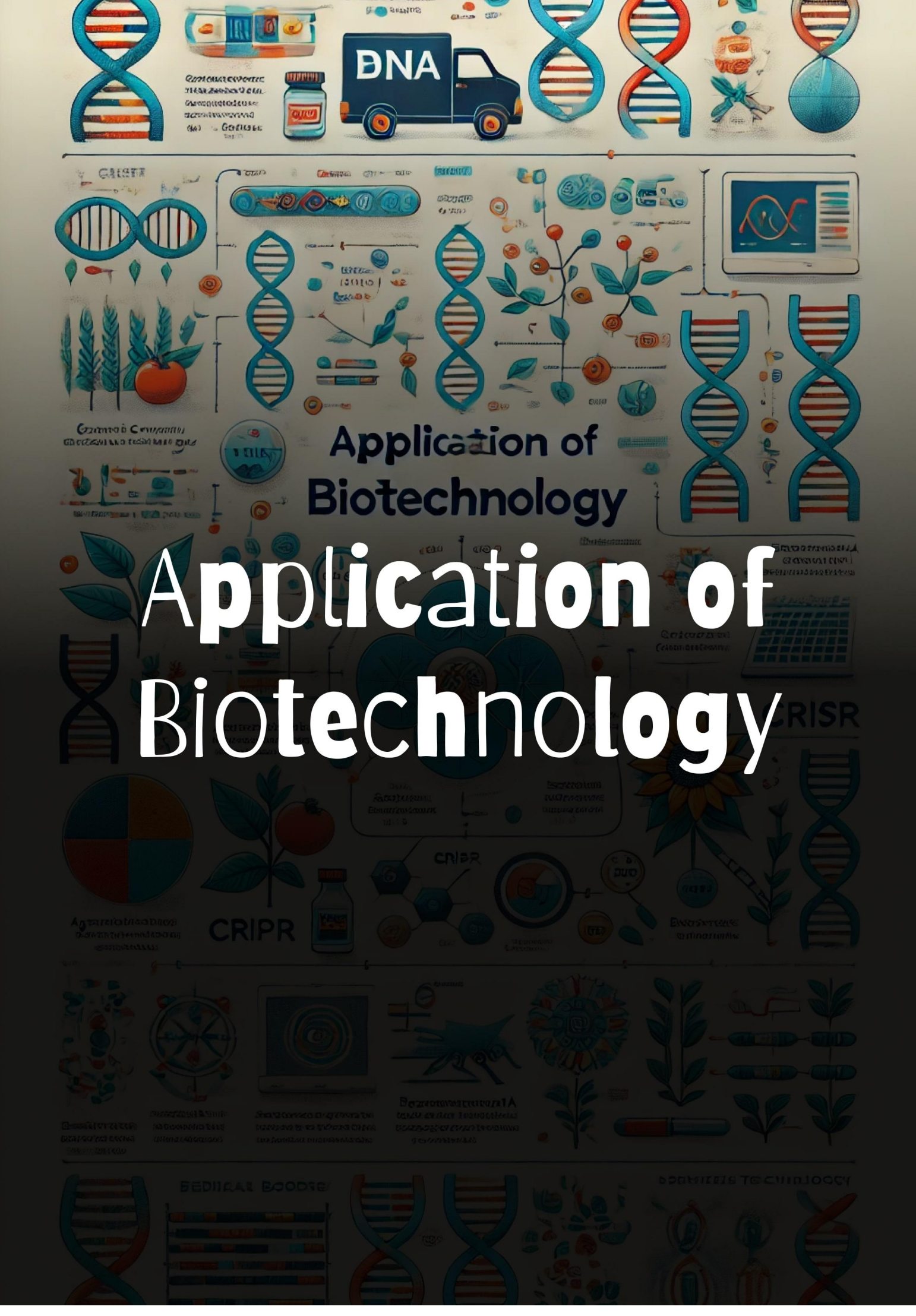


Application of Biotechnology

APPLICATION OF BIOTECHNOLOGY

Biotechnology is useful in various field :-

- Use of Biotech in Agriculture - Green Biotechnology
- Use of Biotech in medicine - Red Biotechnology
- Use of Biotech in marine industry - Blue Biotechnology
- Use of Biotech in other industry - White Biotechnology

USE OF BIOTECH IN AGRICULTURE

To increase food production following method can be used :-

AGROCHEMICAL METHOD

ORGANIC FARMING

GENETICALLY MODIFIED CROP BASED AGRICULTURE

GENETICALLY MODIFIED CROP

⇒ Genetically Modified crop have following advantages over other crops :-

TO PRODUCE NUTRIIIONALLY RICH CROP!-

Example :- i) Golden Rice - These rice are rich in Vit-A + Iron
ii) Protein Rich Potato

TO PRODUCE CROP WHICH IS RESISTANT TO ABIOTIC

★ Abiotic stress is environment stress → Drought, Saline soil, nutritionally deficient soil, etc.

Example :- Resistant tomato crop → These tomato crop have Na proton antipart system during maturation excess salt is removed from this growing tomato.

TO DEVELOP HERBICIDE RESISTANT CROP

- Sulphonyl urea and Glycophosphate are used as herbiscides.
- Arabidopsis has Acetalactate Synthatase gene (ALS), this gene provide resistance against herbiscides.
- This gene was transferred to tabacco.

TO REDUCE POST HARVESTING LOSS

- To develop flavour savour tomato → These tomato have high shelf life (high storage timing).
- Activity of polygalactose enzyme is inhibited so ripping will be delayed.
- Anti - sense technolgy is useful.

TO DEVELOP CROP USEFUL IN PHERMECY

- Hirudin is anti coagulant obtained from leech
- Gene of Hirudin was transferred to Brassica napus (Black mustard) and it get collected in seed of this plant.

- oil is extracted from this seed for Hirudin.

Bt-COTTON → TO DEVELOP INSECT RESISTANT PLANT

- Bt stand for Bacillus thuringensis.
- This bacteria secreates insecticidal protein which can kill.

LEPIDIPTERANS
- Tabbacco bud-worm
- Army worm

COLEOPTERANS
- Beetles

DIPTERANS
- Flies
- Mosquito

- Synthesis of insecticidal protein take place during particular growth phase.
- These proteins are crystal in nature so they are known as Cry Protein and gene is known as Cry gene
- Particular bacterial strain secreates particular type of proteins which kills particular type of insects.

MECHANISM OF ACTION

- This Protein remain inactive (insoluble) in bacteria of but once it is ingested by insect it becomes active and soluble in the gut of insect and this will make the gut cell porous so swelling will be seen in the cell and ultimately these cell will burst and insect will die.

- Alkaline pH of gut converted this protein into active form.
- Gene for Cry protein can be transferred to various crops with help of Ti-plasmid this will result into

1) Bt - Rice
2) Bt - Soyabean
3) Bt - Brinjal
4) Bt - Potato

PEST RESISTENT PLANT

Plant → Tobacco

Pest → Meloidegyne incognitia (Nematode)

Part affected → Root

Disease → Root knot Disease

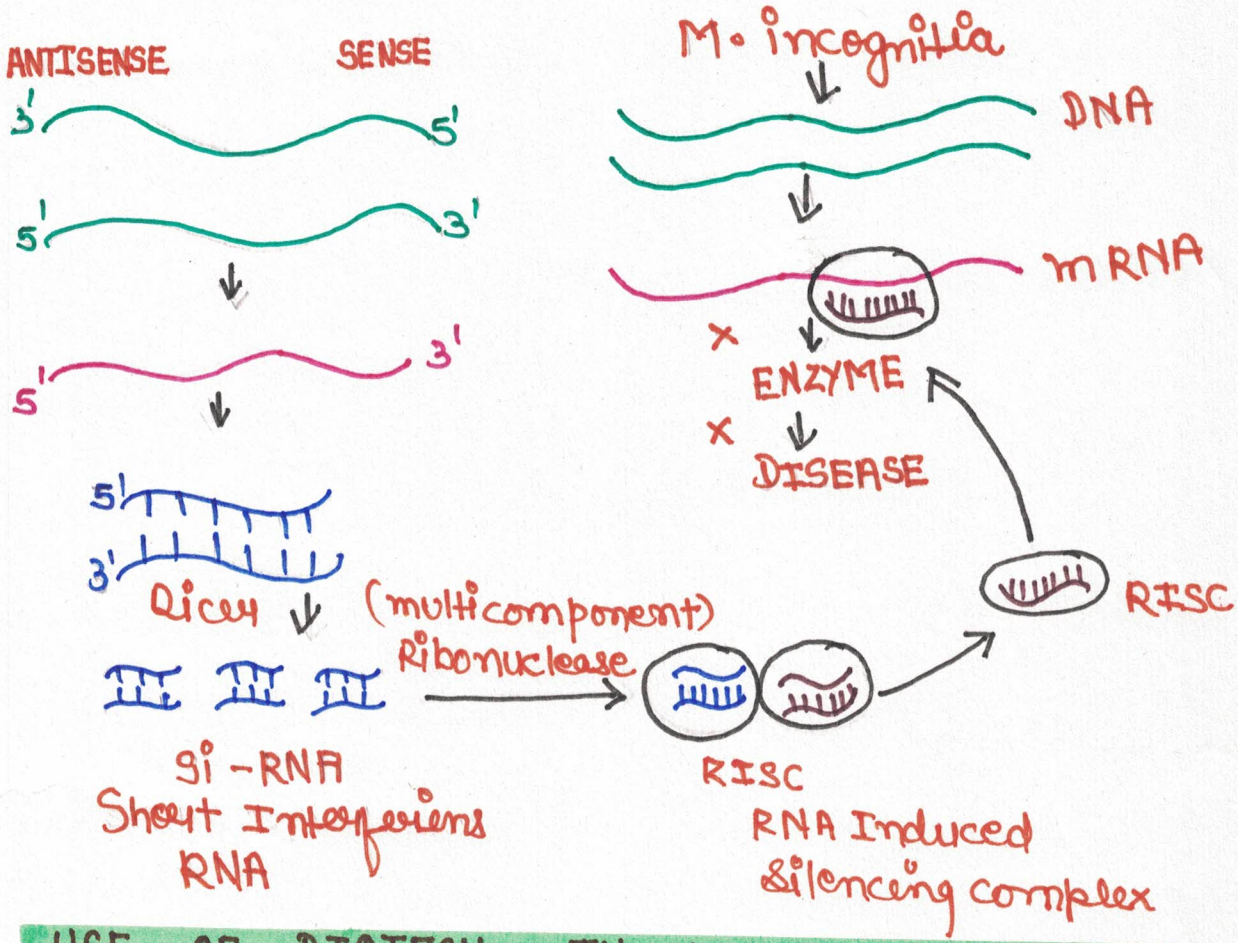
TECNIQUE OF DEFENCE

Anti sense technology OR
RNA Interfereance technique OR
RNA silencing technique

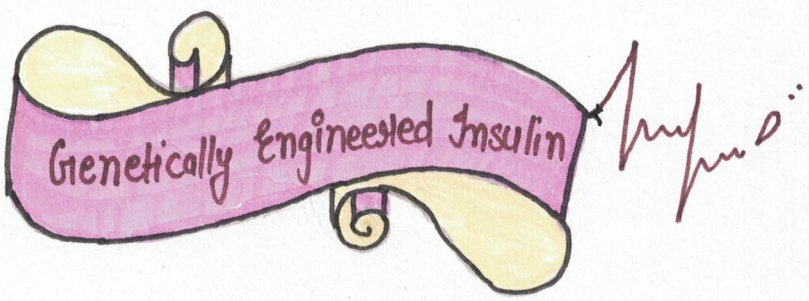
- Fire and Mello develop this technique and got Nobel Prize in 2006.
- In eukaryotic cells this technique is naturally present as cellular defence.

THERE ARE TWO METHODS FOR THIS TECHNIQUE

a) Entry of double stranded DNA into the host cell.
b) Entry of synthetic gene having sense and anti-sense both part.



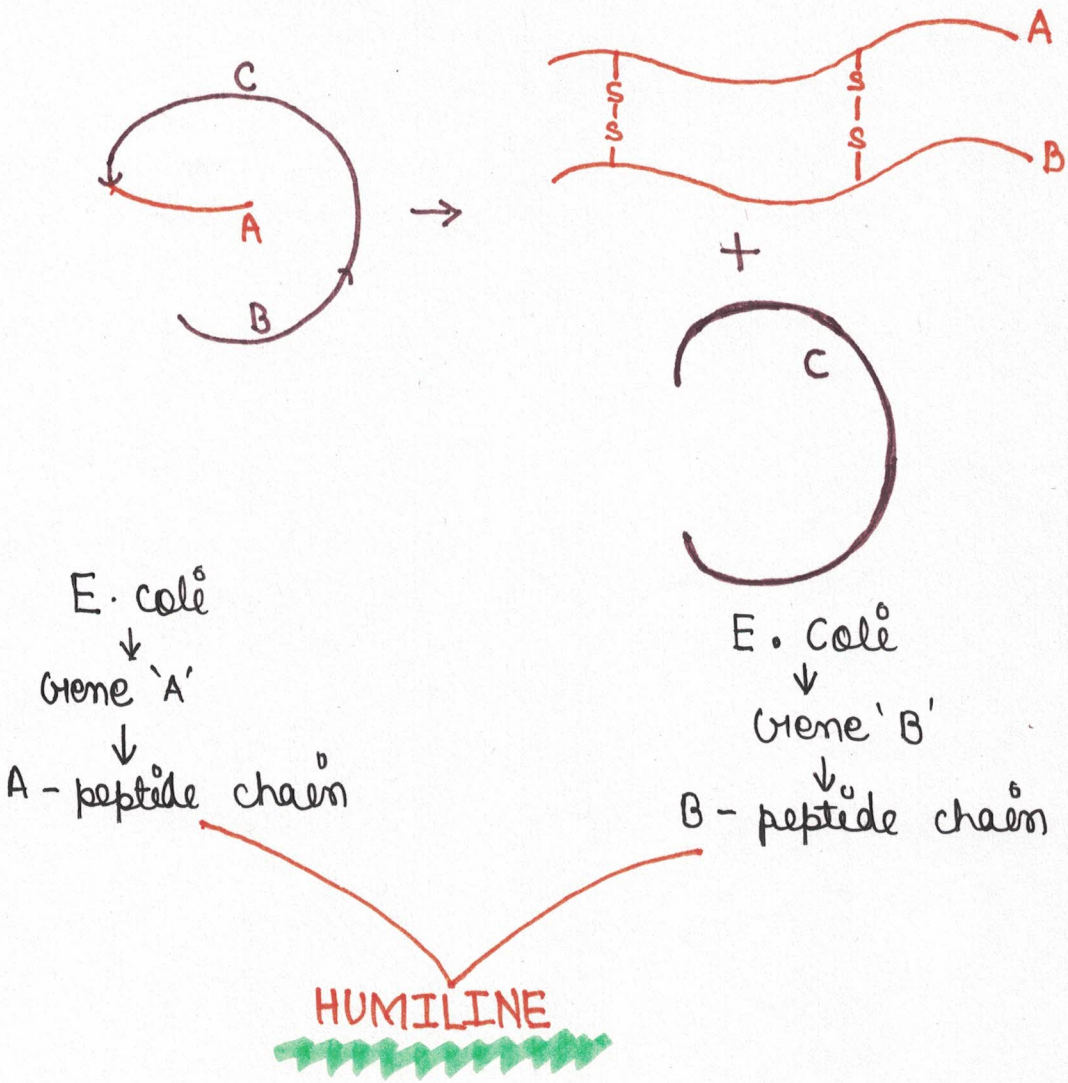
USE OF BIOTECH IN MEDICINE



Insulin is secreated from pancreas and it has three polypeptide chain.

Chain A → 21 amino acid long sequence.
chain B → 30 amino acid long sequence.
chain C → 33 amino acid long sequence.

- Before releasing insulin into the blood 'C' peptide chain is removed so mature insulin in blood has only A and B peptide chain.
- Eli Lilly company in 1983 produced human insulin (Humalinc) by Recombinant DNA Technology with the help of E.coli and both chains were prepared seperately.
- Presence of C-peptide chain in blood ensures that source of insulin is pancreas.
- Banting and Best were first to isolated insulin from dog's pancreas.
  '14 November - World's Diabetic day'
- A and B chain are attached with two disulphide bonds.



GENE THERAPY

- In 1990, 4 year old girl child who was suffering from SCID (SEVERE COMBINED IMMUNODEFICIENCY DISORDER) received gene replacement therapy.
- In SCID there is a deficiency of ADA (ADENOSINE DEAMINOSE)
- Gene replacement should be performed during early part of life.

MEDICAL DIAGNOSIS

- Biotechnology is helpful in determining the disease.

Example :- Tuberculosis, HIV, cancer etc. can be determined

a) PCR Recombinant DNA technology is helpful.

b) Radioactive DNA probes are helpful.

c) ELISA etc.

HETEROLOGOUS HOST

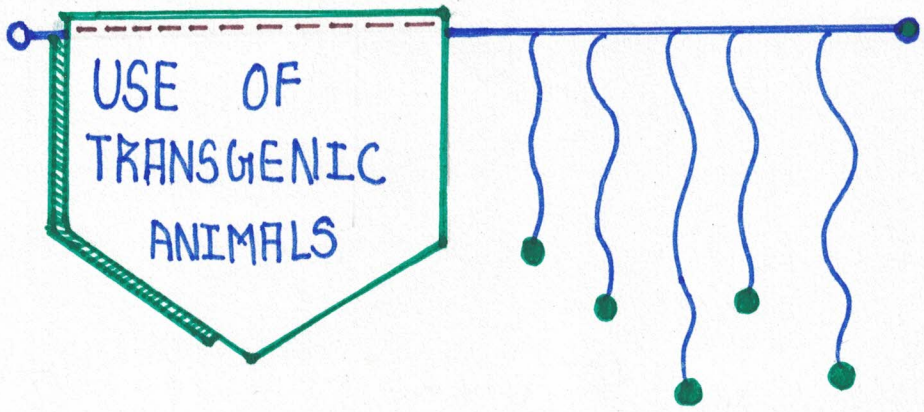
Host from other species is heterozyous host.

TRANSGENIC ANIMALS

These animals have recombinant DNA.

- In more 95% of cases mice is used as transgenic animal.
- First transgenic animal was supermose.

- First transgenic monkey ANDI (INSERTED DNA TECHNOLOGY)



TO STUDY NORMAL GROWITH AND PHYSIOLOGY OF DEVELOPMENT

- Study of Growth Hormones, Insulin like growth factors and their effects on normal growth and development can be studied in these animals.

TO STUDY VACCINE SAFETY

- Vaccine trials are performed on transgenic animal to study effect of vaccine on gene.

  Example :- Polio vaccine was used over mice.

TO STUDY CHEMICAL SAFETY

- Effect of chemicals as carcinogens or disease causing agents is studied on transgenic animals.

TO STUDY CHRONIC DISORDERS

- Disease like Alzeihmers, Parkinson's, cancers which show chronic pattern.

TO OBTAIN BIOLOGICAL PRODUCT

- Transgenic cow 'Rosie' is used for production of milk containing κ - lactalbumin.

- Milk of Rosie cow has 2·4g protein in 1 litre of milk.
- this milk is best suitable for new born babies.

TRANSGENIC MICROBES

a) for obtaining coagulation factors.
b) α_1- antigen antitrypsin → used in Amphysema.

TRANSGENIC MICROBES

- Escherita coli used for production of insulin, interferon, interleukens, etc.
- Pseudomonas Putida → Anand Mohan chakraborthy.
- It is a superbug → oil eating bug.

OCT → Octane
XYL → Xyaline
NPH → Naphthaline
CAM → Comphor

GEAC → Genetic Engineering Approval Committee

- For validity of genetic Modified research.
- Safety of introducing genetic Modified organism /crops for product and services.

Harmfull effect of GM Crops

Environment Pollution → when GM crops pollinates wild variety
Development of Antibiotic Resistance.

Pentadiplandra Brazzeiana

- It's a example of Biopiracy
- It's a west African plant
- It's patent is with USA
- It produces Brazzein protein which is 2000 time more sweet than Sugar

Biopatent and Biopiracy

Patent is given for :-

- New invension including product
- Improvement in old technology or old invension.
- New concept or design
- The process of generating product.