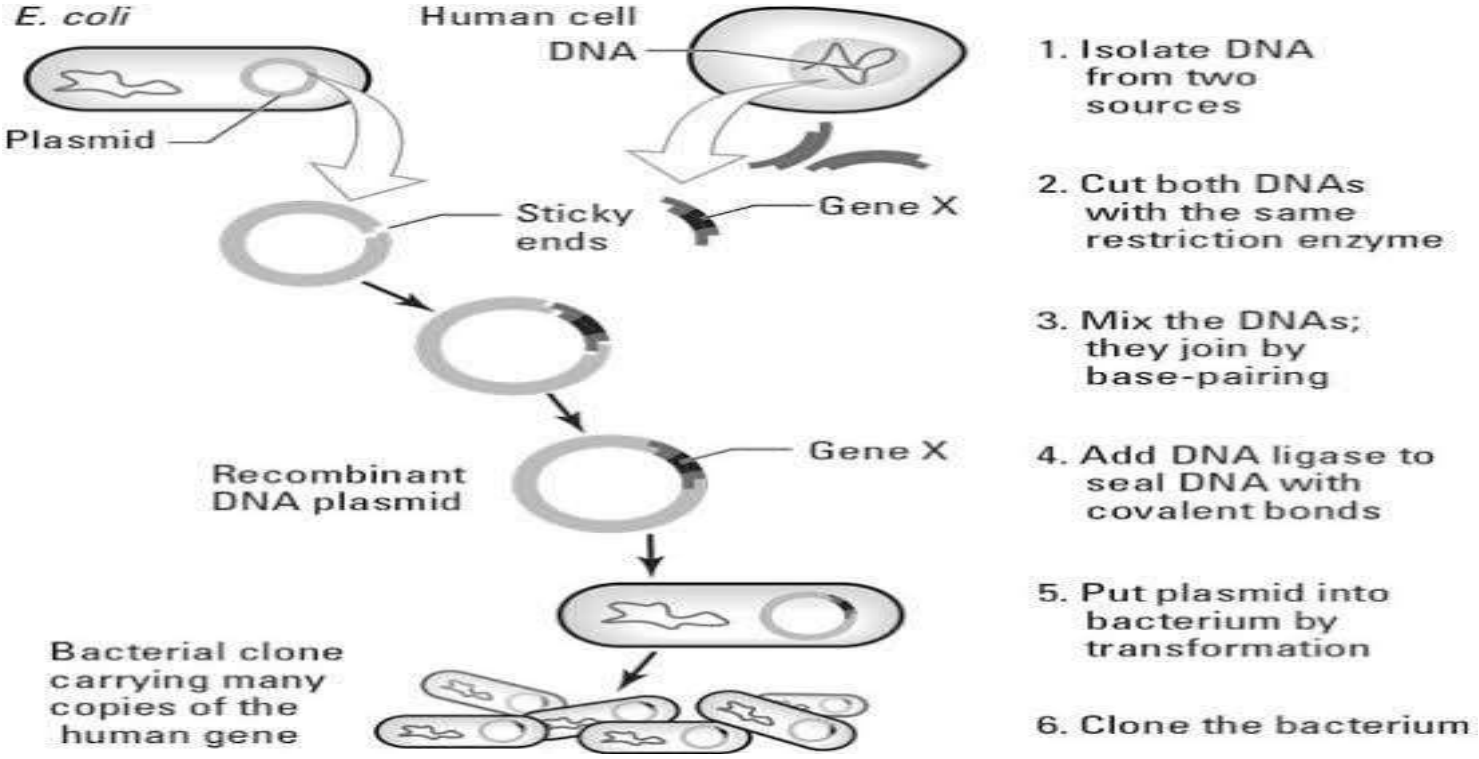
Application of r-DNA Technology

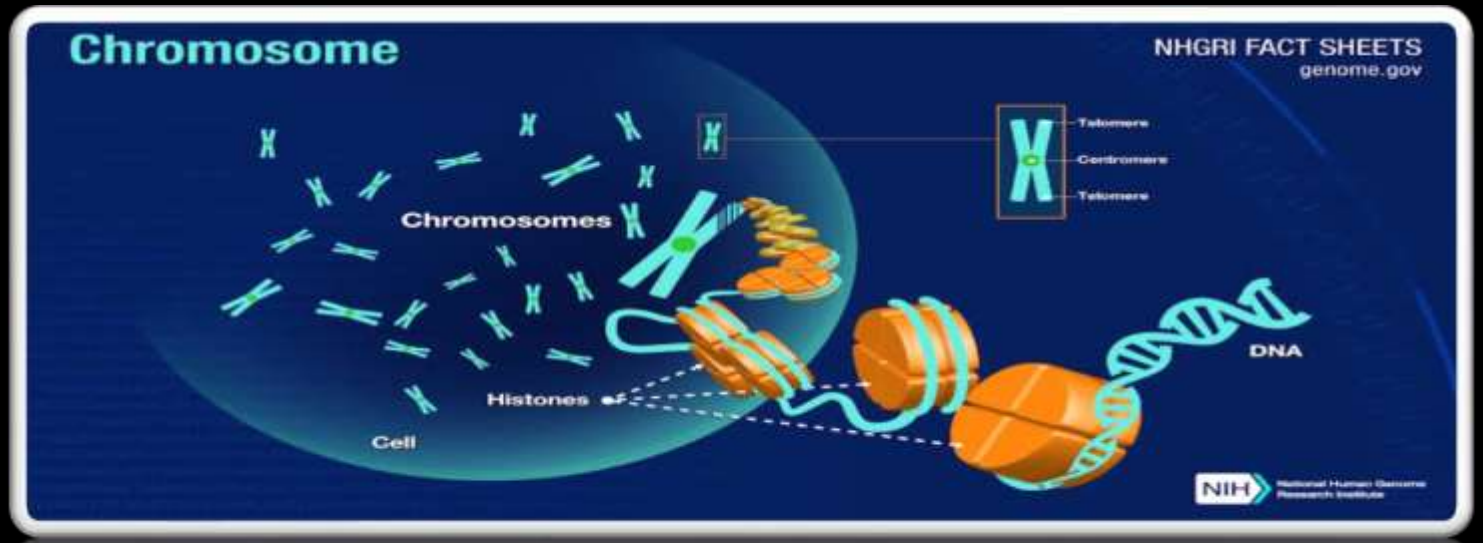
Brief introduction about r-DNA technology

- A series of procedures that are used to join together (recombine) DNA segments.
- A recombinant DNA molecule is constructed from segments of two or more different DNA molecules.
- Under certain conditions, a r-DNA molecule can enter a cell and replicate there, either on its own or after it has been integrated into a chromosome.
- Since the focus of all genetics is the gene, the fundamental goal of laboratory geneticists is to isolate, characterize, and manipulate genes.

Step in r-DNA technology



Application of r-DNA Technology



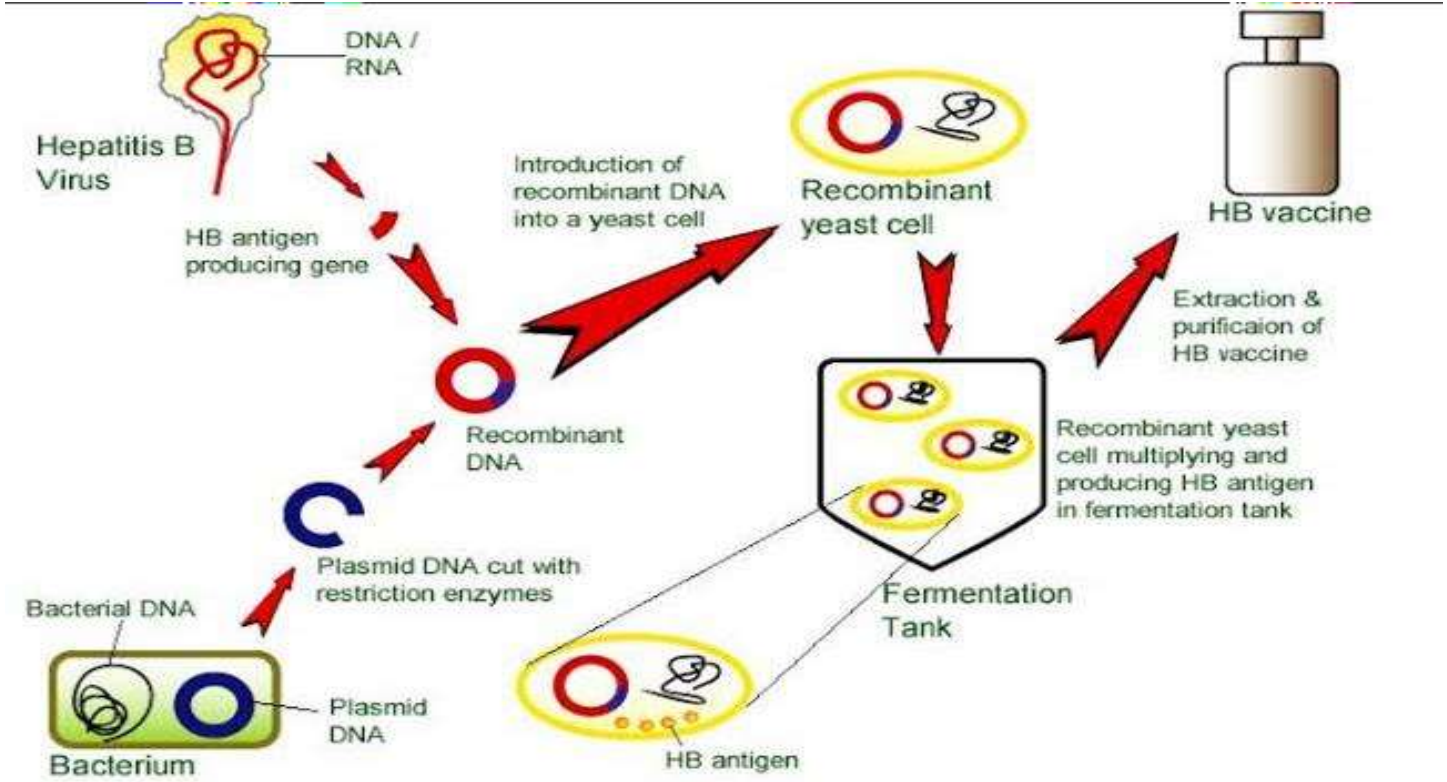
Applications of r-DNA

Application of r-DNA Technology

Production of vaccine

- Introduce live attenuated
- Acquired immunity
- r-DNA can be used to clone gene for protective protein.
- Example- HB, influenza, HIV Vaccine

Production of Recombinant HB Vaccine



Production of hormones

Insulin: It controls the glucose level in humans.

By r-DNA technology, cloning of human insulin gene is done.

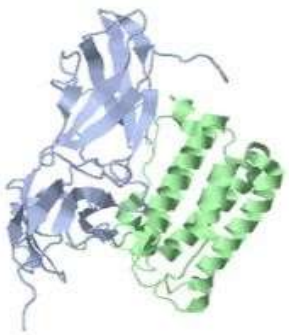
Availability of insulin.

Human growth hormone: Role in growth, regeneration

or differentiation.

Biosynthesis of Interferons

- Interferons have antiviral as well as anti-cancerous properties.
- Virus infected cells produce very little quantity of Interferon.
- By r-DNA technology, the genetic factor of human fibroblasts is introduced into the bacterial plasmid.
- These genetically engineered bacteria are cloned
- and cultured.



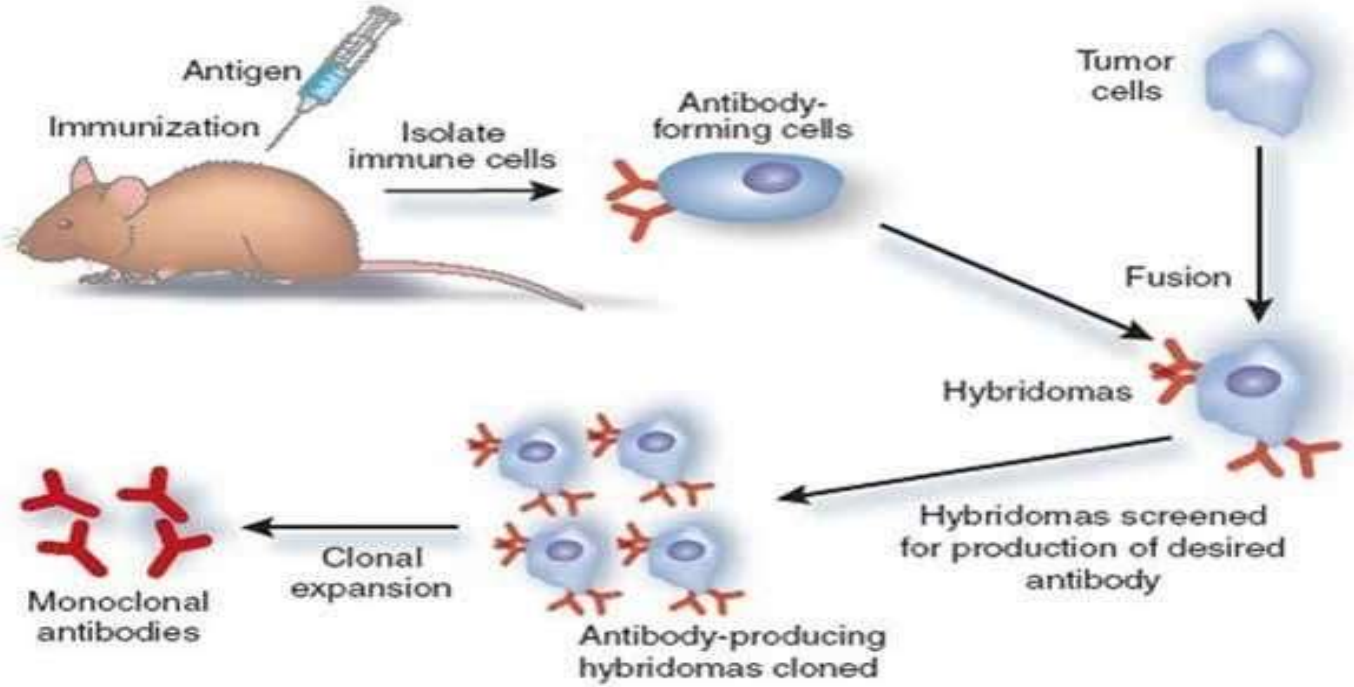
Production of antibiotics

- They denatured the harmful living pathogens.
- Antibiotics manufactured by microbes are very useful for human.
- r-DNA technology benefits in surging the manufacturing of antibiotics by enlightening the microbial strain via genetic characteristics modification.

Monoclonal antibodies

- Antibodies are specific protein produced by the immune system in response to antigen.
- Monoclonal antibodies produce from single clone of antigen. That's why are monospecific in nature.
- Used for diagnosis of disease, Pregnancy and treatment of cancer

Procedure of Mono Clonal Antibody by r-DNA Technology



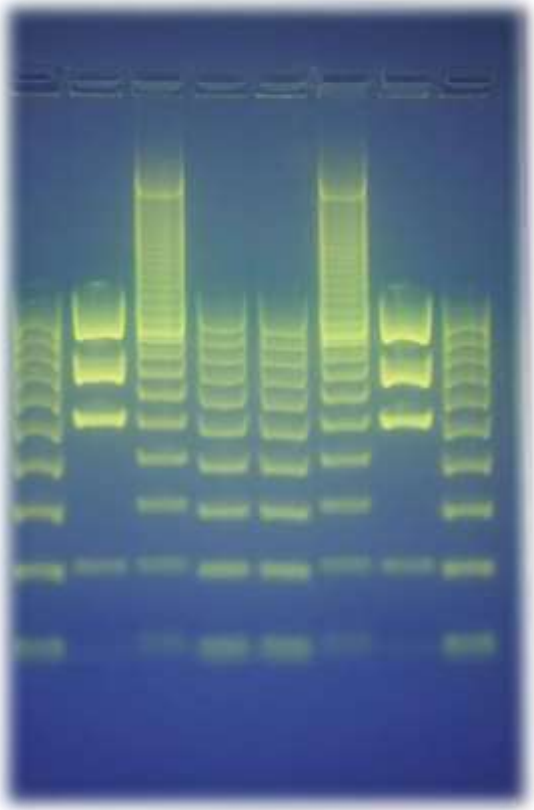
Molecular Diagnosis of disease

- Infectious diseases diagnosis mainly depends upon isolation and identification of pathogens, which may take several days.
- Development of diagnostic kits to identify pathogenic organisms by knowing the organism-specific DNA sequence has provided rapid, specific and correct diagnosis.

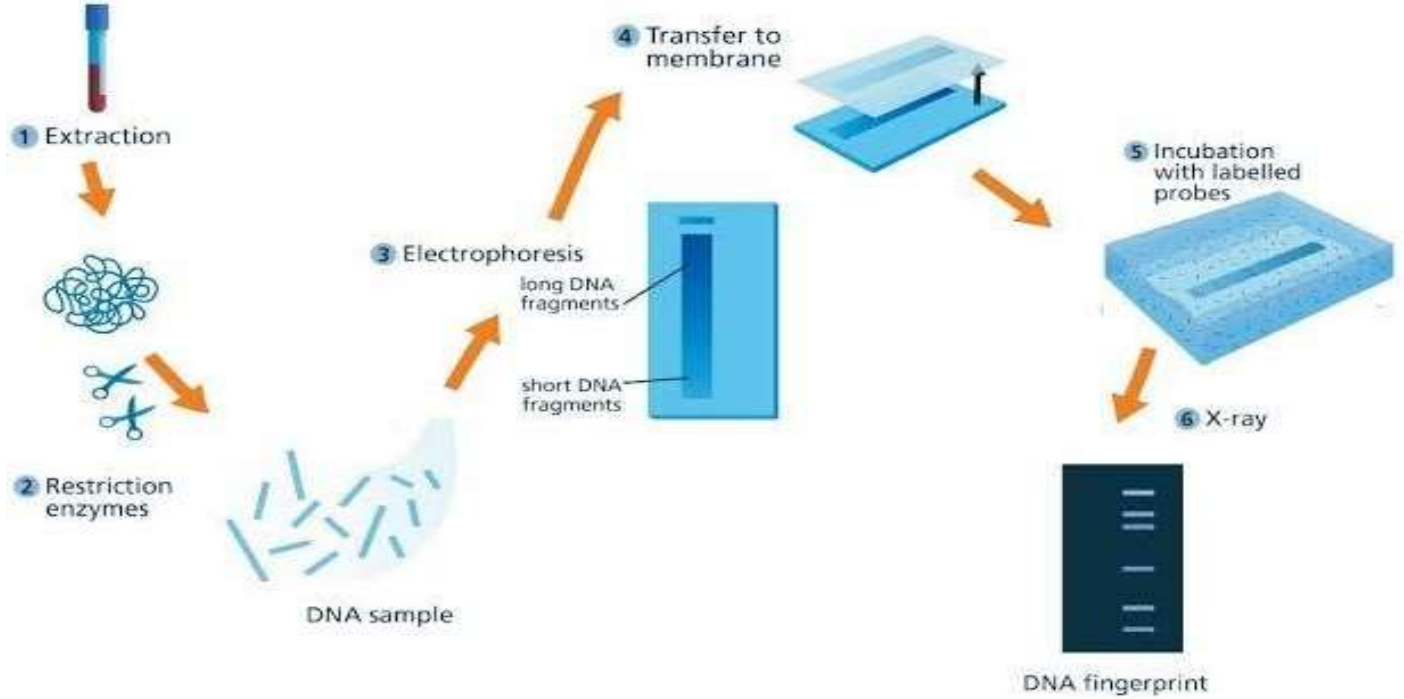
- Various diagnostic kits have been developed for AIDS, cancer, foot and mouth diseases, tuberculosis, etc.

DNA Fingerprinting

- Dr. Alec Jeffreys developed DNA fingerprinting technique.
- Every person have its unique finger patterns that differs from other individual.
- There is possibility to alter these patterns but specific principle is unknown. Finger prints are detected on the basis of number of highly polymorphic genes i.e. VNTR's.



Brief introduction about r-DNA technology



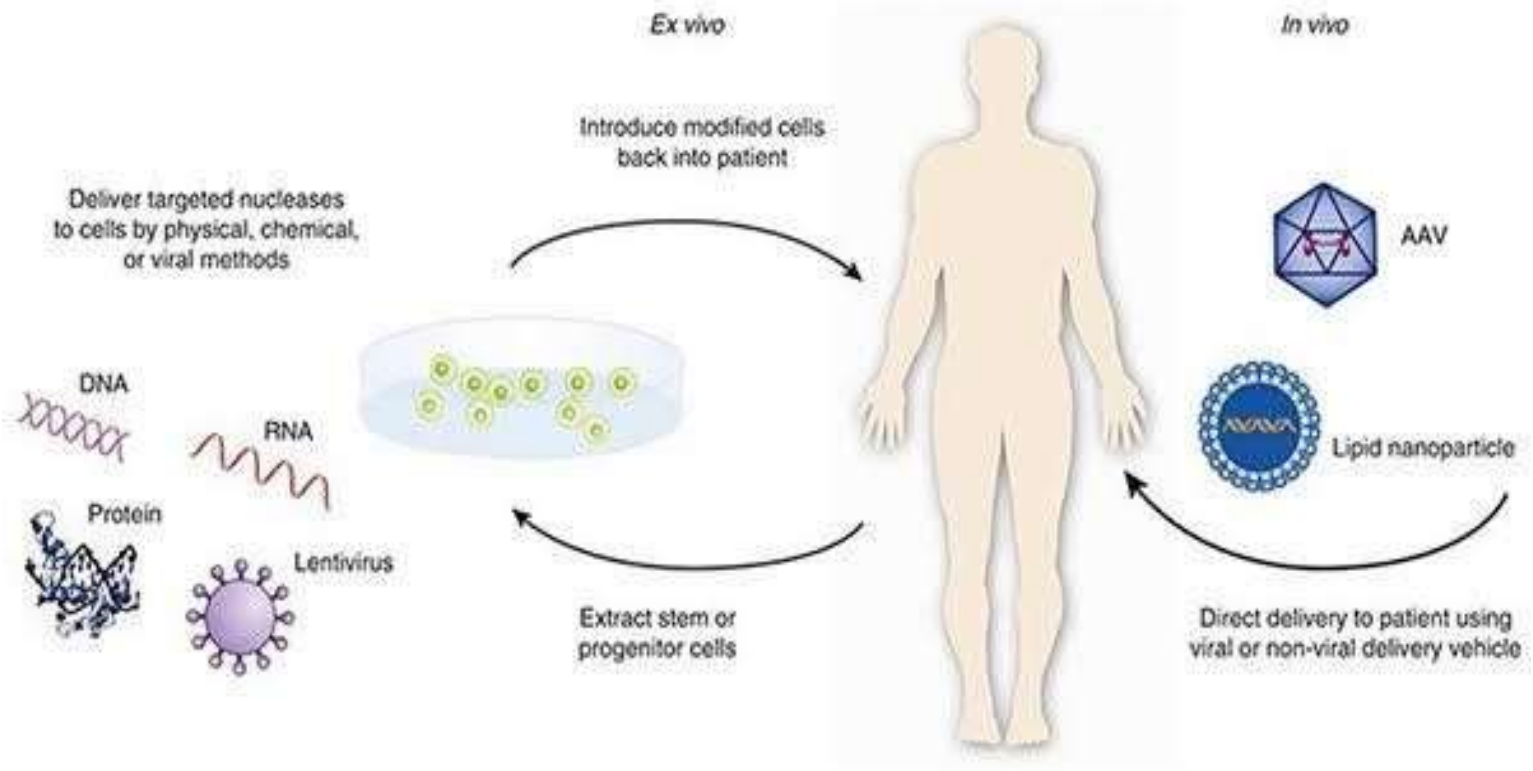
Gene Therapy

- Injects functional genes into a cell to replace missing or defective genes in order to correct genetic disorders.

- A gene that is inserted directly into a cell usually does not function. Instead, a carrier called a vector is genetically engineered to deliver the gene.

- Gene therapy may be done in-vivo or e-vivo.

Gene Therapy



Application of r-DNA in environment

- We can use recombinant DNA technology in environment to clean up the environment
- Measure the presence of hazardous compounds
- By recombinant DNA technology we can remediate environmental pollutants.
- Waste product of agriculture have cellulose that do not easily decompose.
- By Recombinant DNA technology plastic degradation can be enhanced by genetically modified organisms.
- Degrade oil spills or organic waste.

Application of r-DNA in environment

- Used in development of bioindicators
- bacteria have been genetically modified as 'bioluminescors' that give off light in response to several chemical pollutants.

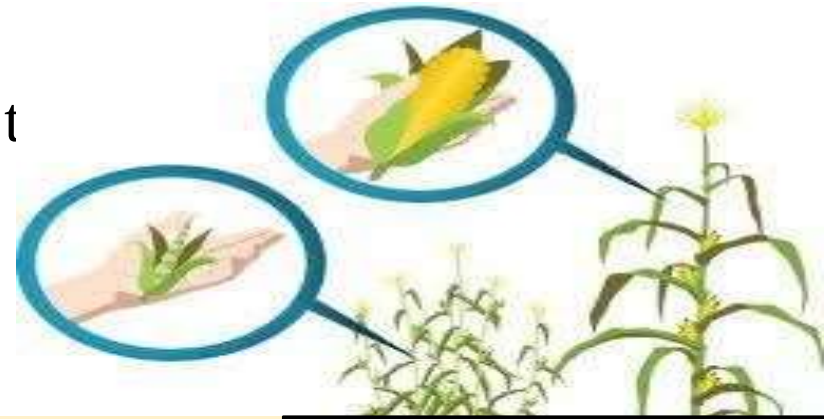
Application of r-DNA in environment

These are being used to measure the presence of some hazardous chemicals in the environment.

- Other genetic sensors that can be used to detect various chemical contaminants are also undergoing trials
- and include sensors that can be used to track how pollutants are naturally degrading in ground water.

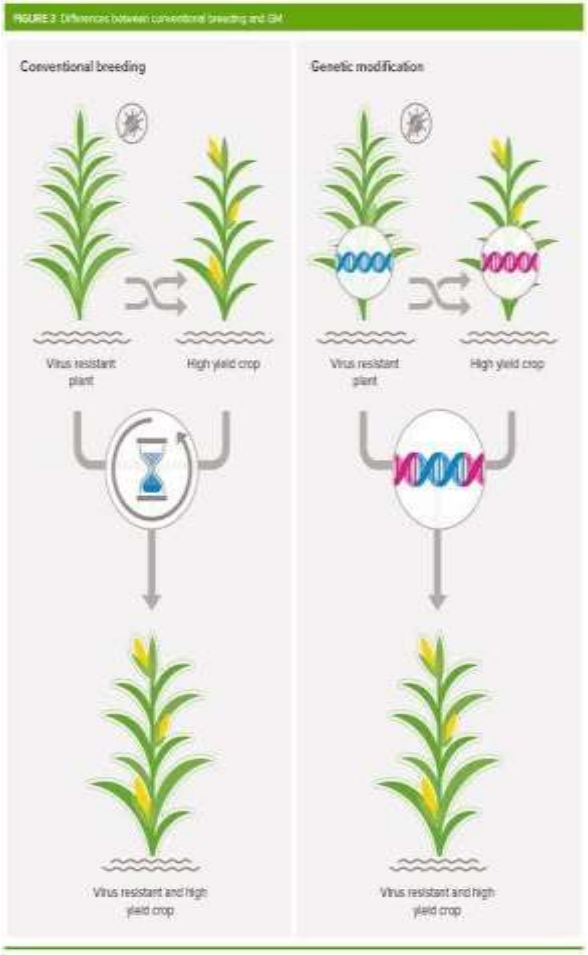
Application of r-DNA in agriculture

- Recombinant DNA technology can be used for insertion of genes in plants not only from related plant species, but also from unrelated species such as microorganisms.
- used for the production of transgenic plants with higher yield nutritional values.
- increased resistance to stress and pest



Used In

- Development of plant having improved yield.
- Development of stress tolerant plant.
- Transgenic plant as a source of biopharmaceuticals.



Plant with improved yield

Genes are inserted into plants to increase their yield.

- Researchers at Japan's National Institute of Agrobiological Resources added maize photosynthesis genes to rice.

- Increased yields by 30 percent.

Stress tolerated plants

Plant resistance to environmental stress:

- rDNA technology is used to develop crops that can tolerate abiotic stress.

- Genetically modified tomato and canola plants that tolerate salt levels 300 percent greater than normal.

Herbicide resistance plants

- Roundup is an herbicide but it kills almost all species of plants.
- using rDNA technology, modified EPSP synthase gene (that produced enzymes that were still functional but were not inhibited by glyphosate) have
- been introduced into crop plants
- such as cotton and soyabean.

Insect resistance plants

Cry genes (popularly known as Bt genes) from a bacterium Bacillus thuringiensis are isolated. Then plant is modified using this gene.

e.g. cotton, rice, maize, potato, brinjal, cauliflower, cabbage etc.) with Bt genes have been developed.

Disease resistance plants:

Plants are modified to produce resistance against diseases. e.g tobacco was first modified to produce resistance against tobacco mosaic virus.

Production of biopharmaceutical

- rDNA used to produce a plant that will generate a seed that expresses a desired therapeutic protein.
- Then seed stock is use for producing the desired protein.
- The desired protein can be extracted from the seed.
- E.g In corn biopharmaceuticals are produced.

Edible vaccine

- The genes encoding antigenic proteins can be isolated from the pathogens.
- Expressed in plants producing antigens can be eaten for vaccination/immunization (edible vaccines).
- E.g In banana and tomato edible vaccines are made.

Application of r-DNA in Industry

- Traditional industrial microbiology is merged with molecular biology to yield improved recombinant processes for the industrial production.

- primary and secondary metabolites, protein biopharmaceuticals and industrial enzymes are formed for industrial usage

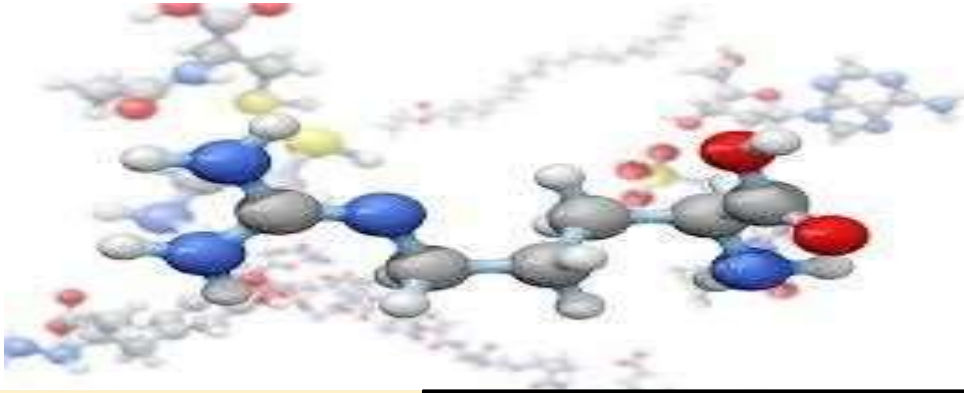
Vitamins

- Vitamin B, is produced commercially by direct fermentation utilizing the fungus Ashbya gossypii

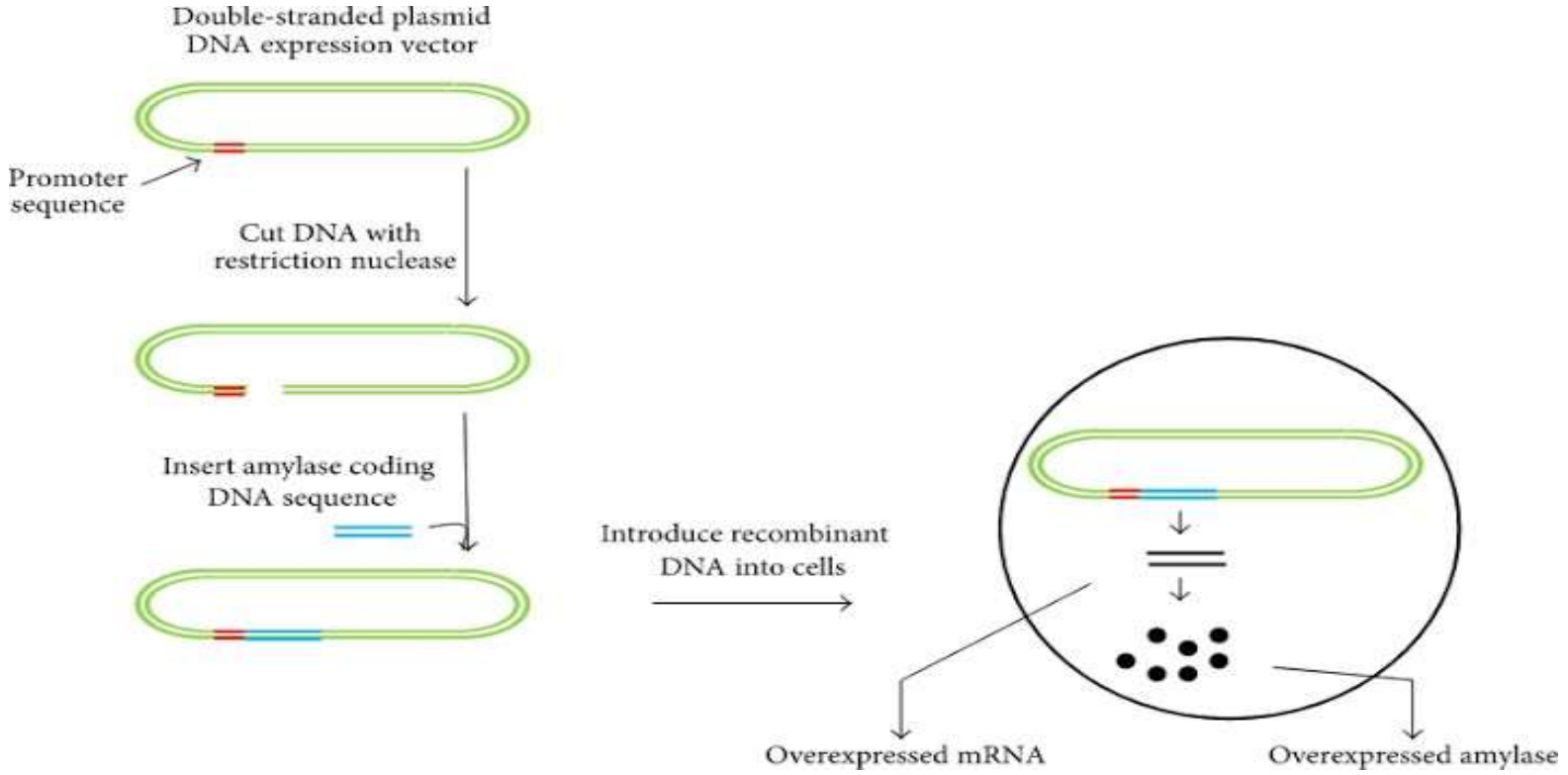
- Vitamin B12 is produced by a direct fermentation utilizing streptomyces species such as streptomycin griseus.
- Vitamin C is produced by utilizing Gluconobacter oxydans.

Amino Acids

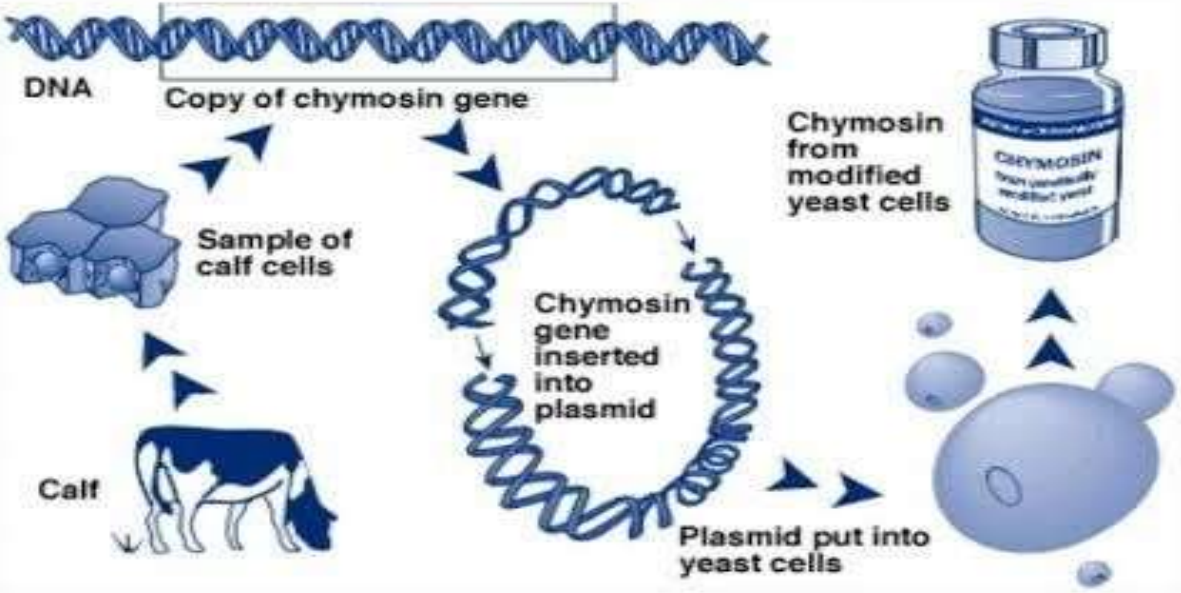
- E: coli and cloning vector pBR322 were used to increase the genes for the production of amino acids e.g. glutamic acid, lysine, phenylalanine, valine.
- amino acids, L-glutamate (MSG) and L-lysine, mostly used as feed and food additives.



Production of enzymes



Genetic Engineering of Chymosin



Thank You