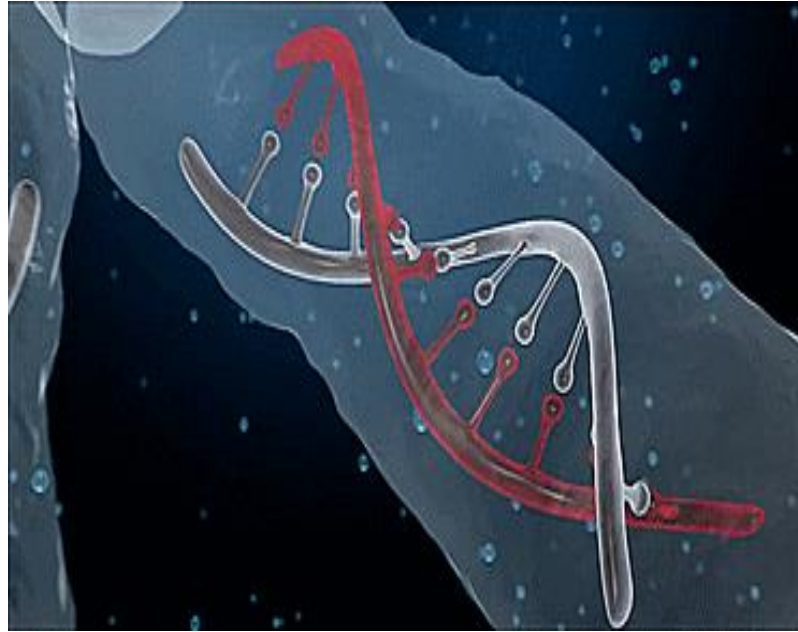


Introduction of Biotechnology



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Definition

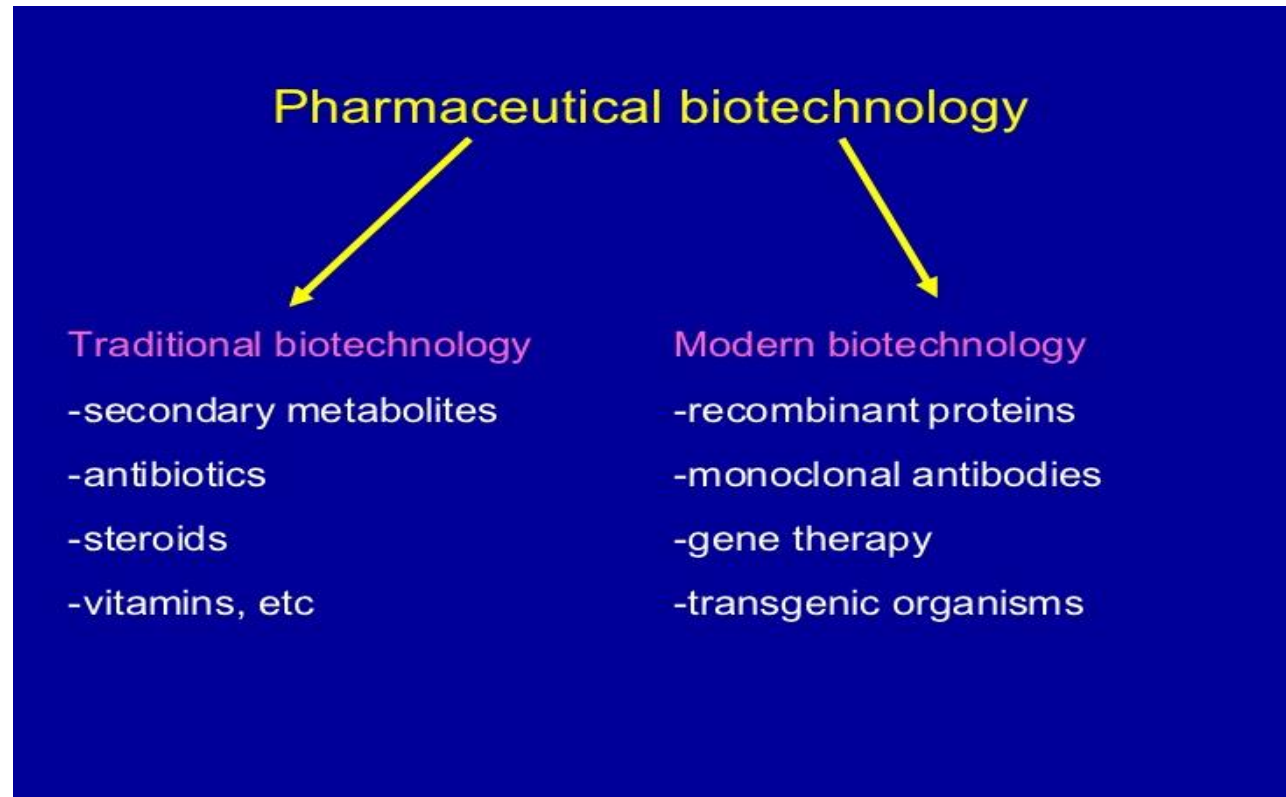
Biotechnology is the **use of living systems and organisms to develop or make useful products**, or "any technological application that uses biological systems, living organisms or derivatives there of, to make or modify products or processes for specific use"

European Federation of Biotechnology (EFB) has defined biotechnology as "The integration of natural science and organisms, cells, parts thereof, and molecular analogues for products and services".

European Association of Pharma Biotechnology (EAPB), **pharmaceutical biotechnology** is defined as a science covering all technologies required for the production, manufacturing, and registration of biotechnological drugs

➤ Pharmaceutical biotechnology is a relatively new and growing field in which the principles of biotechnology are applied to the development of drugs.

➤ A majority of therapeutic drugs in the current market are **bioformulation, such as antibodies, nucleic acid products and vaccines.**





Oldest form of biotechnology



**Making breads and curds
with the help of micro
organisms.**



Application of fermentation in production of wine and other alcoholic beverages is also a biotechnological technique



Year	Historic event
1797	Jenner inoculates child with viral vaccine to protect him from smallpox
1857	Pasteur proposes that microbes cause fermentation
1928	Penicillin is discovered by Fleming
1944	A very proves DNA as carrier of genetic information Waksman isolates streptomycin as antibiotic for tuberculosis
1953	Structure elucidation of double helix of DNA
1967	First protein sequencer is perfected
1970	Discovery of restriction enzymes
1973	Cohen and Boyer produce first recombinant DNA in bacteria with restriction enzymes and ligases
1977	First expression of human protein in bacteria
1980	US Patent for gene cloning to Cohen and Boyer
1981	First transgenic animal
1982	Humulin as first recombinant biotech drug approved by FDA

Year	Historic event
1983	Invention of Polymerase Chain Reaction (PCR)
1986	First recombinant vaccine for Hepatitis B
1988	First US Patent for genetically modified mouse
1990	<p>Launching of the Human Genome Project</p> <p>First somatic gene therapy to cure ADA-SCID</p> <p>First transgenic cow produces human proteins in milk</p>
1994	Approval of DNAse for cystic fibrosis
1997	First animal cloned from adult cell (Dolly)
2000	Rough draft of the human genome is announced
2002	<p>Draft version of the complete map of the human genome is published</p> <p>First oligonucleotide drug is approved by FDA</p>

COMMON PHARMACEUTICAL BIOTECHNOLOGICAL PRODUCT

The common pharmaceutical biotechnology products that are made by the biotech pharmaceutical companies includes:

- *Antibodies**
- *Proteins**
- *Recombinant DNA Products.**

ANTIBODIES

Antibodies: Antibodies are proteins that are produced by white blood cells and are used by the immune system to identify bacteria, viruses, and other foreign substances and to fight them off. In the recent years, monoclonal antibodies are one of the most exciting developments in biotechnology pharmaceuticals.

Example:

Actinin Alpha monoclonal Antibodies,

Actin smooth muscle monoclonal antibodies e.t.c

PROTEINS

Proteins: Proteins made of amino acids are large, complex molecules that do most of the work in cells and are required for the structure, function, and regulation of the body's tissues and organs. Protein biotechnology is emerging as one of the key technologies of the future for understanding the development of many diseases like cancer or amyloid formation for better therapeutic intervention.

RECOMBINANT DNA PRODUCT

Recombinant DNA Products: is the genetically **engineered DNA created by recombining fragments of DNA from different organisms.** Some of the

Recombinant DNA Products includes:

*Recombinant DNA Vaccines

*Recombinant DNA Drugs

*Recombinant DNA Enzymes

Recombinant DNA Growth Hormone

*Recombinant DNA Insulin

*Recombinant DNA Yeast

*Recombinant DNA Proteins

RECOMBINANT DNA VACCINE

A recombinant vaccine is a **vaccine produced through recombinant DNA technology**. This involves inserting the DNA encoding an antigen (such as a bacterial surface protein) that stimulates an immune response into bacterial or mammalian cells, expressing the antigen in these cells **and then purifying it from them**.

Example

Hepatitis B infection is controlled through the use of a recombinant hepatitis B vaccine.

RECOMBINANT DNA DRUGS

Name of Drug	What Human Protein is Formulated As The Drug	Pharmacodynamics of the Drug
1. Humulin Chart comparing Time Activity	rInsulin [FDA approval 1982]	Diabetes: Used by over 3.5 million people in the U.S. every day
2. Humatrope	rHuman growth hormone (hGH) (Somatropin) [FDA approval 8/96]	For Somatropin Deficiency Syndrome (SDS) in adults and GHD in children
4. Forteo	rParathyroid hormone, [FDA Approval Nov 26, 2002]	Treatment of osteoporosis in women and men

RECOMBINANT DNA PRODUCTS

R-DNA PRODUCT	EXAMPLE	FUNTION
R-DNA ENZYME	CHYMOSINE	Essential to the manufacture of firm cheeses
R-DNA GROWTH HORMONE	PROTROPIN	Support growth and development
R-DNA INSULIN	HUMULIN	For the treatment of insulin-dependent <u>diabetes</u>
R-DNA PROTEIN	TISSUE PLASMINOGEN ACTIVATOR	Involved in the breakdown of blood <u>clots</u>

Applications of Biotechnology

1. Insulin (a hormone used to control diabetes) is produced in bacteria
2. Erythropoietin (used to treat anemia by stimulating red blood cell production)
3. Human growth hormone (somatotropin; used to treat growth deficiencies)
4. Factor VIII (used to treat hemophilia);
5. Interferons (used against certain cancers and viral infections)
6. Interleukin-2 (used as an immune enhancer and in adoptive immunotherapy)
7. Tissue plasminogen activator (dissolves blood clots)
8. Epidermal growth factor (help heal wounds, burns, and ulcers)
9. Pro-urokinase (an anticoagulant used to treat heart attack)
10. Vaccine production.

Thank You