Concept of Biotechnology

Dr. Rupesh B. Yadav

Asst. Prof.

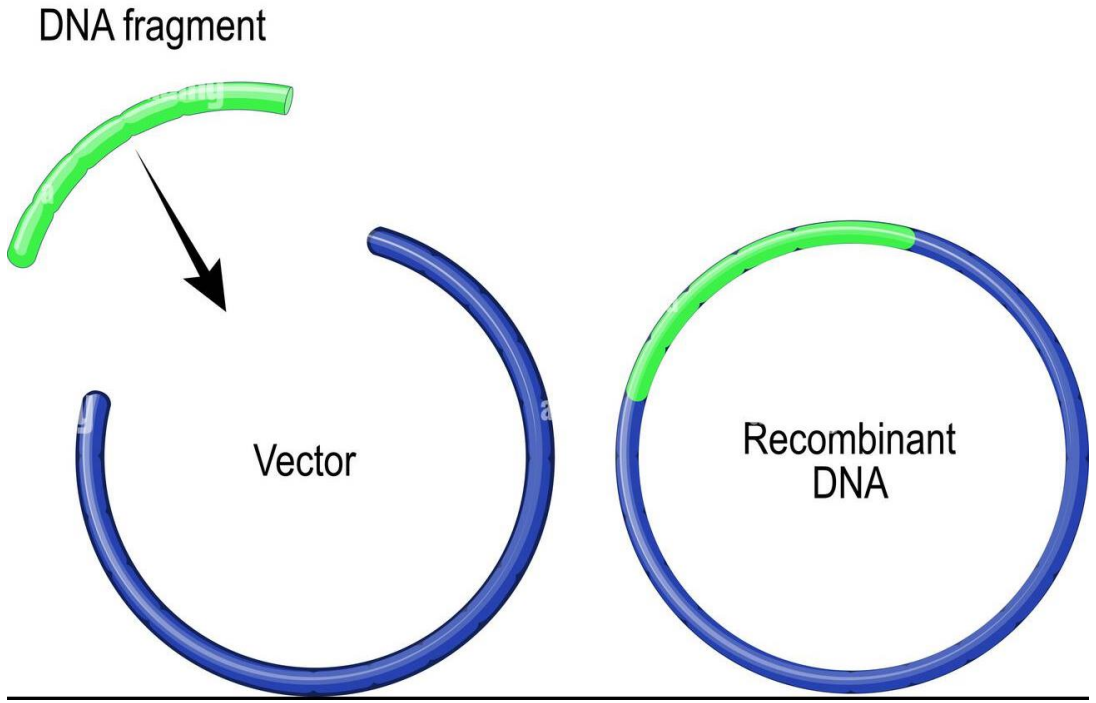
TCSC, Mumbai.

Definition

- Biotechnology is "the integration of natural sciences and engineering sciences in order to achieve the application of organisms, cells, parts thereof and molecular analogues for products and services".

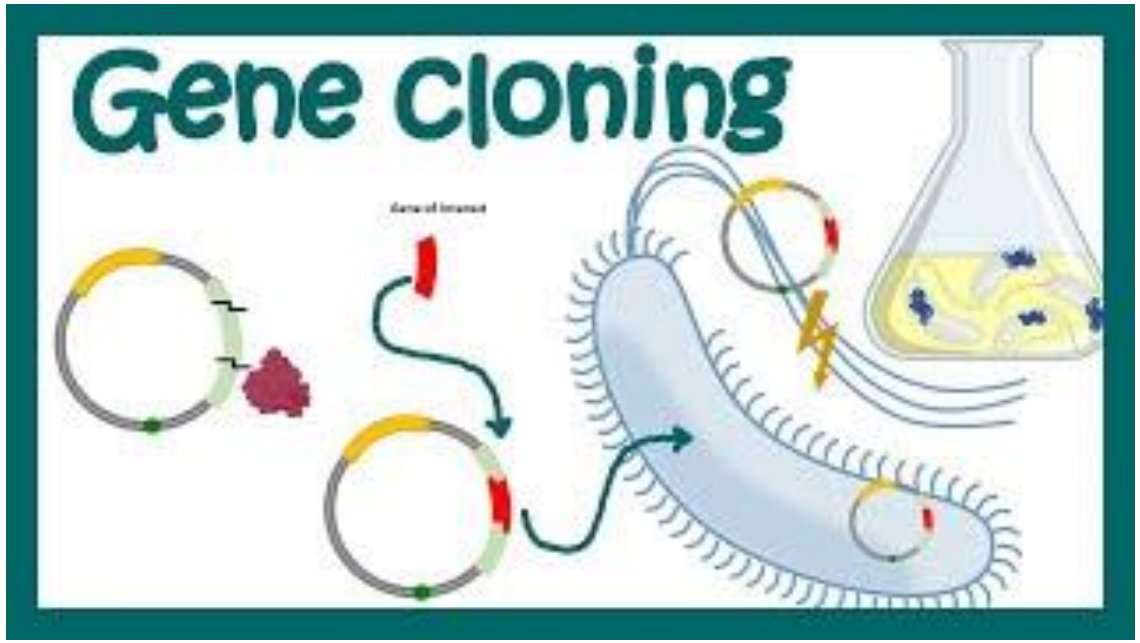
Scope

- **1. Genetic Engineering (Gene Technology as a tool):**
- Genetic engineering is the most fundamental technique in biotechnology. It involves recombinant DNA and gene cloning.
- **i. Recombinant DNA** is obtained by allowing breakage of a DNA molecule places to isolate a specific DNA segment and then inserting it in another DNA molecule at a two desired position.
- The process is known as recombinant DNA technology.



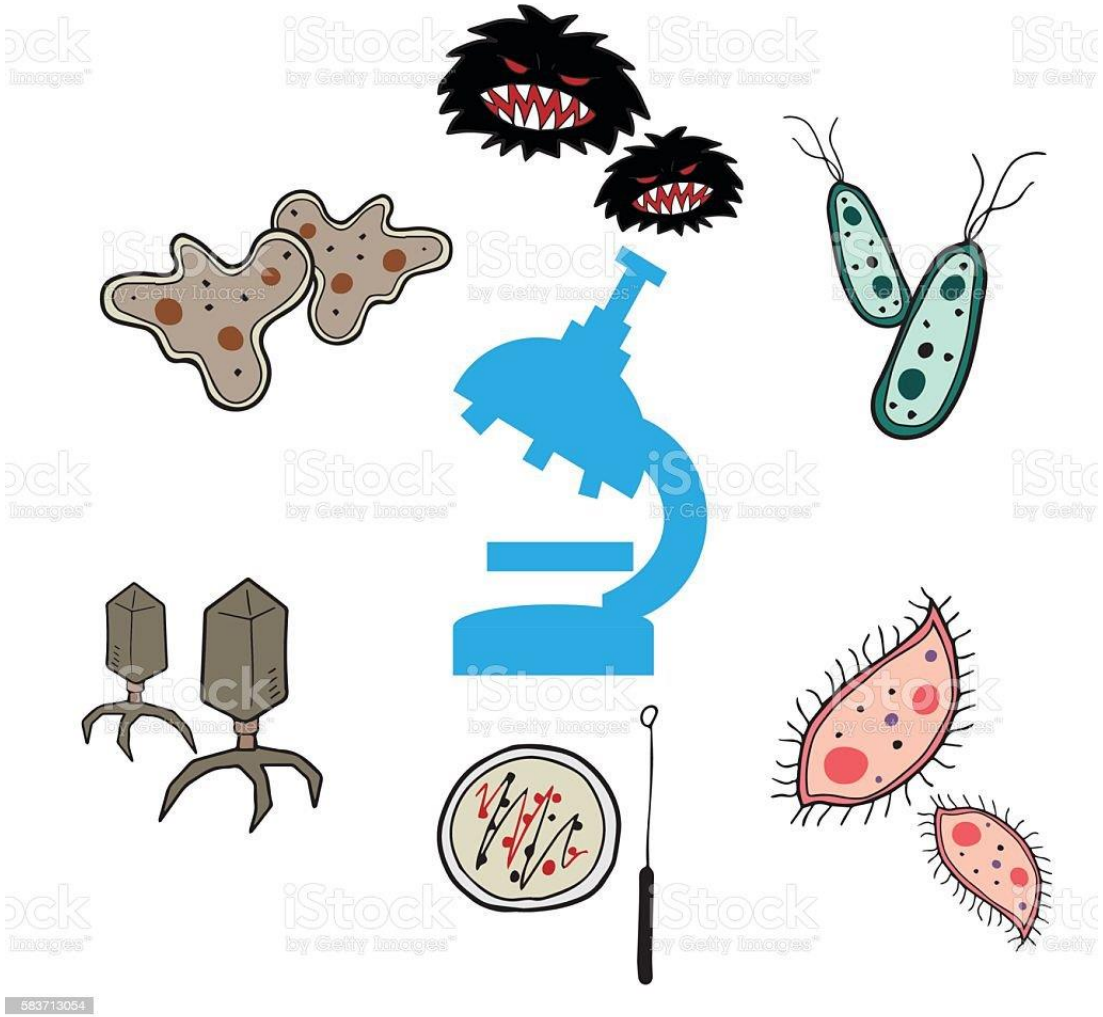
Scope

- **1. Genetic Engineering (Gene Technology as a tool):**
- **ii. Gene cloning is the technique by which multiple copies of desired gene is obtained by placing the recombinant DNA in host cell with the help of vectors.**
- **So far, a number of vectors have been developed.**
- **For example, vectors such as plasmids and phages reproduces in a host cell like *Eschereria coli* in their usual manner even after insertion of the foreign DNA.**



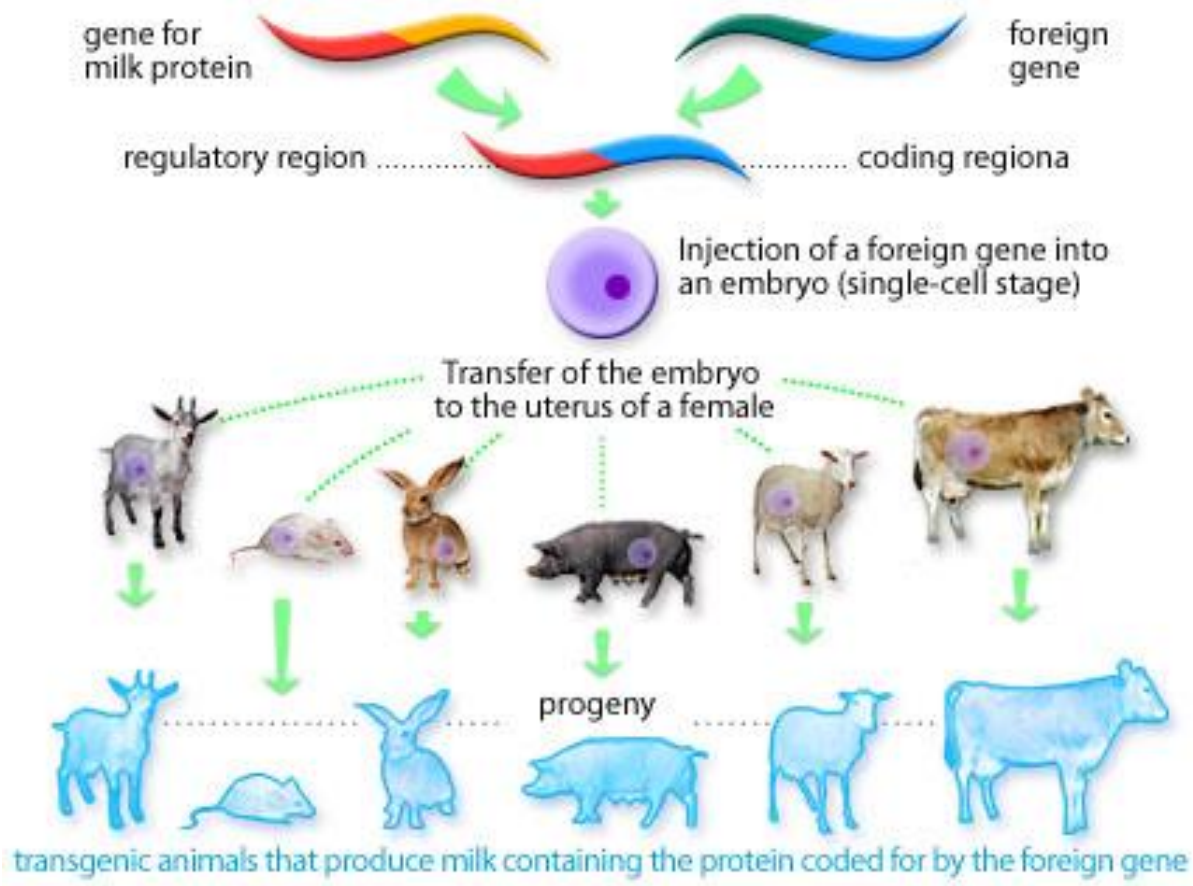
Scope

- **2. Microbial Biotechnology:** includes commercial production of microorganisms; production of enzymes, antibiotics, fuels etc.; production of microbial pesticides, bioremediation (cleaning of oil spills, waste water treatment etc.); oil and mineral recovery.



Scope

- **3. Plant Biotechnology:** includes hybridization, cloning, chloroplast engineering, antisense technology etc.
- **4. Animal Biotechnology:** includes cloning, formation of transgenic animals, production of human antibodies in animals etc.



Scope

- **5. Aquatic Biotechnology:** includes molecular genetics of aquatic organisms, improvement of strains for aquaculture, enhancing seafood quality etc.
- **6. Medical Biotechnology:** Includes production of monoclonal antibody, Gene therapy, Stem cell therapy, Production of vaccines and therapeutic antibodies, human genome project etc.

Scope

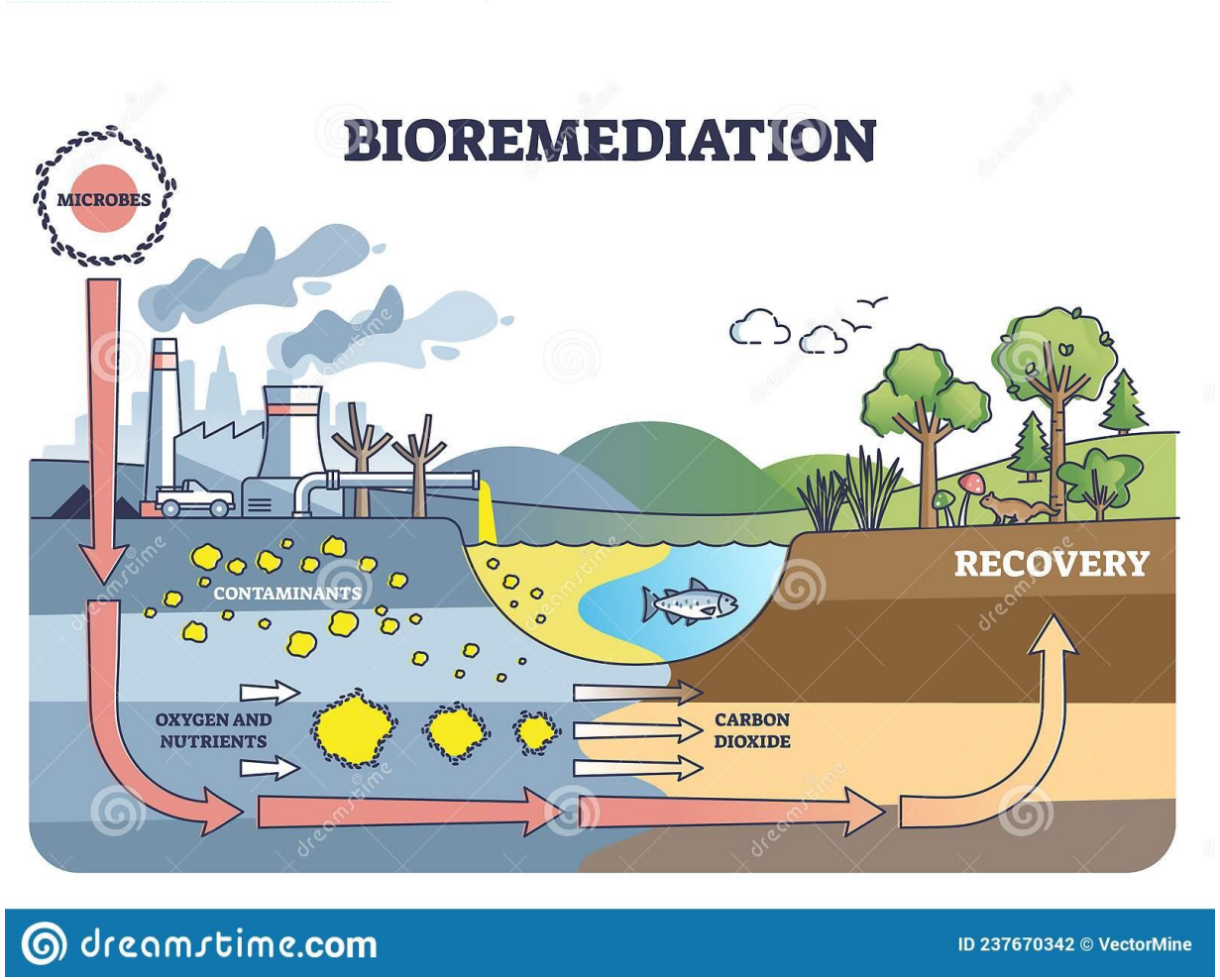
- **7. Forensic Biotechnology:** Includes DNA fingerprinting and forensic analysis.
- **8. Regulatory Biotechnology:** includes regulation of biotechnology, that is, framing laws, rules and regulations, and monitoring biotechnology products, bioengineered plants and animals, environmental contamination etc..

Scope

- **8. Biotechnology and Industrial Microbiology:** In pharmaceutical and chemical industries, a **number of drugs and chemicals can be produced with the help of various techniques of biotechnology** (using the knowledge of microbiology and genetic engineering) and at the same time, the **quality and quantity of these drugs and chemicals can be increased considerably**.
- Therefore, this is another area of biotechnology, receiving major attention of biotechnologists.

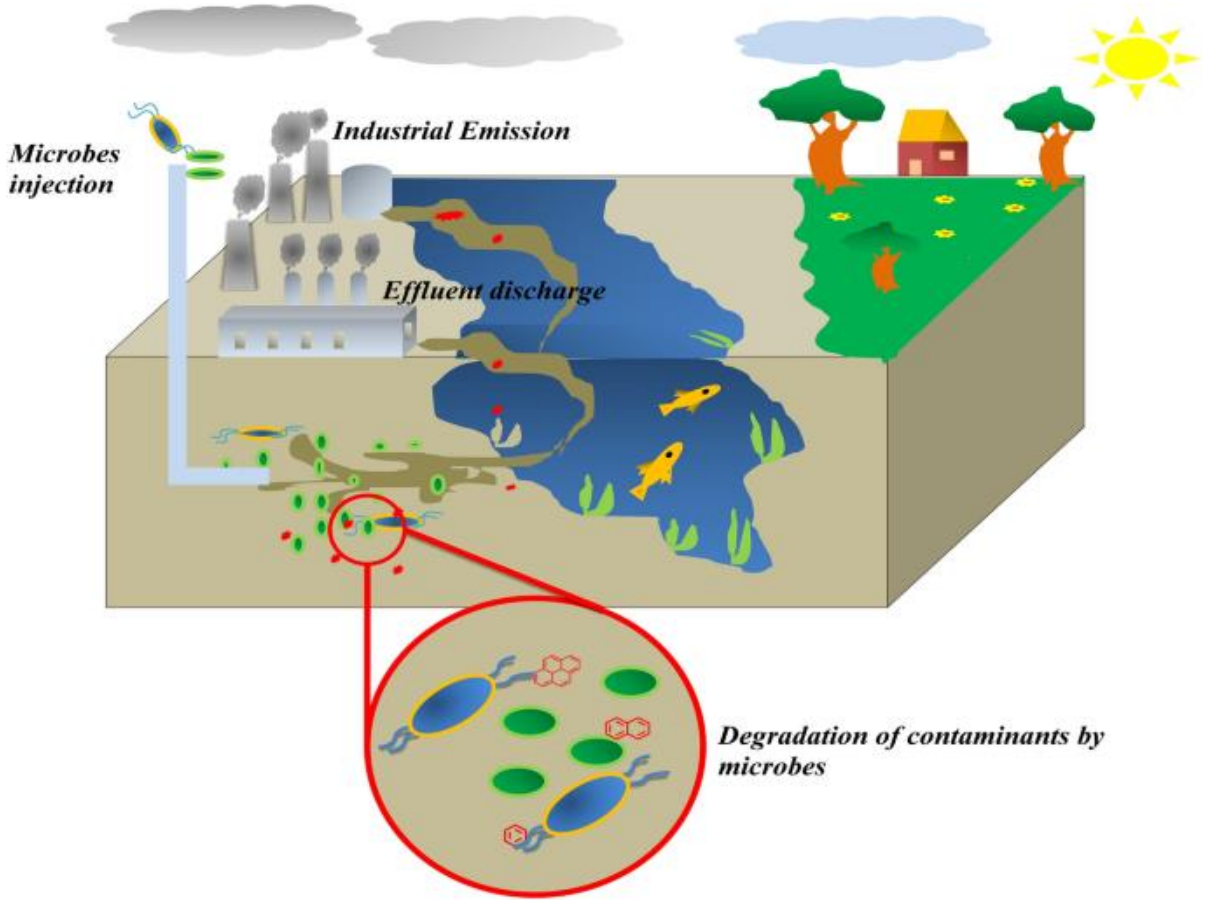
Scope

- **9. Biotechnology and Environment:** Various techniques of biotechnology have been developed for dealing with many environmental problems such as pollution control (water, land and air pollution), biodiversity conservation, restoration of degraded lands, controlling depletion of natural sources by using renewable energy sources like biogas, energy crops, cellulose, waste materials etc.
- The use of living organisms to process, degrade, and clean up naturally occurring or man- made pollutants in the environment is known as bioremediation.



Scope

- **9. Biotechnology and Environment:** Presently, a number of microbes have been developed which can be used as biosensors, biofertilizers, biopesticides etc. for various purposes such as removal of metals from industrial effluents, cleaning of spilled petroleum oil entering into the environment due to accidents and blow-outs of oil-wells, control of weeds and herbicides, reducing hazards of chemical fertilizers and so on.



Scope

- **10. Biotechnology and Livestock Production:** Livestock breeding industry has already benefited in a big way by improving the efficiency of reproduction using various techniques such as super ovulation, embryo transfer and cloning.
- Another important aspect is increased milk production in dairy cows by using the recombinant DNA derived bovine growth hormone (somatotrophin).Recombinant DNA derived bovine growth hormone has also been used to young stock to increase daily live weight gain associated with higher content of protein at the expenses of fat in cattle, sheep & pig.

GENETICALLY MODIFIED ANIMALS

Achievements

- I. Medical Biotechnology:
  - i. Discovery of penicillin & other antibiotics.
  - ii. Gene theory
  - iii. Stem cell technologies.
  - iv. Drug designing
  - v. Production of insulin
  - vi. Human genome project.
- II. Forensic Biotechnology:
- III. Animal Biotechnology:
- IV. Environmental Biotechnology:

Thank You