanding about the research done in India which is frequently labelled mindlessly as imitative. If eminent scientists like Raman, Bose and Bhabha, to name a few, had not succeeded in contributing for which they are now remembered, we would have surely labelled their work imitative and mediocre as most of ours are – and rightly so. I will go a step further and claim that in spite of their success, they were out-and-out imitators, if imitation means working on problems which, because of their academic or technological significance, are being pursued by scientists and engineers in other countries, and I also insist that this is a perfectly legitimate and the only way of doing good science. It is by their efforts, of which we are proud, that the gap with the West in our technological achievements has been significantly reduced. Only if we succeed in our current efforts will we be freed from the criticism that we are imitating the West.

The picture painted above, however, is incomplete. Our modern achievements in developing technologies within a short period suffer from a major lacuna: we have not contributed significantly to the fundamental knowledge which led to these technologies. In gen-

eral, the post-independence Raman and Bose are to be found elsewhere, not in India (Chandrasekhar, Khorana and Sen). Evidently, we are unable to excel in basic sciences because something is seriously wrong at home and not because we are indulging in imitative research. As argued above that is where we must excel like Raman and Bose.

In my opinion, the success in technological achievements is so glaringly bright against the backdrop of largely mediocre contributions in fundamental knowledge that our vision has become myopic; we have forgotten that basic science is the mother of technologies. Abdul Kalam and Rajan in their recent book, *India 2020*, do not expect the evolutionary role of science in emergence of technology from the efforts of Indian scientists, specially the younger ones, and labour hard not to allude to this vital creative function of science at a time when Radhakrishna wants the bright students not to leave the country. Devoid of the most valued role to add to world-class knowledge³, surely Indian science has one foot in the grave already. Why should we expect our ambitious bright students who would like to work for nothing less than world-class knowledge – we have done it in the past – to stay back home?

It is my view that scientists who had the power and the clout, and could have cared for the base as they cared for the development of technologies in the post-independence era, lacked the foresight and let the house drift. The silence and the indifference of the scientific community only aided this decay resulting in widespread mediocrity. The members of our numerous Academies did not attempt to resist this decline. This lacuna, if not eradicated soon, will inevitably retard our technological progress because in the new global trend of patent culture we will have to depend on Western patents hiding the critical fundamental knowledge needed for translating them into viable technologies, an additional problem to be faced from now on. Therefore, unless we match the quality in basic research, the lag in technological development is bound to increase in the near future.

Mediocrity in our highest learning centres continues since we have neither the courage nor the will to weed it out

by asserting authority and scientific control presumably because our culture encourages misplaced 'tolerance' – the *chalta hai* culture – of which we are usually uncritically appreciative. The West deals with it decisively with all seriousness. Eminent scientists have warned their generation from time to time – not moralized on the behaviour of the younger ones – to be on vigil and have also not hesitated in learning from others like us. For instance Michael Polyanyi, sensing a possibility of degradation of the high standards in Western institutions, said in a lecture specifically delivered to sensitize the Western scientific community against the danger⁴: 'Unless it is somehow assured that professional teachers and research workers will not lack scientific qualifications of a certain grade, the whole system of endowed scientific institution is bound to dissolve in chaos and corruption. The experience of undeveloped countries, where scientific opinion is imperfectly organized, teaches us that even a comparative slight weakening of scientific control can have marked deleterious effects on the integrity of scientific activities'.

This time sense and seriousness to intervene *before the damage is done* eludes us. Younger generations will perhaps learn from us to face an approaching crisis before it overpowers them, but our attempt to deal with such situations should appear sincere and worth emulating.

Our priority should be to keep the house in order. The culture of prolonged indifference lets matters go from bad to worse right under our nose until it is too complex to be checked at personal or in small group level which could have been more easily influenced by our opinion had we intervened earlier. We prefer to observe silence hoping real or imaginary petty gains, or simply due to fear which many times are only imaginary or the price to be paid is insignificant considering the larger interest of our own institutions. Big or small, this price will have to be paid.

With all the cultural values held fast in the past, we have not been able to put our house in order probably from antiquity as the prayer from Rigveda would suggest. Let us admit that and do some long overdue introspection.

1. Radhakrishna, B. P., *Curr. Sci.*, 1998, **75**, 881–882.
2. Chattopadhyaya, D., in *History of Science and Technology in Ancient India: Formation of Theoretical Fundamentals of Natural Science*, NISTAD, New

Delhi, KLM Pvt., Ltd. Calcutta, 1991, pp. 89–148.

3. Abdul Kalam, A. P. J. and Rajan, Y. S., *India 2020: A Vision of the New Millennium*, Viking, 1998, p. 186.
4. Polyanyi, M., in *Science, Faith and Society*, University of Chicago, Chicago, 1964, p. 50.

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India's status after Pokhran-II

I read the letter entitled 'Nuclear weapons' by B. M. Udgaonkar in the correspondence section (*Curr. Sci.*, 1998, **75**, 871). I would like to make a few comments.

Firstly, Udgaonkar's reference to Einstein's moral realism appears somewhat misplaced. Einstein modified his pacifist position in the face of the great threat posed to humanity by the rise of Hitler and Nazism to power in Germany, the 'compelling circumstances' that Udgaonkar refers to. Rajasekaran's reference, which Udgaonkar is critical of, is to Einstein's position against nuclear weapons in the Cold War era, when the situation had substantially changed. Surely it cannot be Udgaonkar's position that any security threat that India faces today is comparable to the one faced by the world from fascism. If such a strange conclusion is indeed his position, then Udgaonkar needs to substantiate it in far greater detail than he has in the letter.

Secondly, Udgaonkar refers to the rejection by the nuclear weapons states of the Indian stand, that the use of nuclear weapons be declared a war-crime, in the final June–July 1998 negotiations to frame the statutes of the International Criminal Court. Undoubtedly the nuclear weapon powers have hypocritically preached the virtues of non-proliferation while continuing to refine and develop their nuclear arsenals. These arsenals remain despite the demand for the abolition of nuclear weapons that have come from governments and peoples all over the world. But after Pokhran-II, after the declaration that India was inescapably a nuclear weapons state, after it had been declared that the possession of nuclear weapons was the 'inalienable right of one-sixth of mankind', after 'a comprehensive security dialogue' had begun with the world's leading nuclear weapon power

to bolster claims to nuclear power status, did Indian negotiators retain the moral high-ground to declare that the use of nuclear weapons must be made a war-crime? When negotiations were on to justify India's entry into the nuclear weapons club, it is somewhat unsurprising that India's stand at the International Criminal Court negotiations was dismissed as posturing.

Similarly with regard to Udgaonkar's reference to the advisory opinion of the International Court of Justice, the current official position on nuclear weapons status is a comprehensive rejection of the earlier position that India had taken before that court.

Thirdly, Udgaonkar is of the opinion that India should continue to press for a nuclear weapon-free world while 'maintaining a minimal deterrence'. However, it has been widely noted by several commentators on nuclear issues that the concept of *minimal deterrence* is a very nebulous one.

It is worth noting that the concept itself had its origin as a possible mid-way point on route to total abolition¹. Several difficulties are evident in regarding this concept as part of a nuclear doctrine².

i) If zero is not the minimum required by minimal deterrence, as is clearly implied by Udgaonkar, then what constitutes an acceptable number? The relevant question here is of course minimum with respect to what. Is it to be defined with respect to Pakistan's capabilities, China's or even that of the United States, given that its nuclear fleet traverses the entire globe? Depending on the answer to this question, a minimal deterrence could take on vastly different forms. It is not clear whether India currently has attained either the technological capability (without resorting to further testing, an option that

appears unavailable)³ or the economic capability to deal with all the possible scenarios of 'minimal' deterrence.

ii) Will 'minimum' deterrence be fixed at a stable minimum or will the numbers constantly shift, leading to an open nuclear arms race, particularly in the sub-continent? The point to remember here is that the same level of weaponization will be perceived differently by different observers, a fact which is clear from the history of the Cold War. Whatever constitutes a minimum deterrence for India would be construed as an aggressive threat by India's neighbours in the sub-continent. Pakistan would continue building a nuclear arsenal while other nations would be threatened by the nuclear risk posed by this race.

Even without external pressures, once nuclear weaponization is accepted as policy, new ideas for further weaponization will emerge, pushing an arms build-up and furthering heightening tensions and imposing costs. A notable recent example is the reported decision to develop an anti-ballistic missile shield for New Delhi⁴ that has attracted criticism even from pro-weapons strategic affairs experts.

iii) Will the declaration of a posture of minimal nuclear deterrence enhance our security, or lead instead to a degradation of the security environment with increased strains on our conventional arms as well as increased defence costs all round? The current evidence is that the posture of nuclear weaponization has not only *not* improved our security (it became clear with the Chagai tests that Pakistan had been given the opportunity to weaponize too), but in fact has gifted our western neighbour a situation of strategic parity. India had, prior to Pokhran-II, a situation of strategic superiority, based on its superiority in conventional arms.