



Biotechnology

Definition:

Biotechnology is a branch of biology that utilizes living organisms to develop products and processes that enhance various aspects of human life.



Related SLO

Students' Learning Outcomes

Define biotechnology as the use of living cells and organisms in products and processes that can improve the quality of life.

Exercise based Question

1. What is biotechnology?

Q: How biotechnology has improved the quality of life?

Biotechnology has played a revolutionary role in improving the quality of life. This field supports biological systems, cellular mechanisms, and genetic engineering to create advancements in areas such as healthcare, agriculture, and environmental management.



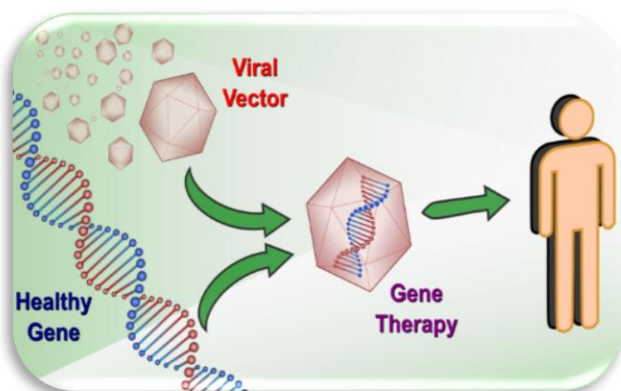


Applications of Biotechnology

Biotechnology has wide range of applications in the field of medicine, agriculture, industry, food and environment.

Medical field: Biotechnology has brought revolution in the field of health through:

- **Gene Therapies:** Used to treat genetic disorders by correcting defective genes.
- **Vaccines:** Development of vaccines to prevent diseases.
- **Diagnostic Tools:** Tools to identify the root cause of diseases.
- **Medicine Production:** Production of medicines to fight against diseases, such as:
 - Insulin
 - Growth hormones
 - Vaccines
 - Interferon (anti-viral proteins)
 - Beta endorphin (pain killer)



Short Question

Write the applications of biotechnology in Health:

Biotechnology is used to:

- Cure diseases.
- Improve health.

For example insulin, vaccines and many other lifesaving products are formed by the use of biotechnology.

Exercise based Question

2. Name at least two lifesaving products of biotechnology.
3. Investigate how the biotechnology has brought revolution in the field of health.

Short Question

Q: For what purpose insulin is used?

Insulin is used for diabetic patients.





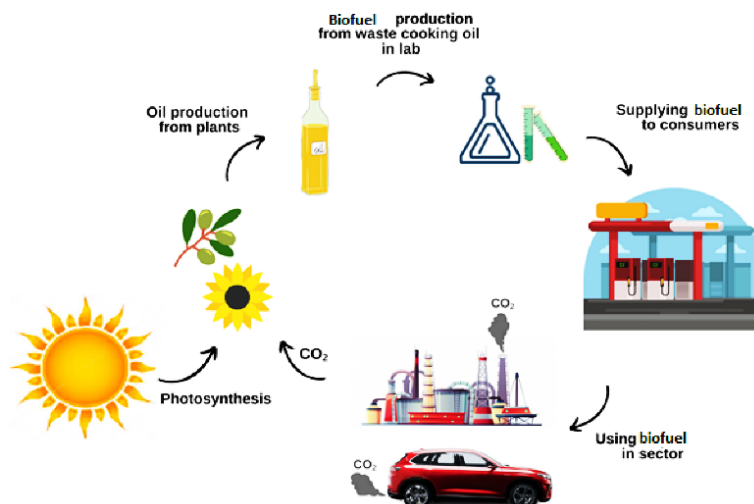
Agricultural field:

- **Crop Yields:** Improving crop yields through genetic modification and selective breeding.
- **Pest and Disease Resistance:** Enhancing resistance to pests and diseases.
- **Nutritional Content:** Improving the nutritional content of crops.



Industrial field:

- **Bio Plastics:** Production of environmentally friendly plastics.
- **Biofuels:** Developing sustainable biofuels.
- **Enzymes and Medicines:** Production of enzymes and medicines in pharmaceutical industries



Exercise based Question

Write the applications of biotechnology in:

Agriculture:

In agriculture, biotechnology is used to:

- Improve the yield of crops.
- Make them safe for human use.
- Kill insects and weeds.

Short Question

Why genetically modified crops are better?

Genetically modified crops are better because:

- They have better yield production.
- They are resistant to pests and weeds.
- They produce nutritious food.



Food industry:

- **Food Production:** Enhancing food production through biotechnology.
- **Food Quality and Safety:** Improving the quality and safety of food.
- **Sustainability:** Contributing to the sustainability of food production.
- **Genetic Modification:** Developing crops with improved traits, such as pest resistance, and enhancing the nutritional profile of food crops.

Exercise based Question

Q: How biotechnology help in better food production?

- Use of better quality genes in the animals is producing high yields of milk and meat.
- Production of better quality fruits, vegetables and their increased shelf lives are also the result biotechnology.



Exercise based Question

Q: Write the applications of biotechnology in:

Food production:

Biotechnology is used for:

- Better production food quality of fruits and vegetables.
- Production of disease resistant plants.
- Production of nutritious food.



Environmental biotechnology:



Exercise based Question

How biotechnology improves our environment?

Genetically modified bacteria are used to treat sewage and refuse. They may also be used to clear spilled oil. Microbes which are used as bio-pesticides, bio-fertilizers, biosensors etc are being developed using biotechnological techniques.

- **Pollution Control:** Offering innovative solutions for pollution control through bioremediation.
- **Waste Management:** Improving waste management techniques.
- **Conservation:** Contributing to conservation efforts.

Q: Find out which biotechnological products you are using in your daily life?

Following biotechnological products are used in our life:

1. Insulin	2. Vaccine
3. Cheese production	4. Alcoholic drinks
5. Growth hormone	6. Beta-endorphin
7. interferon	8.

**Multiple choice questions**

1. Which of the following is an antiviral protein?

- a. Capsid b. Interferon c. Insulin d. Vaccine

Explanation: Interferons are proteins made and released by host cells in response to the presence of pathogens, such as viruses. They help to inhibit viral replication within host cells, activate immune cells, and increase host defenses.

2. In the poor countries of South Asia, which crop is the main food of rural population?

- a. Maize b. Rice c. Wheat d. Potato

Explanation: Rice is the staple food for a large portion of the population in South Asia, especially in rural areas. It is a major source of calories and nutrition for millions of people in countries like India, Bangladesh, and Pakistan.

3. Drought and excessive _____ in soil also have harmful effects on crop productivity.

- a. Water b. Minerals c. Salts d. Insects.

Explanation: Excessive salts in the soil, a condition known as soil salinization, can lead to poor water absorption by plants, inhibit growth, and reduce crop yields. This is a significant problem in many arid and semi-arid regions.

4. A gene is identified in weed plant which enables the plant to show tolerance to:

- a. salts b. drought c. heat d. all of these

Explanation: Certain weed plants have developed genes that confer tolerance to various stress factors such as salts, drought, and heat, allowing them to survive in adverse environmental conditions. Genetic modifications can incorporate these traits into crops for better resilience.



5. Which crop has been modified?

- a. Cotton b. Pea c. Onion d. Millet

Explanation: Cotton is one of the major crops that has been genetically modified, primarily to increase resistance to pests and reduce the need for chemical pesticides. Bt cotton is a well-known example of a genetically modified cotton variety.

6. Which vaccines of diseases have been developed using biotechnological techniques?

- a. Typhoid and malaria b. **Hepatitis B and Typhoid** c. Hepatitis C and Malaria d. HIV and Hepatitis C

Explanation: Both Hepatitis B and Typhoid vaccines have been developed using advanced biotechnological techniques. These techniques include genetic engineering, recombinant DNA technology, and mRNA technology.

7. Which branch has improved the quality of life?

- a. Botany b. Anatomy c. Biotechnology d. Zoology

Explanation: Biotechnology has had a significant impact on improving the quality of life through advancements in medicine, agriculture, and environmental protection.

8. What is the primary goal of gene therapy?

- a. To replace defective genes b. To enhance athletic performance c. To create new food sources d. To improve energy efficiency

Explanation: Gene therapy aims to correct or replace faulty genes responsible for diseases, thereby treating or potentially curing genetic disorders.



9. Which of the following is a common application of biotechnology in agriculture?

- a. Developing new mining techniques
- b. Genetic modification of crops
- c. Manufacturing of steel
- d. Space exploration

Explanation: Biotechnology is widely used in agriculture to create genetically modified crops that can resist pests, tolerate harsh conditions, or have improved nutritional profiles

10. Beta-endorphin is used as:

- a. Pain killer
- b. For diabetes
- c. For growth
- d. To kill virus

Explanation: Beta-endorphins are natural peptides in the body that act as painkillers

11. Herbicides and pesticides are used to:

- a. Cultivate crops
- b. Grow crops
- c. Eliminate crop enemies
- d. Modify crops

Explanation: Herbicides are used to control unwanted plants (weeds) that compete with crops for nutrients, while pesticides target insects and other pests that can harm crops. They do not cultivate, grow, or modify crops.

12. Which of the following is used in additive foods and some medicines?

- a. Vitamin A
- b. Vitamin B 12
- c. Vitamin C
- d. Vitamin D

Explanation: Vitamin B12 is often added to foods and supplements to prevent deficiencies.

13. It is useful for stimulating growth:

- a. Vaccine
- b. Interferon
- c. Beta endorphin
- d. Growth hormone



Explanation: Growth hormone is specifically used to stimulate growth and development in children with growth deficiencies