**Medical Biotechnology**  
  
  
Medical biotechnology is a combination of different science – oriented subjects, namely Cell Biology, Genetics, Nanotechnology, Bioinformatics, etc., to carry out advancements in the field of medicine. It makes use of recombinant DNA technology in different therapeutic forms.  
  
In Medical Biotechnology, one learns how diseases affect human body at the cellular level. Its aim is prevention and treatment of the disorders, thereby increasing the lifespan of an individual.   
  
  
**History of Medical Biotechnology**  
Biotechnology has been applied in the medical science for hundreds of years with mankind’s revelation that diseases can be cured from living organisms by using their products.  
  
**2,500 years ago** - First antibiotic: moldy soybean curds used to treat boils (China).   
  
Script q (The Chinese first used antibiotics about 2,500 years ago. Back then, they realised that the fungus that grew on soybean curd could cure boils. This ancient wisdom was also known to the healers of Egypt and Mesopotamia, even earlier. The fungus was making a chemical (streptomycin), one of the first antibiotics. If you ate this antibiotic, it killed the bacteria that caused the boils.)  
  
**1928** - Scottish bacteriologist Alexander Fleming discovers penicillin, the first true antibiotic  
  
Script (Antibiotics are compounds produced by bacteria and fungi which are capable of killing, or inhibiting, competing microbial species. This phenomenon has long been known; it may explain why the ancient Egyptians had the practice of applying a poultice of moldy bread to infected wounds. But it was not until 1928 that penicillin, the first true antibiotic, was discovered by Alexander Fleming, Professor of Bacteriology at St. Mary's Hospital in London.)

**1944** - Waksman isolates streptomycin, an effective antibiotic for tuberculosis.  
  
Script (In 1943, Albert Schatz, a Waksman student, isolated streptomycin. In 1944, clinical trials demonstrated the drug's effectiveness against gram-negative bacteria including Mycobacterium tuberculosis. Despite substantial problems with toxicity and drug resistance, streptomycin soon formed the foundation of multidrug therapies for TB. With the introduction and use of antibiotics, mortality of TB was reduced drastically.)

**1967** - Dr. Maurice Hilleman develops the first American vaccine for mumps.  
  
Script (Maurice Hilleman was responsible for developing more than 40 vaccines, including measles, mumps, hepatitis A, hepatitis B, meningitis, pneumonia, Haemophilus influenza bacteria, and rubella. His vaccines have been credited with saving millions of lives and with eradicating common childhood diseases)

**1973** - Dr. Stanley Cohen and Dr. Herbert Boyer use bacterial genes to perform the first successful recombinant DNA experiment.  
  
Script ( it is a technique which inserted a recombinant DNA molecule into a cell for replication. Dr. Edwin Southern develops a blotting technique for DNA called the Southern blot. It becomes a seminal technology for studying the structure of DNA.)  
  
1978 – The discovery of human insulin  
  
Script (Dr. Herbert Boyer of the University of California, San Francisco, constructs a synthetic version of the human insulin gene and inserts it into the bacterium E coli, allowing the bacterium to produce human insulin.)  
  
  
**Describe the Pros and Cons of Medical Biotechnology**  
  
It is easy to see how biotechnology can be used for medicinal purposes. Knowledge of the genetic makeup of our species, the genetic basis of heritable diseases, and the invention of technology to manipulate and fix mutant genes provides methods to treat the disease.  
  
Here are some of the Pros of Medical Biotechnology

* Development of tailor-made medicines. Using pharmacogenomics, pharmaceutical companies can create drugs based on the proteins, enzymes, and RNA molecules that are associated with specific genes and diseases.   
    
  Script (These tailor-made drugs promise not only to maximize therapeutic effects, but also to decrease damage to nearby healthy cells.)
* More accurate methods of determining appropriate drug dosages. Knowing a patient’s genetics will enable doctors to determine how well the patient’s body can process and metabolize a medicine.   
    
  Script (This will maximize the value of the medicine and decrease the likelihood of overdose.)
* Improvements in the drug discovery and approval process. The discovery of potential therapies will be made easier using genome targets.   
    
  Script (Genes have been associated with numerous diseases and disorders. With modern biotechnology, these genes can be used as targets for the development of effective new therapies, which could significantly shorten the drug discovery process.)
* Better vaccines. Safer vaccines can be designed and produced by organisms transformed by means of genetic engineering. These vaccines will elicit the immune response without the attendant risks of infection.   
    
  Script (They will be inexpensive, stable, easy to store, and capable of being engineered to carry several strains of pathogen at once.)

Here are some of the Cons of Medical Biotechnology

* Risk to Human Life in Clinical Trials - A huge risk of medical biotechnology is its impact during clinical trials. Because it’s such new tech, people can and have gotten hurt—and even died—during trials of the technology.  
    
  Script (Because of these risks, extensive research should be performed before even thinking of introducing tech to human subjects, and those who are participating in a trial should be extremely aware of any and all possibilities.)
* High Cost May Exclude the Poor - While medical biotechnology has huge potential to make medicine more efficient and easy, what’s the cost? This technology is often hugely expensive compared to traditional treatments.  
    
  Script (There is an ongoing give and take about finding new medical advancements and the cost it takes to do research and then market the findings for purchase. There is also the concern that high costs of tech treatments can exclude an entire class of people from being able to utilize them. This is also a huge give and take, with science and medicine having a responsibility to help all patients—not just those who are wealthy enough to buy the best care.)
* Bioterrorism is a National Concern - Medical biotechnology has been used for security measures to help prevent a large number of people from possible bioterrorism. But the development of these projects takes away funding and time from curing known diseases.  
    
  Script (It becomes a real question of how to divide resources among projects and knowing where the resources are most needed. It’s difficult because we don’t know if people will die from bioterrorism but with so many people being concerned, it seems like a worthwhile place to spend time and money.)  
    
  **Describe some of the application areas of Medical Biotechnology.**

**Stem cell research**: Biotechnology plays a big part in supporting stem cell research, which supports the exploration of growing stem cells in a lab setting or in vitro. This could help in situations where patients may be suffering from a disease or disorder where implanting stem cells could help restore their vitality and give them a new lease on life.  
  
Script (How does it work? Because stem cells can repeatedly divide and transform into other types of body cells, biotechnologists can learn how to work with their unique profiles to encourage growth of specific types of cells. Though research is ongoing, it’s reported that the results show hope for the future of this unique medical approach.)

EXAMPLE:

* Heart tissue regeneration: Researchers are testing the use of iPSC (induced pluripotent stem cells)-derived cells to regenerate damaged heart tissue in patients who have had heart attacks. These cells can differentiate into heart muscle cells and replace the damaged tissue, potentially improving heart function.

**Vaccine development**: Medical biotechnology plays a critical role in the development of new vaccines and the production of existing ones. This includes the use of recombinant DNA technology to produce vaccine antigens, as well as the development of novel adjuvants and delivery systems.

EXAMPLES:

* HPV vaccine: This vaccine was developed using recombinant DNA technology to produce virus-like particles that resemble the outer shell of the HPV virus. These particles stimulate an immune response that can protect against HPV infection and cervical cancer.  
    
  Script (You’ve probably heard of the Human Papilloma Virus (HPV) and how it’s linked to cervical cancer—which is the second most lethal form of cancer for women, next to breast cancer. Statistics show that cervical cancer kills 275,000 women annually, which is why a vaccine for HPV is so important.)
* COVID-19 vaccines: The Moderna and Pfizer-BioNTech COVID-19 vaccines use mRNA technology to deliver instructions to cells to produce a spike protein found on the surface of the virus. This stimulates an immune response that can protect against COVID-19.

**Drug development:** Medical biotechnology is used extensively in the development of new drugs and therapies. This includes the identification and purification of therapeutic proteins, the development of recombinant DNA technology for the production of drugs, and the use of gene therapy to deliver therapeutic genes to patients.

EXAMPLES:

* Insulin: Recombinant DNA technology is used to produce human insulin in large quantities. Before this technology became available, insulin was extracted from the pancreases of pigs and cows, which could cause allergic reactions in some patients. Recombinant insulin is identical to human insulin and is less likely to cause adverse reactions.

**CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats):** CRISPR technology or CRISPR-Cas9 utilizes a protein called Cas9, which acts like a pair of molecular scissors and can cut DNA. CRISPRs are specialized stretches of DNA and are used in medical biotechnology as a tool to edit genomes.

EXAMPLE:

* **Genome Editing** - uses a different approach to correct genetic differences. Instead of introducing new genetic material into cells, genome editing introduces molecular tools to change the existing DNA in the cell.

Script ( Bago pala siya tawaging Genome Editing, ang unang tawag sa kanya eh Gene Therapy. Sa Gene therapy techniques allow doctors to treat a disorder by altering a person’s genetic makeup by introducing new genetic material sa cell, And siyempre as further the study goes, mas nag maraming nadadagdag and explore hanggang sa mas upgraded na siya and tinawag na Genome Editing. And yung mga study about sa genome editing eh

* Fix a genetic alteration underlying a disorder, so the gene can function properly.
* Turn on a gene to help fight a disease.
* Turn off a gene that is functioning improperly.
* Remove a piece of DNA that is impairing gene function and causing disease.)  
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
    
  reference:   
    
  <https://www.biotecnika.org/2019/11/career-in-medical-biotechnology-what-is-medical-biotechnology/>   
    
  <http://biotka.mol.uj.edu.pl/zbm/handouts/2015/JD/01_Medical_biotechnology_2015.pdf>   
    
  <https://www.biotechnology.amgen.com/timeline.html#1970s>

[https://bio.libretexts.org/Bookshelves/Introductory\_and\_General\_Biology/Book%3A\_General\_B iology\_(Boundless)/17%3A\_Biotechnology\_and\_Genomics/17.01%3A\_Biotechnology/17.1G%3A\_Biotechnology\_in\_Medicine](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/17%3A_Biotechnology_and_Genomics/17.01%3A_Biotechnology/17.1G%3A_Biotechnology_in_Medicine)   
  
<https://www.wgu.edu/blog/medical-biotechnology-advancements-ethics1811.html>   
  
<https://www.techtarget.com/whatis/definition/biotechnology?fbclid=IwAR1C8mqrjGHd9uo_bAqwidsAd6cgL2JhQFfTpD87JXv73hrabe7gyzDgsT0>

<https://medlineplus.gov/genetics/understanding/therapy/genetherapy/#:~:text=Gene%20therapy%20is%20a%20medical,of%20using%20drugs%20or%20surgery>