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Editorial

The Past Predicts a Bright Future for Indian Science

During the last few hundred years of the millennium that is coming to an end, the world has changed at a pace scarcely imagined even by writers of science fiction. But in one sense the more things change, the more they seem to remain the same. The basic strengths and weaknesses of mankind have not changed one bit, the world-wide web notwithstanding. Therefore our past continues to provide us valid clues about the future.

The recent history of science begins with the European Renaissance, the beginning of which has been arbitrarily fixed in the year 1543 by Charles Singer (1). The justification for such a precise date is that during that year appeared two publications of great importance. One was a book on Astronomy by Copernicus, and the other a book on Anatomy by Vesalius. Both these books, for the first time after more than a thousand years, dared place greater reliance on observation than on authority. Science had at last managed to free itself from the grip of the ancient classics. The spirit of enquiry could once again breathe freely without the Church clipping its nose (2). What happened after 1543 is now history. Taking off more or less from where the Greeks and Romans had left it, science advanced rapidly. The growth of science was soon followed by technological progress and the industrial revolution. The impact of the events of the last four centuries on lifestyle has indeed been spectacular and unprecedented in the history of mankind, both in its pace and extent.

As we contemplate these phenomenal achievements of science and technology, we, as Indians, cannot but feel hurt by the fact that the scene of these achievements has been primarily Europe, which has now been joined by North America. India is nowhere in the picture. What disturbs us further is the realisation that we have been trapped in a difficult situation. In the West, the scientific spirit came first, science next and technology last. While Europe was performing this journey, we were grappling with foreign invasions and foreign rule. After independence, expediency compelled us to borrow technology first, we have tried to develop our science next, and are now waiting for the scientific spirit to arrive (3). Many of us keep wondering: can this journey really be performed successfully in the reverse direction ? Is the adoption of ready-made technology compatible with the rise of the scientific temper ?

However, the outlook might change if we look further back in history. The European renaissance was preceded by the scholastic age in the 13th Century. Further, European science could not have taken off without the foundations laid by the Indians, Greeks and Romans in 500 B.C.–200 A.D. (the Golden Age), which were preserved by the Arabs in the form of translations. Going still further back, the achievements of the Golden Age might not have been possible without the foundations laid by the ancient civilizations (c. 3000 B.C.) of India, China and Egypt. What makes these events appear independent is long gaps separating them (Fig. 1). The gaps are periods of political instability, religious intolerance, feudalism,

Fig.1. Long gaps between spurts of creativity. An interesting conclusion which may be drawn from the long gaps is that peak achievement is possible only when everything is right, and everything is right only occasionally and briefly in a small part of the world.

obscurantism and the like, but with the return of more favourable circumstances, the human spirit has repeatedly bounced back, and taken off from where the previous period of enlightenment had reached. Therefore, the perception that the modern miracles of technology are the culmination of a chain of events that began with the European renaissance can only be maintained by refusing to look back far enough. It ignores the achievements of the Indus valley civilization in mathematics, astronomy and city planning, the achievements of Chinese medicine and the architectural marvels of Rome, the remains of which survive to this day. There was sufficient communication even in the distant past to ensure a continuity in successive periods of enlightenment across long distances. Finally, a little introspection would reveal that the development of science and technology is a bit like the chicken and egg story, it is difficult to say which came first. The first concern of man is to achieve physical comfort, which needs technology. The primitive man who observed that by rubbing two stones one can generate fire no doubt had a scientific temper, but he must have looked at fire primarily as a potential tool for cooking rather than as a physical phenomenon worthy of detached scientific study. The same would apply to the man who translated the sight of a rolling log of wood into the invention of the wheel. These technological developments would

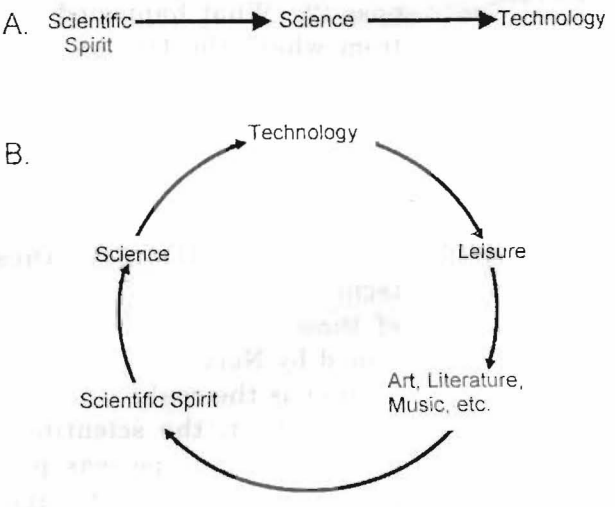

Fig.2. A. The linear model of development of science and technology. This model seems to be the result of not looking back far enough.
B. A more rational way of looking at development of science and technology as a part of social and economic development.

have made life somewhat comfortable for man, and ensured the basic necessities with very much reduced effort, generating thereby mental peace and leisure. Only after that could luxuries like literature, music and art have found a place on the human agenda. These intellectual luxuries have a tendency to boost our innate scientific temper, which in turn leads to development of science[1]. Science leads to technology, which generates still more leisure, and so on. Thus the course of civilizations has a circular rather than a linear configuration (Fig. 2). This circular model gives us a historical basis for optimism because we can start at any point in the cycle and hope to progress further.

Rays of hope consistent with the circular model have already started illuminating the horizon in India. With pragmatic considerations in view, immediately after independence we invested in a strong industrial and technological base, much of which had to be transported from the West and transplanted in the Indian soil which did not seem ready for it. We followed it up with a geometric expansion of science education and the establishment of institutions for advanced scientific research. This enormous effort has, so far, generated quantity rather than quality. India has the dubious distinction of having one-third of the scientific manpower of the world–more than our share, because we are, population-wise, only one-sixth of the world. But our impact on science has been negligible–one may take away all the contributions of Indian science in the last 50 years without inflicting any substantial loss to the scientific knowledge of mankind. However, the efforts made since independence have not been a waste. We have given way to a generation that is inquisitive, creative, articulate, and has a sense of national pride. We have the likes of Vikram Seth, Deepak Chopra, Amartya Sen, Arundhati Roy, Amjad Ali Khan, Mira Nair, Leander Paes and Sachin Tendulkar, to name just a few, to boast of. We have a huge middle class whose basic needs have been satisfied and who have the leisure to take interest in finer aspects of life. The world is suddenly interested in our culture, and has started looking up to us for our spiritual heritage. In short, India now counts. Haven't we unwittingly moved part of the circle (Fig. 3) and aren't we poised for a leap to the next stage, i.e. flowering of the scientific attitude ?

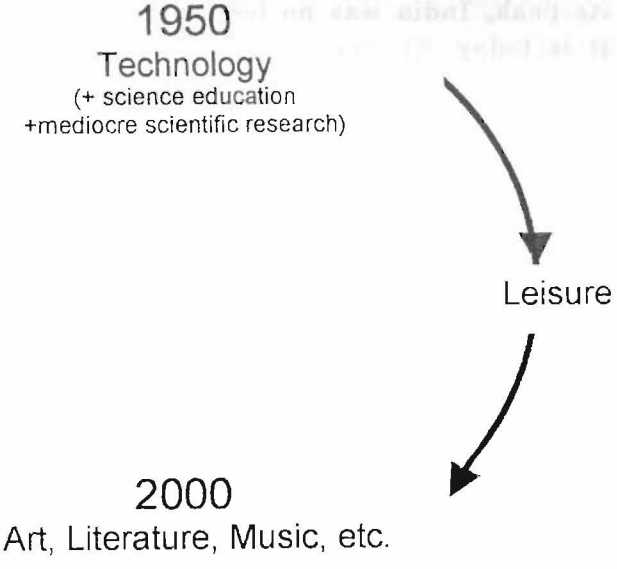

Fig.3. We seem to have travelled one half of the circle depicted in Fig. 2B in the last 50 years.

[1] This is true only upto a point. Preoccupation with making life more comfortable with the help of technology often detracts from the pursuit of pure science. That is probably why U.S.A and Japan are now finding it difficult to find scientists for their R&D efforts. Strange as it may seem, wars have generated enormous advances in medicine and other branches of science.

In view of the above historical perspective, Dr. Sidhu's letter listing the woes of researchers in India (4), down to earth though it is, scratches only the surface. Nevertheless, it makes many valid points which prompt introspection and give valuable leads for steps which would improve our research output. Further, although the hurdles enumerated by Dr. Sidhu may not be insurmountable, there is one more view of history which compels caution, if not despair. It may not be a mere accident that all major religions of the world originated in Asia, and nearly all scientific development has taken place in Europe (Fig. 4). This is certainly not the first time that the spiritual bent of mind of Asians, particularly Indians, is being made the scapegoat for our poor performance in science. However, this argument, although specious, is very weak. Let us examine the holes and cracks in our spiritual armour.

First, when Indian science was at its peak, India was no less spiritual than it is today. Second, the West today is no less spiritual than India. If by spirituality we mean belief in a common spirit pervading all manifestation in the universe, actions which should emanate from that belief have, in the recent past, originated largely in the West. Examples of such actions are the concern for forests, wild animals and domestic animals. Humanitarian help for victims of natural disasters, famines and wars, the sick, the poor and the downtrodden has also come in the greatest measure from Western countries. Finally, spiritual growth alone was never the Indian ideal. A balanced approach to life was not a monopoly of the Greeks as is now commonly stated: the Indian ideal, formulated long before the Greek civilization, was a balanced growth encompassing *kama* (desires), *artha* (means to fulfill desires, commonly considered to be money), *dharma* (right conduct, within the framework of which *kama* and *artha* had to be pursued) and *moksha* (spiritual liberation) (5). Thus there is no basic conflict between science and spirituality, or for that matter between spirituality and any creative endeavour. The dichotomy between spirituality and action in the external world is a distortion which grew in India after the advent of Buddhism, which in itself is a paradox[2]. Buddha himself, after achieving *Nirvana* chose to return to the world, its miseries notwithstanding, so that he could share the benefits of his enlightenment with the rest of mankind. In recent times, Swami Vivekananda and Sri Aurobindo have been powerful advocates of

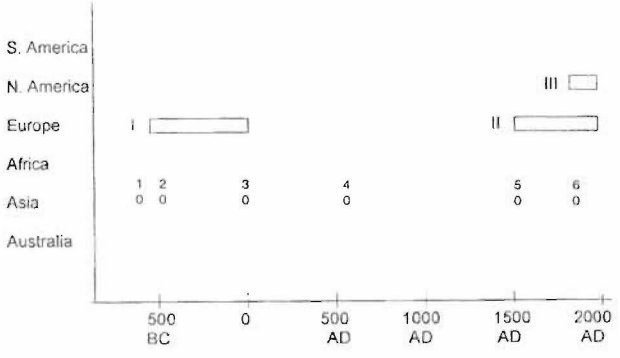

Fig.4. Birth of religions and scientific development in the world during the last 2500 years.
1, Buddhism; 2, Jainism; 3, Christianity; 4, Islam; 5, Sikhism; 6, Bahai faith.
I, II, spurts of scientific development in Europe
III, Spurt of scientific development in North America

[2] There is also a dichotomy in our action in the external world which we have to overcome – that between our attitude in the lab and outside the lab. Many of our scientists put on the scientific temper only in the lab. Outside the lab they are just as irrational and superstitious as the general population.

life affirmation with a spiritual attitude. Spirituality and activity are not just compatible; a spiritual attitude enriches external action by taking away from it elements of egoism, selfishness and greed, and adding to it the motive of consecration.

Thus there is no inherent reason why India cannot contribute to science. The phase of decline of the Indian civilization is over. There are several pointers suggesting that in the cycle of scientific development (Fig. 2), we are at a very favourable point for take-off. Our leaders, Nehru onwards, have shown a deep commitment to science. As a society, we have developed a sense of national pride. During the last couple of decades we have seen a remarkable surge of indigenous literature and arts, somewhat comparable to that seen in 13th century Europe. We have an active educational and cultural exchange with the West, and we are not restricted by any orthodoxy which may prevent us from absorbing the best features of the outside world (2). We are the repository of timeless wisdom, which includes novel instruments of arriving at the truth. If only we can capitalize on our strengths while being aware of our weaknesses, we can safely predict a very bright future for Indian science.

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