

## What is Biotechnology?

The Convention on Biological Diversity (CBD) defines biotechnology as any technological innovation that uses biological systems, living organisms, or derivatives thereof, to make or modify products for specific use.

The Organization for Economic Co-operation and Development, OECD (1999) accepted a working definition of biotechnology as "The application of science and technology to living organisms as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services".

Biotechnology provides a set of tools that, if appropriately integrated with other technologies, can be applied for the sustainable development of agriculture, natural resources, health and pharmaceuticals, industry as well as protection of the environment. The tools used include fermentation, microbial inoculation of plants, plant cell/tissue culture, enzyme technologies, embryo transfer, protoplast fusions, polyclonal or monoclonal antibody technology and recombinant DNA technology (genetic engineering).

The development of biotechnology is divided into three main generations:

- The first generation biotechnology started in 1750 BC and included processes such as fermentation, microbial, natural products and the use of biological control agents against animal and plant diseases and pests. The fermentation process is widely used in industries for production of beverages and medicines. The microbial process is used in agriculture for nitrogen fixation, control of pollution in the environment, bio-mining, biogas production and also in pharmaceutical industries.



- The second-generation biotechnology started in 1863, when Gregor Mendel discovered that pea plants passed on traits from parent to progeny in discrete biological units that would be later known as genes. It also includes tissue culture, polyclonal and monoclonal antibodies, and DNA - markers techniques. Tissue culture is used in agriculture and livestock for rapid multiplication or micro- propagation and production of pathogen free plants, embryo rescue and artificial insemination. Polyclonal and monoclonal antibodies techniques are used in the production of medicines and for vaccine development as well as diagnostic tools for animal and plant diseases. The DNA markers techniques are used in agriculture and livestock for characterization of animal and plant genomes, selection processes, and as a diagnostic tool.
- The third generation of biotechnology is known as "Genetic Engineering (GE)", "recombinant DNA technology", "gene technology" or "modern biotechnology" started in 1972 when scientists pioneered a way of combining biochemistry in a technique that led to the birth of recombinant DNA, a modified DNA molecule created by combining DNA from two unrelated organisms.

The technology allows the transfer of selected genes between different organisms, species, genera and phyla. Once transferred, these genes may be transferred to offspring of the modified individual through normal reproductive processes. Genetic engineering has resulted in the production of Genetically Modified Organisms (GMOs). ***Genetically Modified Organisms (GMOs)*** can therefore, be defined as ***organism in which the genetic material has been altered in a way that it does not occur naturally.***

