Retired hurt, not the scientists but the science of India

Vijayan[1] summarizes the problems faced with respect to funding of research. He suggests how grant system could be improved to achieve better quality in research. The manner in which grant applications are handled and funds are released is only one dimension (albeit a major one); there are other aspects to the problem.

A number of editorials by Balaram analyse, compare and contrast various dimensions of higher education, science and scientific research in India. Desiraju[2] has suggested the need to merge the three science academies in the country. However, there is no significant response from the science community. The Prime Minister of India admits, as quoted in Vijayan's article[1], that there is excessive bureaucracy and hierarchy in the Indian science system. Media recently quoted HRD Minister Kapil Sibal's comment on the appointment of vice-chancellors, which is suffering from political interference. Immediate action can be taken to make political interference a punishable offence and to minimize bureaucracy in universities and scientific institutions. Scientists can be given the freedom to further their academic activities. There is also an urgent need to separate the grant processing and sanctioning divisions of science-promoting agencies such as DST, DBT, DAE and CSIR. These agencies, among others, have become unwieldy and bureaucratic in spite of being headed by reputed scientists. The fate of Indian science is decided by a few and a majority of the scientists remain spectators.

Attention may also be drawn to Gowrishankar's note[3]. While agreeing with him, I would suggest that applications in different areas of science be handled by institutions and universities of repute, where objectivity persists. Carefully chosen peers from such institutions could evaluate projects to ensure that funds are released systematically and that the principal investigator has the freedom to manage funds.

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2. Desiraju, G., *Curr. Sci.*, 2010, **99**, 1510–1512.
3. Gowrishankar, J., *Curr. Sci.*, 2010, **98**, 478.

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The bubbling Baratang mud volcano: a geological signature

The Andaman and Nicobar Islands have always been a discovery destination for biologists, geologists and anthropologists. Situated 1400 km away from the Indian mainland, they remain pristine. Besides their unique flora, fauna and anthropological wealth, their geological resources are equally exciting. The Barren Island Volcano, is well known for its pyroloclastic activities. Here we report an interesting geological signature known as mud volcano (locally referred to as *Jwalamukhi*) from the Baratang Island about 80 km north of Port Blair, Andamans. Usually mud volcanoes are found associated with tectonic subduction zones. They are geological formations created through geo-excreted gases and liquids, and are of global concern[1] because they emit a large volume of methane over 10–33 Tg/year (refs 2 and 3).

The Baratang mud volcano is currently active and secretes greyish slurry (Figure 1) resembling the colour and texture of hydrated Portland cement. Fine slurry suspended in clear watery liquid constantly flows through small cylindrical outlets (3–5 cm in diameter). These outlets eject slurry bubbles throughout day and night. Seldom small and medium sized (0.5–2.0 cm) pebbles are also shot out. The continuously flowing slurry gathers in small puddles and then flakes into fine ash. Seepage from an outlet usually occurs for a period of 4–6 days and then ceases.

In 2004 the mud volcano had a few outlets. In 2011 the number of outlets and the slurry flow have increased. At present the mud volcano, which is amidst

Figure 1. A mud volcano outlet oozing slurry and pebbles; note the vent shooting out a pebble.

Figure 2. A 60 cm high mud cone.

Figure 3. The mud volcano in flame during December 2004.

a patch of moist deciduous reserve forest, has transformed from a flat land into a large cylindrical mound (15 m in diameter). Elsewhere, mud volcanoes develop cones that measure 1–3 m. Because Baratang experiences high annual rainfall (1500–2000 mm), cones are constantly washed off; they are 60–70 cm high during the dry pre-monsoon periods (March–April) (Figure 2). We have documented flame over the mud volcano during 27–30 December 2004, immediately after the tsunami (Figure 3). The bubbling Baratang mud volcano attracts a large number of eco-tourists from different parts of the world.

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A critique on technological development, risks and ethics

With the nuclear disaster looming large in Japan, the vulnerability of nature to man's technological developments and interventions has been convincingly emphasized. The incident confirmed that there is an excessive power of nature to act over man's ability to foresee and judge. The impact of technological development upon natural systems (nuclear plant in an earthquake belt) seldom admits of determination in advance. Man finds himself in a state of ignorance and uncertainty regarding the outcomes of technological developments. Jonas[1] describes the problem of technological risks as follows: 'When predictive knowledge falls behind the technological knowledge, the duty is one of caution – to restrain technological development in advance of a clear vision of its consequences. Consequences, being uncertain, responsibility should be held as a function of uncertainty.'

'Risk' is defined as a function of consequences of an action and the probability of those consequences. A probability of (1) is certain occurrence of an event; a probability of (0) is certain non-occurrence. All probabilities between (1) and (0) represent a state of uncertainty. Risk is interpreted to have negative utility. Hence when R represents the negative utility of risk and B represents the utility of benefit, an act P is acceptable when $R_P + B_P > 0$, and P is unacceptable when $R_P + B_P < 0$.

Much of the confusion in discussions of acceptable risk, particularly for nuclear plants has followed from a failure to specify the standard for acceptability according to a standard of moral value. However, morally acceptable alternatives may be rejected on non-moral grounds. One implication of the act – utilitarian definition of acceptability is that practices which are acceptable become moral obligations. When $R_P + B_P > 0$, there is net social benefit; hence being a good utilitarian, man accepts an obligation to perform P. A theory of value which makes an identification between good or right and acceptable is thus fraught with this difficulty.

The setting up of nuclear energy plants in India (in spite of the fact that the 2004 tsunami reportedly affected the Kalpakkam nuclear reactor in Tamil Nadu) is limited by the state of our knowledge. Ethical responsibility to know the results of our actions in some measure requires us to ask: How is it we know that we know? At best, the subjective approach to probability makes this enquiry more difficult to launch. Confidence estimates collapse of the uncertainty of knowledge with the uncertainty of its object. At worst, it suggests that this enquiry is unnecessary (as we are doing with the probable nuclear energy plants), since experience will dominate the initial uncertainties in the end. This is a plausible assumption in the abstract, but in moral practice, the whole point of the decision-makers is to avoid 'the end'.

We may face uncertainties and risks with hope. Justification for this is somewhat existential. We can regard bland uncertainty with dread or with hope. In a state of dread, we place ourselves at the mercy of events. In a state of hope, however, we acknowledge that we certainly are at the mercy of events, but we do not accept this as the definition of our ontological significance. In hope we act; we take the risk actively and by force of will. From the perspective of hope, we grasp the problem of risk as a problem of moral decision; from the perspective of dread, it is a problem of the natural process.

Neither of the above perspective provides a guarantee of success. However, the perspective of hope provides the total ground for taking a human action to avert disaster for the sake of the biotic community and for nature's sake. Dread provides no ground for positive action, since any positive action could result in disaster. This argument suggests that the justification for hope is not in the ultimate vindication of one's faith, but in the immediate existential transformation of subjectivity which empowers us to act, to do. The person who adopts an attitude of hope on the pragmatic ground that it enables him/her to break the malaise of dread and do something, may be led to a psychological identification with hope that serves as genuine faith. It is hoped that this faith does not become facile. On the other hand, if the problem arises out of a natural process, whose probability is high, even if we rely on our faith of hope, we may end up in a state of dread.

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