



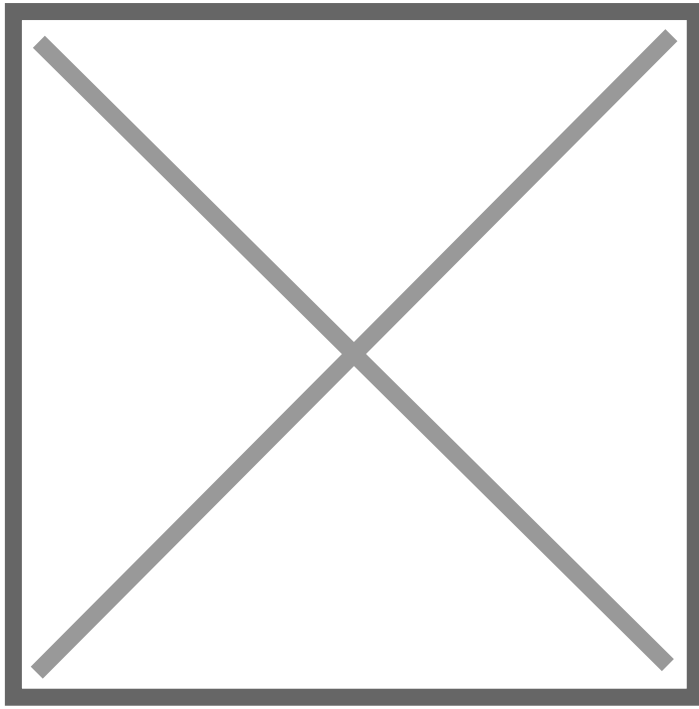
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Tomorrow's focus

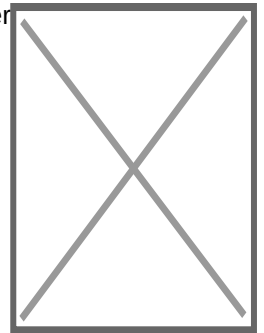
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GUEST

Biotechnology is the fastest growing applied science and is reckoned as the cutting edge of frontier technologies in the years to come.

The 1980s ushered in a new era of industrial revolution shaped by two major technological advances. One is biotechnology based on cell technology and genetic engineering, and the other is information technology. Though biotechnology is very old, recent developments through new research, new techniques, new knowledge and new applications have opened up countless exciting opportunities. In fact, biotechnology at the moment is witnessing some breathtaking and mind-boggling developments. The breakthroughs are helping in curing many diseases both in humans and animals, developing products and processes never witnessed before, reducing the cost of production in traditional products, increasing agricultural production, productivity, quality, shelf-life etc.



In the South-East Asian region, a variety of applications in this field are gaining ground at an impressive speed. Biotechnology is being applied for the production of value-added products (often pharmaceuticals), for export differentiation and to feed the increasing population. India too is emerging as an important player in this field. There are over 363 biotechnology organisations including 175 biotech industries in the country. The value of biotechnology products including conventional fermentation based microbial products produced in the country has been estimated at Rs 890 crore at present.

Biotech diversified

Various sectors such as drugs and pharmaceuticals, food and agriculture, chemicals, energy and environment are harnessing biotechnology for deriving the benefits. The profound impact of biotech on the pharma industry is well known. The application of biotechnology in food and agriculture sector is less advanced compared to developments in pharmaceutical sector. Biotechnology has the potential to increase the productivity of world agriculture and is contributing actively towards it. It is contributing towards increased food production through higher yields and lower costs. New high value-added products have been developed to meet the needs of consumers and food processors. These products include agricultural inputs (seeds, herbicides, pesticides), veterinary diagnostics and therapeutics, food additives and food processing enzymes, more nutritious crops with improved food processing qualities.

Similarly, new plants developed through selective breeding, cell culture techniques or through genetic engineering techniques can alter the nutritional content of fruit and vegetables and also increase consumer appeal. Genetic engineering is being used to develop temperature tolerant plants that can survive in warmer or cooler climates. Frost damage alone causes more than \$14 billion of crop losses annually worldwide.

Drought tolerance would enable cultivation in arid parts of the world. Water from the oceans could be used for irrigation if salt tolerant varieties could be cultivated. In all cases, the amount of land used for production could be greatly expanded.

Biotech benefits

The benefits of biotechnology are widespread.

Medicine

- New and improved treatments for the diseases of heart and blood vessels, cancer and diabetes.
- Better and cheaper antibiotics.
- Vaccines to protect against viral diseases, such as hepatitis, influenza and rabies, and parasitic diseases, including malaria and sleeping sickness.
- Rapid tests that will aid doctors to make accurate diagnoses of many diseases.

Agriculture

- Change in the productivity of crops by producing hardier plants.
- Extending growing seasons and geographical range.
- Reducing growth cycles to increase the frequency of multiple harvests.
- Developing strains resistant to pests, diseases, heat, frost, drought and flooding and increasing yields and minimising post-harvest waste.
- Creation of crops, which make their own fertilizers, with immense savings in costs to the farmers.
- Herbicide tolerance, pathogen/pest resistance in plants.
- Plants, which can thrive on land that presently lies barren because the soil lacks water or is too salty.
- Substances that can speed the growth of farm animals.
- Vaccines that can protect the animals from foot and mouth disease.
- Cheaper forms of animal feed, consisting of microbes grown on waste materials.
- Improve the nutritional value and taste of products and increase their shelf life for easy transportation.

Food processing

- Cutting energy costs.
- Speeding up processing time.
- Diversifying raw material needs.
- Reducing raw materials needs.

Engineering of corn and wheat to enable the plants to fix their own nitrogen could result in a potential savings of \$4 billion annually in fertiliser costs. The development of varieties that are naturally resistant to pests and fungal pathogens offers opportunities to reduce the use of insecticides and fungicides in crop production.

Biotechnology can be used to improve enzymes that are used extensively in the food industry as processing aids. Rapid and sensitive methods for the detection of pathogens, toxins or chemical residues, based on the development of DNA probes or monoclonal antibodies, could help to ensure the safety of the food supply. Biotechnology could provide new techniques for upgrading waste streams, improving utilisation of food processing by-products and decreasing the environmental impact of food processing waste.

The food sector is the oldest user of biotechnology. Biotechnological processes were used first for food conversion. Breweries, bread manufacturers and the dairy industries (cheese, yoghurt) are still predominant in the food sector. Biotechnology can play a role in preventing losses during food processing in developing countries, when post-harvest losses of 10-20 percent of vegetables (some times reaching 40 to 50 percent) and 10-30 percent of tropical fruits are common.

Adoption of biotechnology has cut energy costs and processing time, diversified and/or developed new markets for waste materials, extended product shelf life, modified old products for new markets or designed whole new products, eliminated supply instability and improved quality standards.

Asia accounts for nearly 80 percent of the global production of aquaculture products, followed by Europe (10 percent), North America and Caribbean (5 percent), and Russia (3 percent). Of the total aquaculture production, finfish account for 50 percent, seaweeds 25 percent, molluscs 21 percent and crustaceans 4 percent. In view of the soaring world demand for fish, it appears that the natural harvesting techniques would not be able to meet the increasing demand but the biotechnology applications can make positive contribution to improve aquaculture yields.

In the very long run, biotechnology may have a major impact in shifting the production of fuel and bulk chemicals away from reliance on non-renewable resources (e.g. oil) and toward renewable resources (e.g. biomass). This field appears to be limited, in part, because the international price of oil has remained too low to encourage investment in alternatives, and in part, because the chemical industry throughout the world has been restructured during the last 10 years, moving away from bulk chemical production and toward the production of speciality chemicals, pharmaceuticals, and agricultural products.

Several biotechnology applications have been developed in the environment sector, which broadly includes pollution control, crop enhancement, pest control, mining, and microbial enhanced oil recovery.

Biotech is contributing significantly to improve the quality of life. It is also offering many avenues to investors for setting up commercially viable ventures. But the success of biotechnology development in any country depends upon government support and encouragement, science base, capital base, and industrial base. It is therefore essential to ensure that these conditions prevail before biotechnology can render its economic and social rewards.

Piyush Palkhiwala

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