

Biotechnology and Genetics Engineering

The logo of Galgotias University is a stylized, circular emblem. It features a central blue swirl that transitions into a yellow and orange swirl, all set against a light pinkish-red background. The overall shape is reminiscent of a globe or a dynamic, swirling motion.

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Disclaimer

All the content material provided here is only for teaching purpose.

The logo of Galgotias University is a stylized circular emblem. It features a large, light-colored outer ring. Inside this ring, there are three curved, overlapping bands in shades of yellow, light blue, and light pink, creating a sense of motion or a spiral. The overall design is clean and modern.

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What Is Biotechnology?

- Using scientific methods with organisms to produce new products or new forms of organisms
- Any technique that uses living organisms or substances from those organisms to make or modify a product, to improve plants or animals, or to develop microorganisms for specific uses

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What Is Biotechnology?

- GMO- genetically modified organisms.
- GEO- genetically enhanced organisms.
- With both, the natural genetic material of the organism has been altered.
- Roots in bread making, wine brewing, cheese and yogurt fermentation, and classical plant and animal breeding

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What Is Biotechnology?

- Manipulation of genes is called genetic engineering or recombinant DNA technology
- Genetic engineering involves taking one or more genes from a location in one organism and either
 - Transferring them to another organism
 - Putting them back into the original organism in different combinations

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What is the career outlook in biotechnology?

- Biotech in 1998
 - 1,300 companies in the US
 - 2/3 have less than 135 employees
 - 140,000 jobs
- Jobs will continue to increase exponentially
- Jobs are available to high school graduates through PhD's

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What Subjects Are Involved With Biotechnology?

- Multidisciplinary- involving a number of disciplines that are coordinated for a desired outcome
- Science
 - Life sciences
 - Physical sciences
 - Social sciences

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What Subjects Are Involved With Biotechnology?

- Mathematics
- Applied sciences
 - Computer applications
 - Engineering
 - Agriculture



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What Are the Stages of Biotechnology Development

- Ancient biotechnology- early history as related to food and shelter; Includes domestication
- Classical biotechnology- built on ancient biotechnology; Fermentation promoted food production, and medicine
- Modern biotechnology- manipulates genetic information in organism; Genetic engineering

What Are the Areas of Biotechnology?

- Organismic biotechnology- uses intact organisms; Does not alter genetic material
- Molecular biotechnology- alters genetic makeup to achieve specific goals
 - Transgenic organism- an organism with artificially altered genetic material

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What Are the Benefits of Biotechnology?

- Medicine
 - Human
 - Veterinary
 - Biopharming
- Environment
- Agriculture
- Food products
- Industry and manufacturing

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What Did These Individuals Contribute to Biotechnology?

- Anton van Leeuwenhoek
- Discovered cells
 - Bacteria
 - Protists
 - Red blood



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What Did These Individuals Contribute to Biotechnology?

- Gregor Johan Mendel
- Discovered genetics



What Did These Individuals Contribute to Biotechnology?

- Walter Sutton
- Discovered Chromosomes



What Did These Individuals Contribute to Biotechnology?

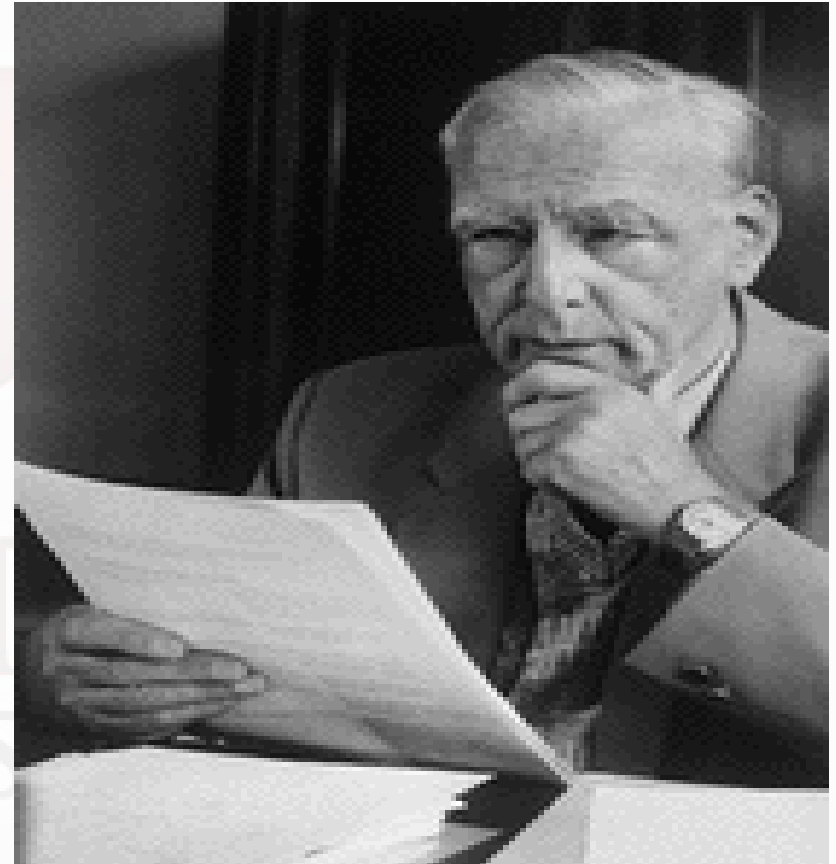
- Thomas Hunt Morgan
- Discovered how genes are transmitted through chromosomes



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What Did These Individuals Contribute to Biotechnology?

- Ernst Ruska
- Invented the electron microscope



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What Did These Individuals Contribute to Biotechnology?

- Sir Alexander Fleming
- Discovered penicillin



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What Did These Individuals Contribute to Biotechnology?

- Rosalind Elsie Franklin
- Research led to the discovery of the double helix structure of DNA



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What Did These Individuals Contribute to Biotechnology?

- James Watson and Francis Crick
- Discovered DNA



What Did These Individuals Contribute to Biotechnology?

- Mary-Claire King
- Mapped human genes for research of cancer treatments



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What Did These Individuals Contribute to Biotechnology?

- Ian Wilmut
- Created the first true clone, the Dorset ewe Dolly



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What Is Molecular Biology?

- Molecular biology- study of molecules in cells
- Metabolism- processes by which organisms use nutrients
- Anabolism- building tissues from smaller materials
- Catabolism- breaking down materials into smaller components

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What Is a Cell?

- Cell- a discrete unit of life
- Unicellular organism- organism of one cell
- Multicellular organism- organism of many cells
- Prokaryote- cells that lack specific nucleus
- Eukaryote- cells with well-defined nucleus

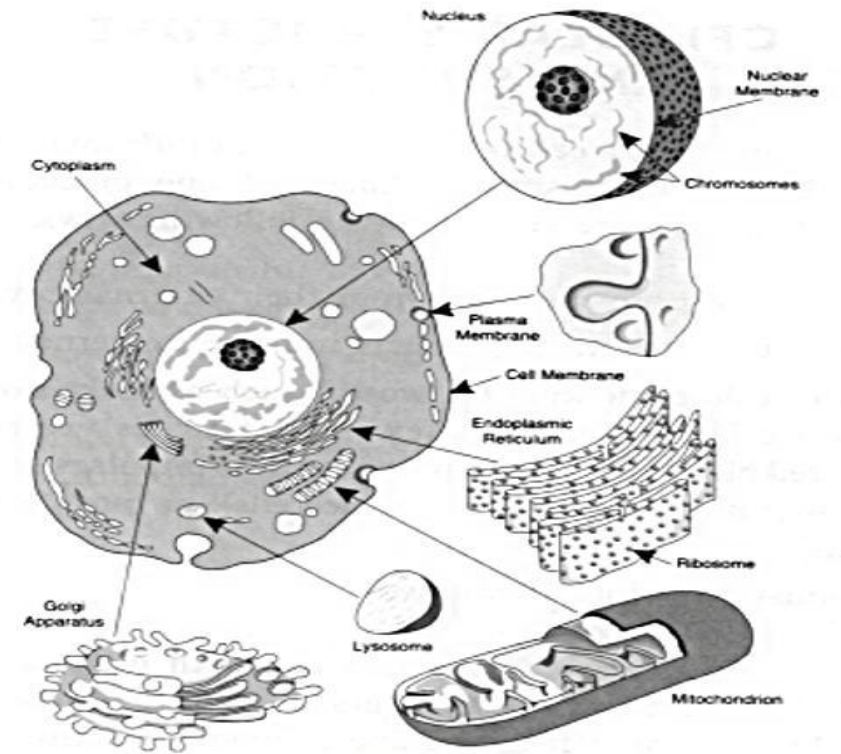


Figure 1-3. Cellular parts.

What Is a Cell?

- Cells are building blocks:
 - Tissue- collection of cells with specific functions
 - Organs- collections of tissues with specific functions
 - Organ systems- collections of organs with specific functions

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What Are the Structures in Molecular Genetics?

- Molecular genetics- study of genes and how they are expressed
- Chromosome- part of cell nucleus that contains heredity information and promotes protein synthesis
- Gene- basic unit of heredity on a chromosome
- DNA- molecule in a chromosome that codes genetic information

What Is Ribonucleic Acid (RNA)?

- Transcription- process of RNA production by DNA
- DNA-thread-like molecule which decodes DNA information

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What Is Ribonucleic Acid (RNA)?

- Kinds of RNA:
 - mRNA- RNA molecules that carry information that specifies amino acid sequence of a protein molecule during translation
 - rRNA- RNA molecules that form the ribosomal subunits; Mediate the translation of mRNA into proteins
 - tRNA- molecules that decode sequence information in and mRNA
 - snRNA- very short RNA that interconnects with to promote formation of mRNA

What Are Genetic Engineering Organisms?

- Genetic engineering- artificially changing the genetic information in the cells of organisms
- Transgenic- an organism that has been genetically modified
- GMO- a genetically modified organism
- GEO- a genetically enhanced organism

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How Can Genetically Engineered Plants Be Used?

- Agriculture
- Horticulture
- Forestry
- Environment
- Food Quality



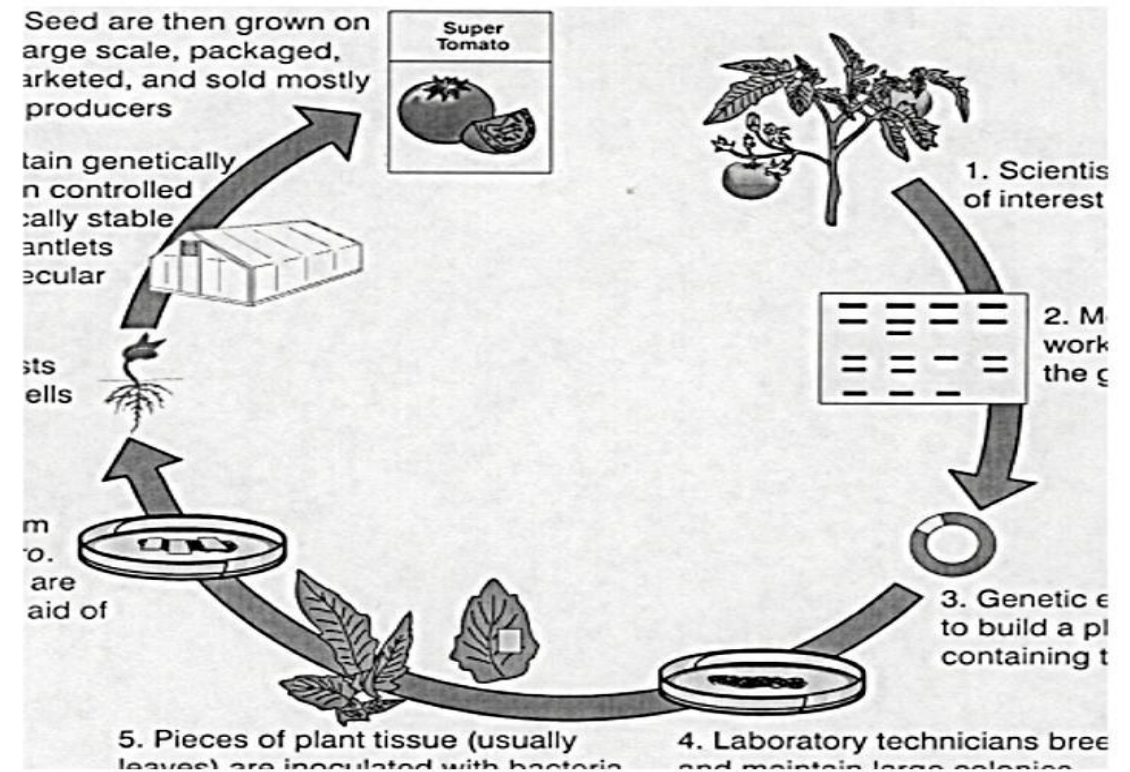
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How Do We Create Transgenic Organisms?

- Donor cell- cell that provides DNA
- Recipient cell- cell that receives DNA
- Protocol- procedure for a scientific process
- Three methods used in gene transfer
 - Agrobacterium gene transfer- plasmid
 - Ballistic gene transfer- gene gun
 - Direct gene transfer- enzymes

How Does Agrobacterium Gene Transfer Work?

1. Extract DNA from donor
2. Cut DNA into fragments
3. Sort DNA fragments
4. Recombine DNA fragments
5. Transfer plasmids with bonded DNA
6. Grow transformed (recipient) cells



What Are Methods of Classical Biotechnology?

- Plant breeding- improvement of plants by breeding selected individuals to achieve desired goals
- Cultivar- a cultivated crop variety

What Are Methods of Classical Biotechnology?

- Plant breeding methods;
 - Line breeding- breeding successive generations of plants among themselves
 - Crossbreeding- breeding plants of different varieties or species
 - Hybridization- breeding individuals from two distinctly different varieties
- Selection

Why Are Plants Genetically Engineered?

- Resist pests
- Resist herbicides
- Improved product quality
- Pharmaceuticals
- Industrial products

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What Is Cloning?

- Clone- new organism that has been produced asexually from a single parent
- Genotype is identical to parent
- Cells or tissues are cultured