

people by many innovations. Srinivasa Murthy of the Civil Department developed a technology for making underpasses with low cost and without disturbing the traffic. He demonstrated this at several places in Bengaluru. (However, this was not used because the local contractors found that this was not a money spinner for them!) Thus in the few years I spent in IISc, I know it was contributing for the good of the country. Perhaps, the Director of IISc could ask all Departments to list out all such works and prepare a report. Such a compilation might provide an answer to Narayana Murthy's questioning IISc's contribution to the society.

Research and technology development demands passion, deep involvement, dedication, sacrifice and perseverance. This is not the end in itself and should be successfully commercialized by the industry. This has been the greatest problem in our country. Academia and industry are in water-tight compartment and do not interact. Academic institutions work with the only aim of producing research papers, so that students get their degrees and the professors get their list of publications boosted, which is important for their careers. In fact many professors refuse to take up work on solving industrial problems because such work will not lead to publications. Industries in turn also do not approach the academic institutions as they feel that such institutions lack knowledge of what the industries need. The situation in the USA and Europe is very different. There industries work closely with universities. In fact there is regular migration of people from industry to academic institutions and vice-versa. They are aware that for industries to be in the forefront of technology, research work is very important. They spend a good part of their earnings on R&D. In addition, they fund

reputed institutions to carry out advanced research related to the industry. No wonder such institutions are in the forefront of technology development.

The above narration is pertaining to the manufacturing sector and should make all stake holders in the country understand why educational and research institutions are what they are. There are not many academicians who like Vasudeva Murthy are interested in applied research. Similarly, there are not many industries which do in-house development to improve their technology and process so as to beat competition. They are also not interested in approaching academic institutions to help them rather than seeking foreign collaborations and technology. This is not good for the country as a whole. The government should curb the tendency of well-established industry to seek foreign technology and ask them to develop their own capabilities for being competitive. For such purposes, they should be encouraged to seek help from academic institutions. In fact, this is happening in China now. After mastering the technologies obtained from USA and Europe, China started making improvements on such technologies, so much so, that it could produce materials at much lower costs and better efficiencies than the technology providers themselves. This is the reason why today China has become the manufacturing hub of the whole world. The emphasis that China is giving on developmental work can be seen from the increased number of international patents that the Chinese are filing. The role of the Chinese Universities has been significant in this. Because of the aggressive stance of the Chinese authorities, the universities are required to get associated with industries, study their processes and problems and come out with appropriate solutions. Equally important has been the

fact that most of the Chinese students who go for higher studies to the USA and Europe return to their country and participate in its development. This is in stark contrast to Indian students who after completing their studies stick on to jobs there and never return. We may take pride in the large number of Indians in US Universities, Laboratories and Industries. But alas, they make no contributions to our country's progress. Academics should be asked to get funding from industry and take up time bound work and deliver tangible results. Only then institutions like IISc will change their working culture and contribute to the good of the nation. Industrialists like Narayana Murthy on their part should fund Indian Universities to carry out state-of-the-art research which would help the two to grow together. We should also strengthen our IP Regime. I find that today our Patent office takes 3 years to just acknowledge the receipt of a filing. I wonder how many years it takes to get a patent.

It is pertinent to mention here that the IT industry in the country has not made any original innovations. It is making money merrily, thanks to the availability of a large pool of cheap labour and high disparity in the exchange rate of Indian Rupee against currencies like the US Dollar and Euro. So should we say the remark of Narayana Murthy is like the kettle calling the pot black?

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Teaching science of biosecurity at schools

Biosecurity is a shared responsibility. As biodiversity resource managers, humans play an indispensable role in its implementation. In principle, bristle-appendaged lemma of grasses can get dispersed through globetrotters via footwear treaded

relocation, e.g. from Alborz Hills in Iran to Ponmudi Hills in India. Likewise, Dead Sea marine fouling forms can be introduced into Pulicat Lake through our Israel-bound travellers, reaching back home with the same unwashed dive-gear in use.

School children must be illustratively enlightened on bioinvasive pathways through metaphorical posters on various themes, viz. handling and disposal of air-freight courier packaging materials; air-dashed inflow of cockles, scallops,

conch shells (of Maldivian atoll origin); knowledge of banned marine products like Mother-of-Pearl, oyster artifacts, moist seaweeds, boxed miniature colour crabs (Xanthidae); enveloped-hilltop silk worms; colour sand transit in handy wrappers; uncured wild sandalwood twigs holed up in handbags and other hidden collectibles, curios, etc..

Effective capacity building on biosecurity begins primarily at home by identifying and building awareness and reinforcing strengths on every emerging biohazard and biological safety, thereby creating a holistic ethos in society. Discussing safety issues per se can focus on avertible unintentional ecological signatures like *Trichogaster trichopterus* – three-spot gourami invasion into canals (emptying into Vembanad lake, Kerala)¹; husbandry of exotic pet fish and stalling their entry into the wild; contact depuration code for *Lantana camara* L. flowers; sensible handling and disposal of water hyacinth root biome; prohibitive Western Ghats endemic flowering plants sacrificial herbarium collection and sanitation methods; bioinvasive routes of common Mesquite, *Prosopis juliflora* (Sw) DC to nature; lackadaisical polychaete worm shipments; personal biosecurity measures and hospital epidemiology for infection prevention and control, etc. Propitious effects of exotic Mosquito fish, *Gambusia affinis* (Baird and Girard) (introduced into Madras waters in 1929 from Ceylon) is a must-read for science hobbyists and enthusiasts at school².

Biosecurity should not be broken in any part of our earthly sojourn in the new millennium. Equipping every novice at school on biosecurity in India is a must and the onus rests on the Government. The laboratory of biosecurity in Indian science education should commence from childhood at school. Bioinvasion science in the limelight since 1956 is *Parthenium hysterophorus* L. of the Americas and its entry as an adulterant in imported wheat, deemed to be a vivid curricular lesson on the ills of biosecurity³. An Indian military mission with non-quarantined military vehicles, sup-

ported *Parthenium* dispersal further through shipping of goats to Sri Lanka⁴. It is also high time to efficiently actuate the sword of biosecurity in India. Harnessing the laws to clean up Indian biosecurity practices is imperative, and that should be incited with total school awareness today and also adult education programmes as a collective responsibility for all Indian homes.

Abuse of biosecurity must not be permitted in India at any cost from now on into the future. It is also the duty of policymakers in India to publicize biosecurity measures that fearfully clock the minds of passengers at all entry ports (sea, air and land). Biosecurity is a maturing activity, always in need of constantly improved information on diagnosis, transmission, clean-up and eradication with time. Documentary films and educative posters by the World Health Organization, discouraging ‘high-risk’ practices (handshakes, large gatherings, traditional burial rituals) that brought people in contact with each other, controlled sparking Ebola aggravation further in West Africa⁵. Hunting and consumption of bushmeat by elite gun-licence holders need to be explained through television programmes and also in the schools about the dreaded threats of zoonosis.

According to Graham Sullivan (Canterbury Environment Regional Manager for Biodiversity and Biosecurity, New Zealand), biosecurity in curricula for school children gives an opportunity to learn that their actions can make a difference to the environment and they can also have prime involvement in biosecurity and protecting their place and country every day⁶. Leiv Sydnnes (University of Bergen) highlighted that education and awareness-raising on biosecurity, elucidating biochemical linkages as part of school curricula at multiple levels is necessary⁷; this is true for India as well. Australia adduced that ‘Incorporating biosecurity into school curricula will render cross-community coverage at a broader level, including those who will one day become the scientists dealing with the issues’⁸.

A coherent biosecurity strategy in which education, regulatory measures and social mobilization are vital, has already been framed as a national recommendation in 2007 in India during the meeting on setting-up of national agenda towards biosecurity⁹. But students are still awaiting to learn in school curricula, the science of biosecurity in relation to agriculture, human health and natural environment. More importantly, should we not equip our children, at the least, to scientifically face the threats of Bioterrorism in today’s world of nanotechnologies?

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