Science needs a front seat

Development of Science in India has brought benefits but these benefits are not necessarily distributed to everyone's satisfaction. Today we talk of highly sophisticated fields of science and have high hopes of pursuing research of international standards, but in realistic terms we hardly feel proud of our scientific power and strength. After 47 years of independence, doubts are being raised over the achievements and contributions of science in India.

An analysis of the development of science is instructive with regard to the national aspirations at the time of independence. In the domain of defence we wanted to become relatively self-sufficient in manufacturing and operation of sophisticated crafts and weapons. In the field of health, our target was to acquire most advanced technologies in the field of diagnostics and treatment and to provide basic health facilities to the millions of our population. In agriculture sector, self-sufficiency in food production was the sole aim. Industrial sector aimed at satisfying domestic consumer goods demand. If we go on estimating the achievements in these sectors, we can easily find that we have come closer to the desired targets. Was this success possible without the contribution of science? Have we forgotten where we were at the time of independence? With the freedom of our country, we had poverty-sunken, disease-prone, highly insecure illiterate mass. We had to fight a few battles with that and we survived.

The science, in the past, has followed national goals and priorities set forth by country's premiers and made them today a realizable truth. Unfortunately, the credit for the progress of the country has always been cornered by the political leaderships, whereas the scientists who really worked for achieving that were hardly given due regard for that, barring a few exceptions like H. J. Bhabha, S. S. Bhatnagar, M. S. Swaminathan, etc. Citing the words of W. H. Auden: 'The true men of action in our time, those who transform the world, are not the politicians and statesmen but scientists. Unfortunately, poetry cannot celebrate them because their deeds are concerned with things not persons and are therefore speechless.'[1]

Today science has grown enough to understand the basics of most modern and sophisticated technologies from the West. We have acquired sufficient indigenous know-how to adopt and install a number of projects based on foreign technologies. Though we have failed in running a few, but that is attributed mainly to the management and financial reasons in a large number of public sectors. Private and cooperative sectors have performed well in a number of fields and undoubtedly prove Indian excellence in the technological front.

Coming to the area of technology development, it seems that India is far behind any developed country. Indian technologies are considered inferior and non-reliable, that is why most of the Indian entrepreneurs preferred foreign technologies even if they were much expensive. But does this point out the inferiority of Indian scientists? The question is: How much do we spend on R & D for development of technologies. And the fact is that it is even less than 1.0% of the total GNP, which in forerunning countries is between 2 and 5% of their total GNP.

Unchecked population growth remains the most serious problem faced by our country. In the words of M. S. Swaminathan, 'There is as yet little widespread understanding of the serious crisis we are likely to face on the food front in the early part of the next century, if we do not intensify our efforts to limit population growth and adopt sustainable land and water use policies'.[2] Under such a situation, we must realize that existing strategies will fail to provide food, clothes and shelter to the ever-increasing millions of our population. It may only be possible through judicious application of scientific techniques. In the coming decades the threat will not be of national security from foreign enemies but from dissatisfied escalating population striving for their basic existence inside the country.

The need to develop our own technologies in the country was never given due importance as efficient and superior technologies were available from foreign countries. With the refusal of giving the technology of cryogenic engines by Russia and the controversial conditions imposed in the Dunkel proposal, continued dependence on foreign technologies seems no more a viable option in the time to come. The global trends clearly reflect that policies of buying foreign technologies will no more be beneficial and India will have to concentrate its efforts in the direction of developing technologies. Time is ripe enough for considering scientific budgets at par with the defence budget. It is the need of the time that at least 2% of the national GNP be spent for scientific R & D. Calling foreigners to invest in the Indian industries alone will not be sufficient. It needs to be supported by a strong indigenous technological base. Now we will have to think beyond self-reliance as liberalization will lead to tough international competition for Indian industries and trade.

It is true that scientific research is becoming a costly affair and care needs to be taken to check the misuse of funds, but freezing or reducing the scientific budget is a politically immature step. Surprisingly, scientific institutions in the country are considered loss-making public sectors and are subjected to curtailment of funds, recession of staff and have to continue with inadequate research facilities. It is incorrect to consider and evaluate scientific institutions as production centres. In fact, scientific institutions form the foundation of the industrial and production centres in terms of meeting their technological needs and supplying skilled manpower. Without the progress of such institutions we cannot think of a strong technological base in the country.

The number of R & D scientists and engineers per million population is also very less in India (200 only) as compared to the developed countries (in Japan, it is 47,436) as per the NISTADS Report on Indian Science & Technology Indicators. It clearly reflects that science in India was never given due importance. It suffered much from the political and social neglect. In our sociopolitical structure, administration received top priority. Administrative jobs in the country are most lucrative and are considered the tops among all other services. It is really a shame to note that most of the scientists have to wait till a late age for getting absorbed into permanent positions. For a long time they have to bear the uncertainties of less-paid, temporary fellowships. It has been their deep interest and

commitment towards science which made them contribute at a relatively high level with minimal inputs. Had scientific jobs been at par with those of administrative, more brains would have entered in the mainstream of science and contributed significantly. A large number of highly skilled scientific professionals have to migrate each year as they are denied even the minimum in this country.

For all developmental needs, science will remain most important and it would be dangerous to keep on ignoring the tremendous powerful contribution it can and could make.

1. Collins, K., *Chem Ind.*, 6 Jan 1986, 9–12.
2 Swaminathan, M S, The Hindu Survey of the Environment, 1994, 7–9.

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SCIENTIFIC CORRESPONDENCE

On coconut and coconut oil – where modern science meets traditional wisdom

Medical opinion is divided on the nexus between coconut oil, hypercholesterolemia and coronary heart disease. Vegetable oils, including coconut oil, have been shown to contain insignificant amounts of cholesterol compared to animal fat[1]. Since the human body has the inbuilt mechanism to synthesize cholesterol from certain saturated fatty acids that are consumed, coconut oil with its medium chain fatty acid content was presumed to contribute to cholesterol synthesis[2]. Contrary to this assumption which has been in vogue for a long time, a direct relationship between consumption of coconut kernel and coconut oil and incidence of coronary artery disease has not been well established. Moreover, population studies on coconut-consuming Polynesians in Hawaiian islands[3] and Sri Lankans from Sri Lanka[4] indicate low levels of serum cholesterol and incidence of heart disease compared to their western counterparts.

The reasons are perhaps not hard to find. Compared to all edible oils, palm and coconut oils contain appreciable amounts of tocotrienols[5], the levels in palm oil being relatively higher. Their concentration in oil is dependent on the extraction procedure. Though coconut oil has a relatively lower tocotrienol content compared to palm oil, the quantity of coconut kernel consumed would compensate for it. Tocotrienols represent a subclass of vitamin E and have similar isomers (alpha, beta, gamma and delta) as in tocopherols, the other subclass of vitamin E (ref. 6). Tocotrienol fractions from palm oil have been found to inhibit biosynthesis of cholesterol[7–9] and tocotrienols decrease hepatic cholesterol production and reduce plasma cholesterol levels in animals[10]. Similarly, administration of tocotrienols to humans reduced serum cholesterol[11]. When genetically hypercholesterolemic pigs were fed a standard diet supplemented with 50 µg/g tocotrienol rich fraction isolated from palm oil, there was a 44% decrease in total serum cholesterol, 60% decrease in low-density-lipoprotein (LDL)-cholesterol[9]. Tocotrienols differ from other known inhibitors of cholesterol biosynthesis in that their mechanism of hypolipidemic action involves post-transcriptional suppression of HMG-CoA reductase[7]. Although alpha and gamma tocotrienol isomers inhibit cholesterol biosynthesis, gamma-tocotrienols exert a 30-fold greater inhibitory activity[7]. Importantly, of the total tocotrienols present in coconut oils about 53% is of the gamma type[5].

Tocotrienols not only inhibit biosynthesis of cholesterol but also prevent lipid peroxidation by virtue of their anti-oxidant properties. For instance, alpha-tocotrienol has 40–60 times greater anti-oxidant activity than alpha-tocopherol, though its vitamin E activity is only 30% of the latter[12]. Being an anti-oxidant, it scavenges the free radicals produced in our body by various mechanisms[1]. There is some evidence that free radical damage contributes to and may actually cause some of the problems associated with many chronic health disorders including inflammation, cancer, atherosclerosis, heart attacks, stroke, emphysema and ageing[1, 5, 13]. Free radicals initiate chain reactions especially in membranes which have a large proportion of unsaturated fatty acids. Despite the presence of anti-oxidant enzymes namely superoxide dismutase, catalase and glutathione peroxidase in the cells, deficiency of vitamin E (tocopherols and tocotrienols) leads to inadequate protection against hydroxy radical-induced damage[1]. Therefore, it is recommended that as the consumption of polyunsaturated fatty acids (PUFA) increases, the intake of vitamin E should be increased[1, 6]. In many oils, with the exception of fish oils, the proportion of vitamin E increases with increase in unsaturated fatty acid content[1].

The people of Kerala consume a large quantity of fish which are rich in polyunsaturated fatty acids but contain low vitamin E. The requirement of vitamin E as an anti-oxidant has therefore to be met from other sources including the tocotrienols present in coconut kernel and coconut oil which are consumed along with fish. Traditionally, women in Kerala applied coconut milk and oil derived from coconut milk (*Urukkuvelichanna*) to their skin. The same was applied for some types of physical injury as it was believed to facilitate healing. Further, in Ayurveda, one of the remedies for the loose facial skin, due to ageing, is to astringe grated coconut on the facial skin[14].

Given the hypocholesterolemic (and anti-oxidant) action of tocotrienols and