# Minds that live for…

Transgenics are present day man-made living organisms that have been genetically engineered to stably harbour, express and transmit a gene borrowed from taxonomically unrelated source. Such genetically modified organisms (GMOs) have been developed in microbes, plants and animals. Since the existence of transgenic is a challenge/tease to the evolutionary course of development of crossability barriers, the skepticism is inevitable. The resulting fallacies mainly include escape of the new gene from the transgenic background into the environment, which have been generally addressed with respect to plants systems only. After the lead taken by America and China, a few European countries and many other countries are in the race to welcome the adoption of GM crops. More or less, in every such case the long-term benefit was considered because presently there is no convincing reason to think of likely harm it can cause, thus overshadowing the negative points on which the existing fallacies are built. Although one must not be against the emerging general view regarding the adoption of the GM crops, certain points seem to have been least addressed.

First, the case of origin of viroids in the early twentieth century, which caused devastating disease in certain crop plants, is worth considering. Evidences suggest that viroids are introns that escaped from the cell under the pressure of indiscriminate use of agrochemicals in modern agricultural practices[1]. If this is true, then as compared to 1920s and 1930s, the pressure of agrochemicals use is ever more severe today. Therefore, the event of yet another intron sequence escape/gene sequence's escape is relatively more probable at present than in the past and we have no reason to say that the alien gene in transgenic background is as stable as other host genes. This may be of concern because about 70% of the GM crops have herbicide resistance which encourages the indiscriminate use of certain herbicides.

Secondly, quite often the transgenic crops have been developed to check the losses incurred due to susceptibility to various biotic and abiotic factors, over accumulation of a particular nutrient element/secondary metabolite or silencing a particular gene encoding an enzyme yielding desirable results. Even with these efforts, the plants can never go beyond their present yield potential, though quality may certainly be improved. But, why has one not thought of tailoring a genotype of wheat that has two-fold more length of ear head or double the number of effective tillers than a potent wheat variety presently has? Perhaps, if one had considered these first, then this would have invited less of fallacies. Obviously, the bias of human psychology comes into picture, e.g. the transgenic microbe of pharmaceutical importance may not receive the same skepticism as that of a non-pharmaceutical one could. Although looking into the global food problem the role of biotechnology cannot be overlooked, a feeble SOS sound may not be ruled out. The Nobel Laureate Norman E. Borlaug has also commented that 'those opposed to such uses of biotechnology are an elite group from wealthy countries who have never lived or worked with poor people'[2].

Thirdly and most importantly, the biological research will, now more often, progress under the lure of money. Under the present era of patenting and financially profiting from it, it may neither allow one to conduct research with renewed hope nor are many research proposals going to be financially supported. One may recollect the review by the Nobel Laureate, James Watson on the thirtieth anniversary of their DNA double helix 'Minds that live for science'[3] and believe that such minds will be nurtured in future for their commitment.

1. Voet, D. and Voet, J. G., *Biochemistry*, John Wiley & Sons, New York, 1999, pp. 1023.
2. *Biotechnology: Global Update*, 2002, **4**(3), 3.
3. Watson, J., *New Sci.*, 21 May 1987, p. 63.

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# Amateur researchers: A vast untapped potential

Even after almost 60 years of independence, and with so much of verbal razzmatazz and paraphernalia associated with the so-called advancement and development of science and scientific research in the country, there is actually very little to cheer about in the area of genuine and original scientific research. The reasons for this may be many, and everyone may have his or her personal opinion on the issue, but hardly anyone can deny the fact that excessive bureaucratization of scientific institutions is one of the main reasons for this state of affairs. This alone is perhaps the mother of several other ills such as corruption, nepotism, bias, insufficiency in performance, etc, unbridled in several CSIR labs, and other government/quasi-government research organizations. This is not aimed to filch away their due credit for their several achievements, but is only to emphasize the fact that had our system been free from these tribulations we would have been in a much better position. Moreover, there is an ardent need for a change in the mindset of science personnel and to make them more aware of our social problems and realities. They must be down-to-earth in their approach to the needs of the common man, and should not look down upon and be indifferent to the events occurring in the society. Lack of

sensitivity among the educated and the elite, is the major cause of backwardness of our people, and it has prevented our nation in obtaining the maximum benefit out of the talent pool available in the country. One can seldom find a scientist honestly analysing the accomplishments of his colleague, let alone bestowing praise and accolades upon him, when obligatory. This tendency of scientists has generated a strong public perception that scientists are heartless and inhumane people.

There is an urgent need to initiate a public debate, led by experts and intellectuals, to make our institutions more efficient, responsive, and people-friendly and promote genuine scientific advancement and a healthy competition among all the players. There is also a need to create adequate space for amateur researchers, and retired scientists and professors. This will ensure the beneficial utilization of the rich potential of skill and brains available in the country. Unfortunately, there is no independent body in place today that caters to the needs of amateur researchers and retired professionals. An unbiased promotion policy and effective regulation of the research activity will help sincere workers, especially freelance researchers, a great deal. Such a body will be of great help in giving much needed help and recognition to those science workers whose primary objective is to earn pleasure and intellectual satisfaction, rather than money. It would not only provide all the necessary logistics and support required by the workers, but also provide a platform for healthy and progressive discourse among researchers. It will also lay down mandatory guidelines for effective regulation of research activity, and prevent waste of resources, by checking unnecessary duplication of work.

This move will help a great deal in inculcating scientific temper and popularize science among the masses, because scientific research cannot and should not remain a personal fiefdom and hegemony of a privileged few. The scientists will also win greater public faith and reverence, as a result. Our science policy must be more people inclusive, than it is today. Only greater participation by the people will ensure that science gets the best available talent and the existence of a healthy and vibrant scientific community in the country.

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# Time to publish: The scientific efficiency of nations

The scientific impact and wealth of nations has been studied in great detail in recent years. In this short note, we propose a very simple indicator for measuring the scientific efficiency of the R&D work force of a country. Most of the scientometric data for countries is now organized using indicators which reflect the number of full time researchers deployed by the country per million of population (say $S$ scientists/million) and also the number of papers published in *Science Citation Index* (*SCI*) based journals per million per year (say $P$ papers/million/year). The ratio $TtP = S/P$ will then have the curious units: years/paper/scientist. $TtP$ is therefore a notional indicator that measures the average number of years a scientist takes to publish an *SCI* paper. This is a proxy for the scientific efficiency of the nation's workforce. Table 1 gives an interesting comparison for some leading countries in scientific R&D.

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**Table 1.** Time to publish: The number of years it took for an average scientist to publish an *SCI* paper as per data pertaining to 2002–03

| Country | FTER/Million[1] | Papers/Million[2] | TtP |
|---|---|---|---|
| Israel | 1,563 | 1018.46 | 1.53 |
| New Zealand | 2,197 | 745.12 | 2.95 |
| Switzerland | 3,592 | 1119.96 | 3.21 |
| Netherlands | 2,572 | 800.21 | 3.21 |
| UK | 2,666 | 796.48 | 3.35 |
| Denmark | 3,476 | 933.34 | 3.72 |
| Canada | 2,978 | 747.56 | 3.98 |
| Austria | 2,313 | 573.96 | 4.03 |
| Greece | 1,400 | 328.86 | 4.26 |
| Australia | 3,439 | 773.17 | 4.45 |
| Sweden | 5,186 | 1136.65 | 4.56 |
| Spain | 1,948 | 394.26 | 4.94 |
| France | 2,718 | 523.86 | 5.19 |
| US | 4,099 | 706.79 | 5.80 |
| Singapore | 4,052 | 676.5 | 5.99 |
| Germany | 3,153 | 525.14 | 6.00 |
| Norway | 4,377 | 715.28 | 6.12 |
| Brazil | 323 | 45.26 | 7.14 |
| Finland | 7,110 | 974.24 | 7.30 |
| Portugal | 1,754 | 227.68 | 7.70 |
| Argentina | 684 | 83.33 | 8.21 |
| Poland | 1,474 | 160.31 | 9.19 |
| S. Korea | 2,880 | 256.51 | 11.23 |
| Japan | 5,321 | 452.78 | 11.75 |
| India | 157 | 11.34 | 13.84 |
| S. Africa | 992 | 52.9 | 18.75 |
| China | 584 | 19.17 | 30.46 |
| Russia | 3,493 | 109.5 | 31.90 |

[1]FTER: Full Time Equivalent Researchers per million people (from Human Development Report 2004).
[2]Papers/Million: Per capita output of S&E articles 2002–03 (from Science and Engineering Indicators 2006).