SERIBIOTECHNOLOGY: SCOPE AND IMPORTANCE

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During 1970s, biotechnology emerged as a new discipline, as a result of combination of biological science with technology. It has been possible due to revolutionary discoveries made in these two areas. Biotechnology is not a pure science, but an integrated effort of these two, the root of which lies in biological science. Biotechnology has been defined as,

The development and utilization of biological processes, forms and systems for obtaining maximum benefits to man and other forms of life

Or

Biotechnology is the science of applied biological process

Or

Biotechnology is the application of scientific and engineering principles to the processing of materials by biological agents to provide goods and service

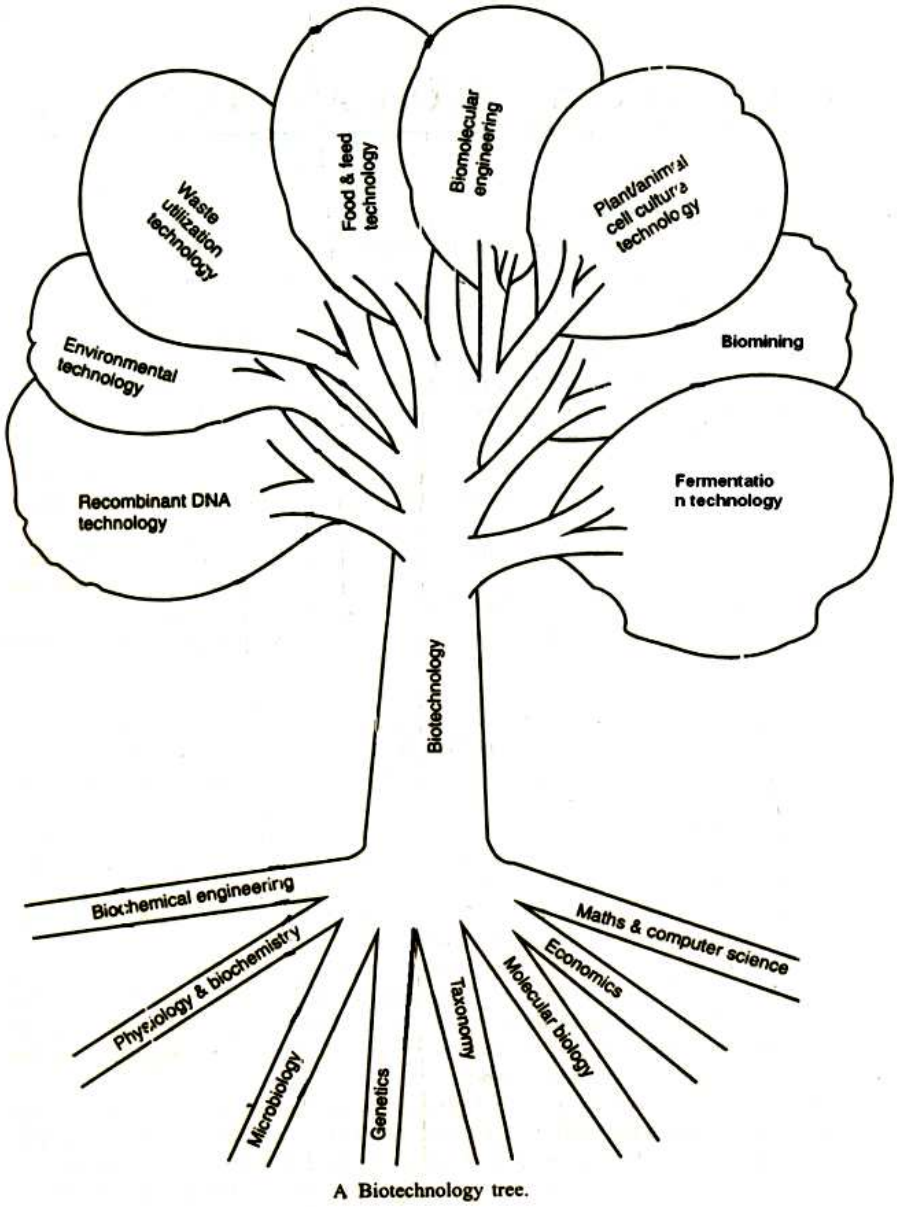
Or

The integrated use of biochemistry, microbiology and engineering sciences in order to achieve technological application of the capabilities of microorganisms, cultured tissue, cells, and parts their of.

The origin of biotechnology is as old as human civilization. *Aryans* started preparing curd and alcohol before 2500 B.C. They used to offer spiritual *soma* to Gods. Who can forget the story of butter-stealing by Lord Krishna during *Mahabharata* period? Since then, the progress made in this direction was very slow until the realization of their significance, and the commercialization of products.

Although involvement of yeasts in alcohol production was known since the time of Louis Pasteur, yet detailed studies were made during 1900. In 1920, for the first time, the Leeds City Council, U.K. established the Institute of Biotechnology. In the late 1960s, OBCD Was set up to promote policies for sound economic growth of the member countries. In 1978, European Federation of Biotechnology was established. Until 1970s, the efforts made by microbiologists, molecular biologists, geneticists, biochemists, medical scientists, biochemical engineers, agriculture scientists, virologists, etc. led to reach their respective disciplines to the zenith.

In the following Biotechnology Tree a schematic view of the different branches of science to form biotechnology and their applications for mankind has been given.



A Biotechnology tree.

BIOTECHNOLOGY FOR CROP IMPROVEMENT

The typical mulberry or any other crop improvement cycle takes 10-15 years to complete and includes germplasm manipulations, genotype selection and stabilization, variety testing, variety increase, proprietary protection and crop production stages. Plant tissue culture and genetic engineering procedures that form the basis of plant biotechnology can contribute to most of these crop improvement stages.

Micropropagation: The technology ensures rapid, true-to-type, disease-free, round-the-year production of plant material. Micropropagation promises multiplication of rare, hard to propagate plants using any plant part whether or not used as propagation material conventionally. Today

micropropagation protocols have been standardized for many ornamental, vegetable, fruit and woody plants by research institutes and private laboratories. Undoubtedly, micropropagation has proven to be a commercially viable method for plant biotechnology in agriculture. The newly developed cultivars can be rapidly multiplied using this technique, thus saving labour, time and energy. Micropropagation basically involves establishment of culture, multiplication of propagules, induction of rooting, hardening and finally the transfer of plantlets from in vitro to in vivo conditions.

Somaclonal and Gametoclonal variation: Traditional genetic manipulation methods have not proven very effective for many breeding objectives. Somaclonal and gametoclonal variation among the callus (mass of undifferentiated cells) derived plant is a potent emerging aspect for broadening the genetic base and, thus, obtaining incremental improvement in the commercial cultivars. Using this technique, several million cells can be screened against various biotic and abiotic stress factors which are highly efficient.

Production of Disease and stress resistant plants: Using dual cultures technique disease and stress resistant plants can be evolved. A culture made of a plant tissue and one organism (such as a nematode) or an obligate parasite/micro-organism (such as a fungus). Dual culture techniques are used for a variety of purposes, including assessing host-parasite interactions, screen the plants against variety of pathogens, *etc*.,

Production of haploids: Haploids are defined as saprophytes with gametophytic chromosome number and have been produced in a variety of plant species using a variety of methods. Although, the significance of haploids in genetics and plant breeding has been recognized for long time, with the advent of biotechnology it received renewed emphasis, so that the production of haploids become an important component of biotechnology programmes.

Embryo culture: Another technique, embryo culture, has given practical approach to obtain interspecific and intergeneric hybrids. Later, these hybrids can be multiplied by vegetative mode of propagation.

Transgenic plants: Transgenic plants are plants that have been genetically engineered, a breeding approach that uses recombinant DNA techniques to create plants with new characteristics. *Eg*., Disease resistance, Pest resistance, Stress resistant *etc*.,

Cell fusion and somatic Hybridization: Development of hybrid plants through the fusion of somatic protoplasts of two different plant species/varieties is called somatic hybridization.

The Seribiotech Research Laboratory [SBRL] was established during 1993 under the World Bank aided National Sericulture Project as per the advice of a high level committee headed by Prof. Lynn Riddiford, University of Washington, USA, to carry out research in the frontier areas of biology for the development of the sericulture industry. The following are the broad mandates of the laboratory:

a. To conduct research in frontier areas of modern biology and to seek potential applications of these work towards improving silk productivity.

b. To interact with other institutions doing basic or applied research in areas related to sericulture and other allied areas.

c. To disseminate technology developed to the target groups through the other R & D bodies of CSB.

Functions: Presently the laboratory is implementing research projects in four main areas as indicated below:

Silkworm Genomics: The focus is on identification of silkworm genes and their functions associated with resistance to viral pathogens, regulation of diapause, regulation of yolk proteins, characterization of RNA dependent RdRp (RNA-dependent RNA polymerase) gene *etc.,*

Host Plant Genomics: The focus is on molecular characterization and identification of various mulberry species and other host plants, development of microsatellites for mulberry *et*c.,

Proteomics: The focus is on identification of immune response proteins and their interactions, and silkworm transcriptome analysis under stress from pests like uzi fly *etc*.

Molecular Pathology: Focus is on identification and molecular characterization of various pathogens like virus, bacteria, microsporidia *etc*. infecting silkworms, diagnosis of pathogens using molecular tools and development of diagnostic tools for the detection of virulent and non-virulent strains of microsporidia.

Silk Biomaterials: Programmes on Silk Biomaterial research have been initiated.

Definitions

1. **Genome:** The complete set of genes or genetic material present in a cell or organism. Or The haploid set of chromosomes in a gamete or microorganism, or in each cell of a multicellular organism.
2. **Genomics:** The study of genes and their function.
3. **Proteome:** The entire complement of proteins that is or can be expressed by a cell, tissue, or organism.
4. **Proteomics:** The study of proteomes and their functions.
5. **Transcriptome:** The complete set of RNA transcripts produced by the genome at any one time.
6. **Transcriptomics:** The study of the transcriptome is termed transcriptomics.
7. **Microsatellites:** A set of short repeated DNA sequences at a particular locus on a chromosome, which vary in number in different individuals and so can be used for genetic fingerprinting.
