

The Indian scientist: Some reflections

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The role of science-based technology as a strong and effective force for development and its capacity to improve the living standard of the Indian people were clearly appreciated by the builders of modern India. Jawaharlal Nehru, a seer of science-based humanism, lent his enormous prestige and power to the cause of building, encouraging and sustaining institutions for technological research and development and institutions devoted to the pursuit of the pure sciences. He had the courage to dream about a new India 'whose temples were to be the universities and research laboratories'. The message to the youthful scientists was that over and above the intrinsic adventure of participating in the scientific quest, they were also contributing to nation-building. It was heady and infectious. India committed itself to the task of implementing an ambitious scientific research programme. Over the years the programme was to grow into an enormous scientific-technical service which would spur the next generation of students into the pursuit of science and technology. In addition to the various national laboratories and major research institutes and a few distinguished universities, the new institutes of technology entered into the propagation of technical expertise with a vengeance. While many students from these institutions felt they should go abroad for higher learning, the level of advanced studies in science and technology in the country had already reached a new high. India's scientific manpower is awesome; by some counts its manpower is the third largest in the world, surpassed only by that of the two superpowers.

Thus, there appeared on the Indian scene a new type of person, a symbol and product of a new national orientation, heir to the university heritage of 'truth unto its innermost parts',

to go 'where no man has reached', to follow 'knowledge like a shining star'.

On this person is pinned the nation's hope to leapfrog into the prosperity associated with a technological industrial society. This new person, the harbinger of a new era, is the object of our study.

The Indian scientist

This essay deals with the 'Indian scientist', a person of Indian origin involved in scientific research. Although most such people are found in their natural habitat - Indian laboratories, research institutes, and universities - a very substantial number are associated with foreign institutions, mostly in the West and particularly in the universities and industrial laboratories of the United States. The American pool has been increasing rather rapidly, with a large steady flow from major Indian universities, including the institutes of technology. For our purpose, we shall take this phenomenon, the existence of a large group of Indian scientists in America, as a 'given' of the system. We do not propose to discuss either the dynamics or the consequences of this migration but limit ourselves solely to an analysis of the scientist's condition and a little bit of his science, sociology and psychology. We do, however, suppose that this community is important enough to warrant such an examination. No statistics will be given, and we plan to cover the broad subject by concentrating on scientists working in America, excluding important and interesting Indian problems. We shall also outline how the American experience affects the pool of scientists in India.

We begin with a brief description of this group as well as a statement of its quandary. The group is a large, competent body quite uniformly distributed over institutions of higher learning throughout the United States. Although its members have contributed adequately to the general body of scientific knowledge (that is, commensurate with their numbers), they can be credited with a disproportionately small number

of fundamental, trendsetting or strikingly creative contributions to science. The typical scientific career of an Indian in American science may be divided into three phases:

1. *The early educational phase.* This consists of graduate studies leading to a Ph D degree, followed by a few years as a postdoctoral fellow or research associate. This phase lasts anywhere from seven to ten years, and by the end of this phase the scientist is approximately 30 years old (a few exceptional people may reach senior academic ranks by this age). This is the golden period of his or her career. During this time there are examinations to pass, courses and other assignments to complete, sundry well-defined chores to finish, scientific interests to be identified, and working alliances to forge. The average performance is excellent, and most Indian students end up near the top. There is a fair amount of encouragement from the research establishment, represented by the professor and fellow students. This happy state is enhanced by an increase in material comforts, because the life provided by even a graduate assistantship is in many ways superior to a relatively deprived Indian middle class existence, and it is from the middle class that most of our subjects come. We believe, however, that deeper psychological reasons may have much to do with this optimistic and positive attitude. The fact that the young person has competed with his American counterparts, in an American setting and under American rules, and succeeded, gives him a great psychological boost and the expectation of a promising career.

2. *Middle professional life.* As a natural consequence of the scientist's coming of age, the godfather role of the professor is withdrawn. He may even become a competitor. This event ushers in a new era, in which the scientist must succeed on his own. During this time the young person directly faces the scientific establishment, in contradistinction to the earlier phase when he was largely an extension of an established professor. For reasons that we shall discuss later, a strange new phenomenon appears; there is a gradual deterioration in relative

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performance and productivity. Local people who were behind in graduate school slowly forge ahead in matters that really count: references to their work, invited papers, and award of tenure. The former euphoria is diluted and the days of enthusiasm and optimism vanish.

Two distinct modes of behaviour appear at this stage. One group internalizes the 'discrimination', accepts the prevailing value system, and settles down to a safe but unexciting and scientifically colourless life, often at levels much lower than they expected. They accept that they will fill the ranks and cannot hope to be in the forefront. The other group resists the tendency to succumb to the injustice of 'discrimination' and expects some redress of the unfairness and that something surely will turn up. Usually, it is the more talented and more ambitious who do not give up the struggle. The result of this extended unwillingness to accept the facts is not vindication, but disillusionment and bitterness. Scientific recognition is rare, the awards even more so.

3. *Mature professional life.* For the first group, who accept the *fait accompli*, later life is safe but lacks zest. They become hewers of wood and carriers of water, are well paid, and swell the ranks of scientific manpower. For the second group, life becomes a continual struggle; the disparity between what they expect and what they achieve is a constant drain on their creative energy. There seems little appreciation for past work and less for continuing contribution, except from the local group which directly benefits from the research; even there the credit may be given grudgingly. But one cannot complain or air one's frustrations because no one listens. The consequences are quite grave; nervous tension sets in and heart attacks occur, often at an early age. Lack of professional satisfaction drives many of this group to seek solace and contentment elsewhere. This results in a certain disinterest, not only in scientific institutions but in science itself. Altogether these feelings lead to a definite reduction in scientific productivity, followed by a sense of guilt and further loss of status.

Of course, there are notable exceptions, but they are indeed few and far between and may be viewed as statistical quirks. Some others avoid this fate

by aggressively adopting as a new value system the ethos and character of the dominant culture.

Universality of science?

Anyone attempting to understand the fate of the Indian scientist must begin by digging into Indian history. There is no recent tradition of scientific research in India. There were individuals like Bose, Ray, Saha and Raman who did enrich the science of their times, but they were singularities, bright stars shining against a background which was largely indifferent to them. They did not create a tradition which could nurture and sustain a modern scientist and give him confidence in his ability independently to produce quality science; they left even less which could inspire him.

There is one strong tradition to which every Indian is heir. This is the tradition which comes of being a colonized people. During India's colonial past, critical and innovative thinking definitely was not encouraged, and often not tolerated. The most talented Indians were trained to value traits which made them excellent sustainers of an already working programme. The programmes were always those of the British, who also defined the problems and offered the solutions. What was needed was the manpower to put ideas into practice. Excellence, for an Indian, simply meant that he carried out the instructions well, and to the satisfaction of the master. Indians performed at best 'at the level of the field captain', and were responsible only for local interim solutions to some operational problems. The success or failure of a pursuit was decided by others. Indians were to understand that they did not belong to the select caste, and hence planning, thinking and implementing a strategy to deal with important issues were not in their domain. One knew the limits imposed by birth in a subject country and did not try to surpass them. This was the heritage common to all intellectuals: scientists, historians, economists and others. Could this be damning enough to create the 'condition' peculiar to a modern Indian scientist? By itself the answer is 'no', but a combination of colonial tradition and absence of a scientific tradition is formidable, and is made

lethal by a hearty dose of the much-touted slogan 'Science is universal'.

On the surface, all is well with the concept of the universality of science. Indeed, the language, the methodology, the content and the results of science are universal, as they must be to be meaningful. Not universal, however, are the institutions of science. What constitutes interesting, important, and even moral scientific problems; how scientific activity should optimally be organized; what the criteria for merit are; how the community rewards good work; and other such questions clearly will be answered in different ways by different societies. It is naive to expect that our sociopolitical and psychological biases will not enter into the institutions of science; after all, these institutions are finally controlled by scientists, who happen to be just as parochial, prejudiced, nationalistic and political as any other large group of people.

Somehow, the new breed of young scientists, especially in the Third World countries, came to romanticize not only science (often deemed to be a panacea for Third World problems) but also the scientist. The word 'scientist' conjures up the kind and benign face of Albert Einstein, and one finds it difficult to associate with him anything mundane or commonplace. This romanticization could have been quite harmless were these scientists never to interact with the real institutions in the West. Clearly, that was not and is not possible. Modern institutions of science are creations of the West, and they hold most of the keys to the doors of modern scientific knowledge. Ambitious scientists from the Third World countries had no choice but to come westward and participate in this alien culture. Desiring to jump quickly into his creative activity, they came in droves. The ethos of the university of science, or rather their understanding of this ethos, made scientists disdain ideas of creating institutions and knowledge appropriate to the needs of their own societies. Colonialism in science was accepted with hardly any resistance; in fact, people happily and willingly embraced it.

This acceptance was accelerated by an extremely important postwar development in the United States. The phenomenal prestige gained by American scientists because of the success of the Manhattan project made it possible for them to launch immense scientific projects for which trained manpower was

sorely needed. The need became even greater when the ambitious space programme was launched. Thus, there was the coincidence of need, and people from the Third World desperate to come. The situation is vaguely reminiscent of the 'indentured labourers' who constructed the railways. There are, however, two major differences: this time the labourers came knocking on America's doors (with their master's and doctor's degrees) and the work was physically less hazardous. Thus, this new relationship of submission to the dictates of the American scientific establishment came about smoothly, willingly, with a smile on the face of the Indian scientist and unconditional acceptance in his heart. It was made even sweeter by a significant improvement in his material conditions, and consequent increase in prestige back home. He was able to resist any pangs of conscience that might arise from a feeling of 'deserting' the society which educated him by invoking the dogma of the 'universality of science' and the 'scientist as a citizen of the world'. In his naiveté he probably believed in the notion that the scientist belongs to the whole world. We must point out, however, that these notions were taken seriously only by the budding scientists from the Third World; most of the western scientists, even as they entered the profession, were quite cognizant of their nationality.

The facts of life

Let us reexamine the psychodynamics of the Indian scientist's experience in more detail. Their world begins in purity and innocence. Several years later, when there are initial signs of discordance, most refuse to acknowledge them. When reference to their work is not given (unless it is with a well-established American, in which case it is basically taken to be his idea), when scientific societies are found to be a bit slow in inviting them for talks, when funding agencies are not particularly excited to see them as principal investigators, when tenure committees appear to be comparatively more demanding, the era of conflict begins. The scientist's first response is often a resolution to work harder. 'If Mr. X made it, there is no reason why I should not be able to'. Working harder, however, does not materially alter the situation, and it

slowly dawns upon them that the scientific institutions (which control most of their lives and careers) are not totally impartial; their universality is not entirely without exception. The discovery is shattering, all the more so because of the illusion, awe and respect with which they viewed these institutions. The longer they resist, the deeper is the hurt.

Careful and cool reflection on the state of affairs reveals that there was no institutional resistance to their careers up to a certain level. As long as they were willing to play in an ensemble led by others, there were no problems. The resistance came when they tried to become conductors of the orchestra. They were allowed, even encouraged, to be bright boys, but they were not expected to be powerful and trendsetting men. If ambition were to drive them towards these goals, the task would be uphill and frustrating. They do have a place in the scheme of things but with well-defined limits, considerably lower than the sky.

Unfortunately, this realization comes rather late in the day. By this time the scientists have become accustomed to living in the West, with all its pleasures and comforts, real as well as imagined. Further, their relationship with the land of their birth has grown more and more tenuous over the years. In most cases, the relationship is limited to occasional visits to relatives and complaints about the prevalent inefficiency, dishonesty and stupidity of all that they left behind. Thus, they find themselves in this unenviable position in mid-career. There are three ways by which people learn to cope with the situation:

1. Adopt the typical immigrant's maxim, 'don't rock the boat', and accept one's fate. After all, there is life beyond one's work. This group settles for what we would describe as a safe but scientifically unexciting life. In general, their scientific careers cease to afford them much satisfaction and they seek happiness elsewhere, in the stock market or real estate, in aerobics, in electronic gadgetry, and perhaps even in social and religious practices they would not have touched back home.

2. Some scientists choose to do unto others what was done to them. They behave like semi-colonial masters in their attitudes to scientists working in India, to hiring practices affecting Indian scientists, and to collaboration with Indian scientists. In this task they

are ably assisted by the very people they wish to exploit: an associate professor in a respectable Indian university would happily come to the United States as a postdoctoral fellow at a modest salary.

3. Some others fight, become very aggressive, and try to get their due by all means available. Such people usually end up spending much time in extrascientific pursuits with minimal results.

Whatever the path, the scientist's productivity usually diminishes as does his interest in science. He strongly resents this decline, is confused and disheartened, and feels at home nowhere. He cannot just pack up and go, certainly not from his scientific work, but he cannot stay and be happily productive. He does not feel a full citizen of the institution which controls his career, yet at the same time he cannot leave whatever the system offers because there is no other secure place to go. Over a lengthy period this situation can become unbearable.

We notice that the entire spectrum of reactions proclaims demoralization and contains very little ongoing and positive thinking. Unfortunately, these are the reactions of a short-sighted and selfish group of people with little social responsibility or concern for the future. We would like to believe that most of them (highly intelligent as they are) do indeed understand or at least sense the basic causes of their dissatisfaction. Therefore, ignorance or lack of awareness could not be the root of their inaction. It is the lack of scientific institutions of their own, built and controlled by themselves, which leads to this unenviable situation.

Cultural determinants of science

It is only natural to ask at this point whether the fate of the expatriate Indian scientist is of more than peripheral interest to the larger question of the fate of the world's third largest pool of scientific manpower, and also whether there is something intrinsically irreconcilable between the culture and tradition of the educated Indian and the modernity represented by contemporary science. We deal with the latter question first, especially because there are concerned social critics who question the wisdom of the country's commitment to a science-based modernization.

Essentially, social critics raise the question of a conflict between modern science and classical Indian culture. It is curious that such a question should arise since classical Indian thinking came very near the common definition of a scientific worldview, a 'relentless value-free search for the laws of nature', not only with regard to the external world but also with regard to life and any possible afterlife. No predetermined values barred the quest in any field of investigation. The sanctity of the Vedas was questioned by the Jains, the Buddhists and the Lokayats. God, constraining or condemning man, rarely appears in the classical schools of philosophy. The Jains and the Buddhists, in their relentless search for causality and the apparent inequality in endowments or circumstances, formulated their respective theories of *karma*, in which God is not involved in the causal chain. Among the six canonical 'systems' of philosophy, *sankhya*, *nyaya*, and *vaisesika* are equally daring. The philosophic tradition of ancient India is that of valueless and fearless free inquiry. How could that tradition clash with modern science?

Some social scientists point out that these philosophical systems are the expression of the 'high, elitist' stream, while the folk culture was fatalistic, animistic, and *karma*-dominated. But this is a double standard. When we judge the scientific worldview we do not equate American science with newspaper advertisements of miracle diets or teenage cosmetics, by advocates of pyramid power, or the Bermuda triangle. Nor does the ever popular astrology column in the newspaper reflect current scientific views on celestial dynamics. Instead, we take the best and the highest as the norm! So, if the philosophic traditions of religions originating in the Middle East, studded with their own values and taboos, were no bar to the age of modern science in the West, how could one see Indian philosophic systems as the bar to a full-fledged development of science? We must look elsewhere for the answer.

India is an extremely heterogeneous society. There exist marked differences, not only in food and clothing, but in language and customs, not only from state to state but also within a state, and between educated city dwellers and villagers. Yet, in the midst of this great diversity, the common amorphous culture of the urban middle class provides

most of the scientific and technical manpower. Before we examine the heritage of the Indian scientist, we will briefly say what we believe it is not:

1. *Classical India*. The urban, educated Indian youth is not aware of the philosophy of Kapila, Gotama or Yajnavalkya, nor the science of Kannada. In most cases, if he has any acquaintance with these names, it would be through children's books like *Amar Chitra Katha*.

2. *Medieval India*. Aryabhatta, Bhaskara, Al-Biruni and Amir Khusro are strange names that he sometimes comes across in a scholarly book, but their discoveries or worldviews have no discernible influence on him. He may pay lip service to J. D. Bernal, Schrachansky or Joseph Needham, but he does not equate their views with his own.

3. *Colonial India*. One tries to suppress the memories of the merchants and missionaries (accompanied by the guns and soldiers of an island country) who created the sterile but orderly edifice of colonial India. But British governance in India made it clear that, scientific or scholarly abilities notwithstanding, men were not born equal. In areas like textile technology, an appropriate Indian technology was replaced by an inappropriate imported technology. India's role in the industrial revolution was not to participate in it but to contribute to its resources.

The land of the free

What then is the heritage and cultural background of the Indian scientist? Our understanding is that it was an amalgam of several half-truths and half-myths, fostered by our system of education and strengthened by the exclusive use of English as the vehicle of communication in the realms of science and technology. Some of these half-myths are listed below.

Western man has built up the entire edifice of the sciences, arts, law, political science, and economics. (We must remember that Greece and the Soviet Union are part of the 'West' as far as India is concerned, although we have difficulty considering Japan as 'western'.) We were colonized and plundered by western man with his military and applied technology, and his science, technology and culture were held up and accepted as superior and worthy of emulation.

With growing awareness of the West over the last four centuries, Indians have come to distinguish the various subspecies of western man: the British, the German, the French, the Russian and, most recently, the American. In the post-war era it was very difficult not to be influenced by the generosity, vigour and the immense resources and resourcefulness of the Americans. We did not want to like the British colonial overlords (though we actually did admire them); the Germans were quite advanced and methodical but we thought them lacking in humanity (we were, in fact, told that they were quite devilish); the Russians had become merciless communists. So the Americans had to be the favourite people for free India to admire, associate with, and emulate. We knew that they were against colonialism and that they were for justice, democracy and economic prosperity for all. After all, they rebuilt Europe and dealt generously with a humbled Japan. Their manners were more natural and friendly than those of the other westerners. Finally, they were the most innovative people, who not only exported massive quantities of food but had also harnessed the hidden energy of the atom. The post-war ascendancy of American science made believers of the most adamant agnostics.

It is no wonder, then, that the science student in India looked to American institutions and American scientists as the cream of the crop. The most ambitious and promising Indian students went to the United States. While the Statue of Liberty issued an open invitation, the Immigration and Naturalization Service took care that the imported crop was 'top of the line'. Those that came generally went to the better institutions, were usually euphoric about the academic opportunities, and were often pleased by the ease with which graduate fellowships were made available. The assessment of and acceptance by the scholars at American institutions then became the norm for this better group of young Indian scientists. While the ageing academic administrators and civil service officers in India talked about the great British (and sometimes continental) institutions, the young scientists saw that America was the scientific equivalent of the British Museum; the best from many lands was brought there. The result was a subtle but significant

transformation; it was not British but American science and technology that became the model.

It was not only the emigration of science students but also the change in the point of view of those who stayed home that contributed to the transformation. Even those who worked only in India looked to American institutions for moral support and sustenance, and it was American recognition that was sought. The physics papers must be published in the *Physical Review* to be 'counted'. Meaningful reference to one's work must come from scientists at leading American institutions. Personal success in the chosen field must include an appointment offer from a major American university. In this context it is quite clear that to understand the 'Indian scientist' we must study the contrast between the expectations and actualities in the Indian scientist's encounter with the American scientist, not just with American science.

This contrast, and its devastating effect on the productivity of the mature scientists, is seen most clearly in the professional life cycle of the Indian scientist living and working in the United States. To a lesser degree, much of what we have said about the expatriate applies to the homebound scientist, whose success and self-esteem also is thought to depend upon the judgement of and acceptance by the western scientific community.

Can science be 'done' in India?

The analysis that we have presented is not a pleasing one; after all, it seems to tell us that the American scientific establishment is less than 'fair' to many of its most outstanding imports. Many will vehemently deny this; others would consider it only marginally relevant. We ourselves are not happy to identify this source of the decline of productivity, but we must protest against attempts to heap such blame on the alleged eternal 'fatalism' pervading the body-politic of India and its scientists. Indian classical culture was anything but fatalistic. Teachers and propagandists like Buddha, Mahavira, Ashoka, Nagarjuna, Sankara and many others actively set out to change the society and its modes of thinking. Medieval India showed remarkable flexibility and adaptation. Its traditional culture survived the onslaught of a dynamic and irrepressible Islam. And most of all, the modern Indian science-technology student (say, at

one of the institutes of technology) is a pushy, ambitious, aggressive young man, not essentially different from his counterpart in the prestigious American schools. Even the Indian peasant did not find his concern with *karma* any hindrance to adopting the hybrid strains of wheat, the herbicides and the chemical fertilizers of the Green Revolution.

Another red herring is that of the poverty of India. In a land of starving masses, where a multitude of pressing problems demand attention, how can science flourish? One might wonder whether only a few societies can afford to sustain and nurture science. These thoughts would be relevant if the Indian government had hesitated in allocating funds for research. This was not the case. The government wisely recognized that the foundation of basic science and research (at the state-of-the-art level in science and technology) is essential if the country is to adopt the 'leapfrog' rather than 'follow-the-leader' approach to development.

Epilogue

The principal aim of our essay has been to draw attention to a sad but true fact, and to stimulate thought by and discussion among Indian scientists, technologists and social scientists. It is a symptom of the malady that there are no proper means by which to air and to clarify this problem. Appropriate organizations are sorely needed. Certainly, before we undertake or even recommend an Indian programme to erect new scientific institutions, it is pertinent to ask why the existing scientific institutions in India cannot serve the purpose. A detailed examination of this question is beyond the scope of this essay but what is relevant is how these existing institutions are perceived within the scientific community. We have already pointed out that an average scientist in India is rather eager, even desperate, to come to the United States. Thus, the general impression is that, barring a very few highly placed scientists, only powerful scientific bureaucrats and scientists of indeterminate merit stay back. These scientific bureaucrats, whose achievements and activities are modest, pose and behave as scientists and so give credence to the charge that science is not done properly or not done at all in India. Therefore, institutions controlled by this set of people are not likely to excite enthusiasm among scientists living in India or abroad, particularly the latter.

This then is a description of the phenomenology as well as an analysis of the underlying reasons for the state of affairs of the 'Indian scientist'. This essay is not meant as an attack on American institutions of science, even though we do point out that these institutions are neither universal nor infinitely benign; no human institutions are. Any large group of people with no organization of their own is likely to feel discriminated against, and unrewarded, and this describes many scientists of Indian origin.

One hopes that this analysis of the past and present will be helpful in pointing some directions for the future. An inevitable conclusion is that Indian scientists must learn clearly to differentiate between science itself and the institutions of science. This realization naturally must force them to create structures suitable to their needs, institutions which safeguard and perpetuate their interests. It is of utmost importance that these institutions be built on solid foundations. They must include a large number of competent and well-trained scientists, who must perform their role honestly and seriously. Only then can the majority of Indian scientists have faith and trust in these institutions and look to them for guidance, encouragement and intellectual sustenance.

We must not forget that pure scientists are rewarded by the peer appreciation and peer recognition given by scientific societies. Research often is not lucrative, depriving them of financial reward, in contrast to technological ventures, where money provides a primary motivation. In addition, scientists place high values on the freedom to decide what research to undertake and on being able to set trends for the guidance of younger scholars. The only way Indian scientists can hope to have scientifically free, exciting and creative lives is to become their own masters. This is possible if today's scientists begin to build institutions that will secure and guarantee these privileges. They will have to rise above the current confusion and despondency. They must build schools of their own, so that from a large body of dedicated professionals will emerge a significant number of trend-setters, extraordinary thinkers, and original creators. And let it be hoped that these will be able to distinguish between the universality of science and the politics of scientific establishments.