

Biology versus computers

Until some years ago, students desirous of studying science in the 11th and 12th classes in the Central Board of Secondary Education (CBSE) system, had to compulsorily study physics, chemistry, mathematics and biology. This I thought was a great improvement over the system that existed in my high school days, when biology and mathematics were made mutually exclusive immediately after the 8th class. However, some years ago the CBSE quietly introduced computer science as an alternative to biology at the 11th and 12th class levels. Thus students now have to choose physics, chemistry, mathematics and computer science or physics, chemistry, mathematics and biology. In effect, students interested in computers cannot study biology and those interested in biology cannot study computer science.

It is widely recognized that this is the age of biology. Any one even casually following the progress of biology cannot fail to recognize the pre-eminent role that computers are beginning to play in present day biological research, be it molecular biology or organismal and evolutionary biology. The advantage that Indian scientists have in undertaking computer-based research projects as opposed to projects dependent on sophisticated instruments is only too well known. The human genome project is expected to

make available a mind boggling quantity of data within the next 2 or 3 years. Although Indian scientists did not participate in the sequencing of the human genome, it is widely expected that we can contribute significantly towards making sense of the more than 3 billion alphabets of the human genome. This of course will require great expertise with computers. What then can be a more retrograde step than to make biology and computer science as mutually exclusive subjects for our students?

An alarming decline in the numbers of students opting for science and the impending dearth of trained manpower to sustain S&T activities of such a large country, have emerged as serious challenges facing the Indian scientific community. A variety of organizations such as the Homi Bhabha Centre for Science Education, the Indian Academy of Sciences, the Jawaharlal Nehru Centre for Advanced Scientific Research and the Department of Science and Technology, Government of India, have launched massive programmes to encourage bright young students to opt for a career in science. Whether or not these programmes will yield the desired results is a moot point but seemingly trivial steps such as the one taken by the CBSE board in making computer science and biology mutually exclusive, will surely wash

away any benefits that might accrue from these efforts.

I am very fond of watching so-called mud dauber wasps tirelessly build little earthen pots, fill them with caterpillars, lay an egg and seal the pot. If one makes a hole at the bottom of the pot, the caterpillars will fall out but the wasp will forever keep attempting to fill the bottomless pot, not realizing that something is amiss. Evolutionary biologists explain this apparent 'stupidity' of the wasp by pointing out that during the course of its evolutionary history, the wasp never had to encounter mischievous scientists who make holes at the bottom of their earthen pots. Those of us who work towards making science an attractive career for young minds will, however, do well to watch out for agents such as the CBSE that can make holes in pots that we are attempting to fill!

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A clean certificate for transgenic plants

This is with reference to the correspondence by K. K. Narayanan entitled 'Are transgenic crops a threat to bio-diversity' (*Curr. Sci.*, 2000, 78, 7). The author had given a clean hit to the transgenic plants in the beginning itself and wanted the readers to forget that he is working at the Monsanto Research Centre. The correspondence thus focused only on the advantages of transgenic plants.

We agree with the author's statement that as with time agriculture has begun to depend on fewer and better varieties. But the next statement that 'introduction of transgenic crop varieties does not add

any new dimension to this scene in modern agriculture' can never be justified. The author is just trying to view the transgenic plants as one among thousands of our old varieties. This approach is not correct. As stated by the author, transgenic plants may be initially widely accepted by the farmers, but these may become a replica of plant protection chemicals which were the 'heroes' in green revolution. The author agrees that bio-diversity is important for future crop improvement and anything against it will be a threat to human existence and should be resisted.

Transgenic plants will result in genetic pollution of traditional varieties by cross-pollinating them¹. According to Green Peace, Novartis, genetically engineered maize has cross-pollinated an adjacent field of conventional maize in Germany². Soon after the production of the first transgenic plant in the early 1980s, gene flow from genetically modified crop was recognized as a potential hazard. Thus, there is the possibility of the development of transgenic plant volunteers in nature and thus endangering natural habitat^{3,4}. Also, there is evidence of interspecific transfer of pollen from transgenic plants⁵.

In the Codex Alimentarius Commission, Ottawa, India and several other nations demanded more extensive labelling of the transgenic food. 'Genetically engineered herbicide-tolerant crops are laced with high level pesticide residues that may disrupt endocrine function, destroy immunologic defences against diseases, including cancer', according to Romeo Quijano, University of Philippines. 'Transgenic plant technology can create dangerous foods by generating mutation in the DNA of the food processing organism,' says John Fagan, USA. 'The fact is it is virtually impossible to even conceive of a testing procedure to assess the health effects of genetically engineered foods when introduced into the food chain nor is there any valid nutritional or public interest reason for their introduction', says Richard Lacey, University of UK⁶. Canada-based Rural Advancement Foundation International (RAFI) condemned this as a conspiracy for monopoly in the food market. M. S. Swaminathan opines that such technologies should be stopped from entering our country by strict import policies.

The 'Bt genes' introduced may lead to a complete destruction of boll worm ecology leading to impaired biological equilibrium. Transgenic plants becoming weed is one which depends on the nature of the plant to be transformed and gene to be introduced⁴. Other hazards associated

with transgenic plants are horizontal gene transfer, development of new viral strains and effect of toxin on non-target insects⁷.

Social impacts may be a wider gap between the north and the south, and growing disparities in the distribution of income and wealth within societies⁸. Increased production will induce small farmers to grow transgenic plants and ultimately the MNCs will control the world food market leading to a complete disappearance of indigenous cultivars, and seed companies. Thus more than 1.4 million poor farmers in Africa, Asia and Latin America who depend on farm-saved seed as their primary seed source, will have to suffer.

While terminator technology is a threat to food security, agricultural biodiversity and future scientific research, traitor technology will be a tool for agro-terrorism propagated by MNCs⁹, in which seeds should be treated with their own chemicals to activate the disrupter genes, in the absence of which the cysteine protease promoter will activate the barnase enzyme to burn-off the germinating seedlings.

It is a matter of pity that even eminent scientists in this field do not consider the problems associated with the transgenic plants. In a seminar organized by UAS, Bangalore, some scientists and policy makers stated that 'every technology has got its own risk'⁵, which they are reluctant to discuss.

Anything against nature's existence will be wiped off and so also terminator technology. An article which discusses only the positive aspects of any technology cannot be accepted.

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Transgenic crops and biodiversity

We found the article by K. K. Narayanan (*Curr. Sci.*, 2000, **78**, 7) very educative. We would like to present the following points for further consideration.

The author, while trying to alleviate the misconceptions on transgenics, seems to prescribe transgenics as the only alternative for the future and relates it to the needs of the exploding population. In supporting the cause the author also equates the natural selection process to **artificial selection** (transgenics). The cultivation of fewer traditional varieties selected from millions of species is based on human preference over the years; but this cannot be compared to the voluntary addition of any gene into a plant. A con-

scientious biotechnologist will not agree with the statement given in the article 'the addition of transgenic crops does not add any new dimensions to the existing scenario in modern agriculture'. Our view is different. Transgenics are a product of artificial selection and hence they cannot fall in line with the traditional varieties. No doubt, any scientific advancement needs to be received well, accepted and adopted in the modern system after a thorough scrutiny of impact on mankind. At the same time, the traditional varieties also have their own role to play.

The author further says that in future, the world community will have to rely

upon only a few evolved varieties (transgenics) to feed the growing population. This would lead to disaster in countries like India where the per capita income is less and per area population is high. If every available and useful variety is converted into a transgenic variety, then, such a thing may be possible. A news item published in *Nature* (6 January 2000) discusses the pros and cons of transgenics related to patency. While the commercial companies hail the (patency of) transgenics, an environmental group Green Peace criticizes this. Stefan Flothmann, Head of Genetic Engineering Department at Green peace, Germany, had said, 'This could lead to monopolies in the seed