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Biotechnologies

The use of biological processes to produce goods and provide services. Biotechnologies involve the use of key techniques developed as a result of joint progress in the fields of biochemistry, chemistry, engineering, genetics, mathematics, microbiology and physics.

Cellular biology

The study, on a cellular level, of biological structures and mechanisms considered not for their specific characteristics, but as the common denominator of all living organisms.

Project ideas

- Organogenesis or the human body on command
- Developing synthetic carrot seeds
- Is it possible to grow blood?
- Cloning plants, animals and humans
- Stem cells for a better quality of life
- Stem cells for greater longevity
- Plant hormones for growing vegetables

Molecular biology

The study of the structure, synthesis and degradation of macromolecules, as well as their metabolic regulation and expression.

Project ideas

- Using daphnia to test the toxicity of various molecules that could be used as medicines
- The use of DNA methylation in gene expression
- Characterizing the mutation of gene P53 in the development of cancer
- In vitro culture
- The resurrection of dinosaurs thanks to DNA
- The stimulation of macrophages using echinacea
- The PERK1 gene favours the growth of *Arabidopsis thaliana*
- Resveratrol and its use in cancer research
- Substitute blood

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Bioprocess

A production process that uses living organisms, parts of these organisms (e.g. certain cells) or products of these organisms (e.g. enzymes).

Project ideas

Improving water quality through biofiltration
 Eliminating polluting phosphates using microorganisms
 Examining the use of glucose in yeast fermentation
 Using plants to desalt water in order to make it drinkable
 Using bacteria to remove heavy metals from contaminated water
 Using biomass to produce ethanol
 Biolixiviation and the mining industry
 Bioremediation using *Rhizobium* to increase the effectiveness of chemical degradation
 Biosorption and bioaccumulation of toxic metals by bacteria
 Biotechnology and fragrances
 Creating a perfume
 Producing electricity using methane resulting from the biodegradation of waste
 Producing immune system regulators
 Producing ethanol from the fermentation of immobilized yeast
 The industrialized production of human hormones (e.g. insulin) using microorganisms
 Biodiesel: a multi-purpose ecological solution
 Photobioreactor: a regenerator of oxygen in the air
 A goat that produces spider silk

Industrial enzymology

The industrial use of enzymes produced thanks to accumulated knowledge in microbiology or genetic engineering.

Project ideas

The use of chymosin in cheese production

Enzyme engineering

Processes that make it possible to use the catalytic properties of enzymes.

Project ideas

Using enzymes to whiten papermaking pulp
 Detecting food-borne pathogens using PCR
 Developing a glue using organic substances
 Biocaptors

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Genetic engineering

The science that deals with the manipulation of genes in living organism.

Project ideas

Should we worry about GMOs?

The effect of genetically engineered plants on agriculture, food and science

Creating a genetically modified plant

Modifying plants so that they can grow in the desert

Phage therapy: what are phages and how are they used?

Helping farmers decide whether or not to choose genetically modified rapeseed

Gene transfer in plants

Are Frankenfoods good or bad for our health?

Genetically modified foods

Risks of permutation with DNA manipulation

Are hybrid plants harmful?

Genomics

The study of whole sets of genes of a living organism and their function.

Project ideas

The rapid identification of biological pathogens through DNA amplification (PCR)

Designing a DNA chip to detect viral DNA

The prenatal detection of genetic disorders

Biotechnologies used in the areas of justice and immigration

Microbiology

Science that studies microscopic microorganisms (e.g. bacteria, viruses) and their functions.

Project ideas

The study of the Pasteur effect on yeast fermentation

Using *Escherichia coli* bacteria to detect pollutants

Biolixiviation in the mining industry

Biosorption and bioaccumulation of toxic metals by bacteria

Beer production

Cheese production

Bioterrorism

Treating waste water using microorganisms

Bacteriophages

Bleaching fungus and the paper industry

Biological wars (biopesticides)

Probiotics and animal health

Antibacterial and antifungal properties of natural products (e.g. Aloe)

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Proteomics

The study of protein interactions in organisms for which genomes are known.

Project ideas

Studying XYZ proteins in metabolic pathway A

The proteome in brewer's yeast

Gene therapy

An alternative approach to treating a genetic disease by inserting or integrating new functional genes into an unhealthy organism.

Project ideas

Gene therapy—a revolutionary approach