

Where we stand in Biotech

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Biotechnology, one of the most important areas of human endeavor today, is comprised of about 30 different technologies which were outlined in BioSpectrum vol.: I, issue: I

Biotechnology areas can be classified into four categories

1. Areas where we have no or little expertise and where we are not doing anything substantial as of now.
2. Areas where we have virtually all the expertise, yet we are not doing anything substantial.
3. Areas where we have made a beginning and are progressing reasonably well.
4. Emerging areas where our country has the potential of providing leadership as all the infrastructure and the basic capabilities exist with us.

Let us look at each of these categories one by one. I would look at the first categories in this article and the last two in an article in the next issue.

Areas where we have little or no expertise

- a. **Gene therapy of human beings**
- b. **Xenotransplantation:** that is, transplantation into humans from organs from other animals. For this purpose, as it

turns out the pig appears to be the most suitable. Transplantation of organs from the pig on to humans leads to an acute and rapid rejection of the transplanted organ which cannot be taken care of by immunosuppressants (such as cyclosporin) that are normally used to prevent an organ being rejected in the case of, say, transplantation of kidney from one human donor to another human recipient. However, it has been possible to genetically engineer a pig, the organs of which will not lead to such a rapid rejection. The prospects, therefore, for pigs serving as a source of organs for human beings, seem to be bright, and India must start working on this new technology

- c. **Production of new materials** such as biodegradable polymers using new ideas, observations, research findings.
- d. **Processing of low-grade ores using microorganisms:** Some work in this area was done a long time ago by Indian scientists, but no such process seems to have been so far commercialized in the country in spite of the fact that we have vast deposits of low-grade ores for a number of metals.

Areas where we have virtually all the expertise but are not been doing anything substantial

- a. **Production of monoclonal antibodies (MABs) for diagnosis and therapy:** In spite of the fact that the technology for producing MABs, at least for diagnostic purposes, is available in a large number of laboratories in the country, we have not yet marketed a single MAB of our own.
- b. **Plant and animal tissue culture:** This is another area where we have an enormous amount of expertise around the country. However, in spite of the tremendous potential for selling exotic plants such as orchids grown through tissue culture, or growing skin for burn victims for which even processes are available within the country, leave aside producing products such as vanillin or taxol through tissue culture. We have not been able to commercialize any such project. In this regard we need to learn lessons from countries such as Thailand which is the largest exporter in the world of orchids grown through tissue culture.
- c. **Standardization, validation and manufacture of traditional plant-based drug formulations**

This is by using good laboratory practice, good clinical practice, and good manufacturing practice, so that they may become prescription drugs around the world. We may have some 40,000 such formulations that have come to us through the four documented Indian systems of medicine (Ayurveda, Siddha, Unani and Tibetan systems) and the undocumented tribal systems of medicine. It is a pity that there is only one traditional drug formulation- Liv-52 manufactured by Himalaya Drug Company, which is a prescription drug outside India.

Many organizations in the country, both in the private and the public sector, such as the CSIR and the Foundation for Revitalisation of Local Health Traditions (FRLHT) have put in an enormous amount of effort in collecting information, for example on medicinal plants. However, there is very little effort put in so far on an appropriate, computerized documentation of the actual formulations used in our traditional systems of medicine, on the basis of which documentation, using rational criteria, formulations could be chosen on a priority basis for standardization, validation and manufacture.

d) Synthesis of peptides

The making of synthetic peptides having commercial value in medicine, fisheries or veterinary practice. There are a fairly large number of institutions both in the public and the private sector which have all the expertise and even the equipment for making synthetic peptides and the protected amino acids required for peptide synthesis. However, there has been no concerted effort on a substantial scale to make peptides of quality for sale around the world, taking advantage of our expertise and the low cost of production.

e) New cloning technologies

These are especially for animals that could produce useful products.

f) Use of PET-SCAN

Positron Emission Tomography (PET) scan to be used either for research and diagnosis, by itself or in combination with magnetic resonance imaging (MRI) for which facilities exist around the country. In spite of PET- SCAN being one of the most powerful diagnostic and research tools available today, we do not have a single commercial PET-SCAN machine in the country which would be backed by an appropriate medical cyclotron to produce short-lived isotopes required for PET-SCAN analysis.

g) Biosensors

Biosensors is the area on which a number of commercial companies around the world are working. This is in spite of the fact that a report on Biosensors was prepared by a NGO, the Hyderabad Science Society, and submitted to the Government of India, some twodecades ago.

h) Use of microbes for effecting chemically difficult transformations

i) Biomediation, for example of effluents or wastes

j) Development of protocol for technologies that would allow one to minimize the effects of biological warfare or bioterrorism

Let us remind ourselves of the ingenious anthrax attack in the United States in 2001. Countries such as the United States are spending enormous sums of money on commercializable defence against biological warfare.

A country so large as ours with the enormous advantages we have will do well to invest in a planned way, through cooperation between the public and the private sector, in the above areas, both for short-term and long-term gains.

PM Bhargava