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Recombinant DNA Technology and its Medical Applications.

Anway Ganguly , M.Sc , B.Ed.

RESEARCH SCHOLAR OF Ph. D (ZOOLOGY) , Seacom Skills University, West Bengal.

Abstract

Genetic engineering is the innovative idea that brings large support and way out in all kinds of necessary needs in life of living organisms as by genetic engineering multiple copies of gene can be produced. With the process of recombinant DNA technology genetic engineering greatly developed into higher level in molecular biology by its transgenesis method of recombination many spheres of life are improved to a higher extent. Artificial recombinant DNA techniques permit the genes in the human genome for its identification and mapping, and allows their fine structure determination. Recombinant DNA technology plays great role in agricultural, medicinal, pharmaceuticals, food industry, clinical and research developments and inventions. In this review paper a concept of recombinant DNA technology, steps involved in the process and medical applications are discussed in concise manner.

Keywords

Recombination, Insertions, Genetic Engineering, Isolation, Amplification, Vector, Transgenesis, Vaccine.

Introduction

The latest excellent technology brings rapid advancement in molecular biology which has its great utilization in medical sciences , genetic engineering , research advantages and biotechnological processes is nothing but the Recombinant DNA technology by which new desirable traits or improved desirable characteristics can be obtained in the living organisms by regulating target gene expressions .This technology consists of the altering sequence of genetic material to acquire enhanced and desired features of living organisms . Numerous applications are performed by Recombinant DNA technology like in food industry, health institutes, environmental aspects, medicinal and pharmaceutical uses, biotechnology or genetic engineering, agricultural improvements for better yields and qualities, and commercial purposes. In this process DNA fragments of desired trait carrying organism having desirable gene sequence is transferred through a proper vector into the recipient organism.

What is Recombinant DNA (rDNA)?

Recombinant DNA molecules are those DNA molecules that are created in the laboratory by methods of genetic recombination by combining two or more sequences which brings genetic material from various sources that is not found in genome normally.

Discovery of Recombinant DNA

Recombinant DNA molecule from various organisms was first assembled in late 1971, in Paul Berg's laboratory at Stanford. To study gene expression Berg thought to transduce cells of bacteria and mammals with a virus having recombinant DNA, but he left away from this plan and thus stopped the experiment. Next the technology of propagation and expression of recombinant genes was discovered by Stanley Cohen and Herbert Boyer in 1973. It favoured the bacterial cells transformation into living organisms for the manufacture of selected proteins . This technology was identified as a tool that is not as same used parallelly in genetics research and was applied immediately in various fields like pharmaceuticals, medicinal, agricultural, industrial, chemical etc. It is responsible for the drastic change and improvement transformation occurs in the world.

Recombinant DNA Technology

A technology which enables DNA to be formed by artificial process. The procedure is used for changing the DNA in the living organisms to obtain desirable characteristics in the desired organism to be transformed by altering sequences in DNA.

Steps involved in the process of recombinant DNA technology :-

In recombinant DNA technology process desired gene for introduction into the host is selected that could be performed with the help of appropriate vector so that the gene can be integrated with its help in this way recombinant DNA is formed. This recombinant DNA is then introduced into the host. Finally the host carries the acquired recombined feature throughout its generations.

I) Isolation of DNA

DNA can be isolated with the help of certain enzymes as it is an enzymatically controlled process by which pure DNA can be isolated.

II) DNA Fragmentation

The purified isolated DNA on association with restriction endonucleases cuts the DNA in to no. of fragments. The restriction enzyme recognizes the location or site at which the desired gene is to be entered in the genome of the host. The restriction endonuclease enzymes specifies sequences, are palindromic sequence that produces nick at specific point on the DNA. The specific site where the endonuclease produces nick or cuts is known as restriction site. The desired gene with complementary sticky ends are cut by this endonuclease and carried by the vector and its binding is accomplished by enzyme ligase.

III) Amplification by PCR

Desired gene after cutting out by restriction endonuclease is amplified by a process known as Polymerase Chain Reaction (PCR). By this process a number of copies of desired gene can be produced. The process continues followed by Denaturation, annealing and extension.

IV) Recombinant DNA insertion into the host

In multiple ways desired DNA can be inserted into the host such as gene gun method i.e biolistics, heating and cooling alternatively. microinjection, calcium ions utilization etc. This transformation enables passing of desired character throughout the generation followed by production of offspring.

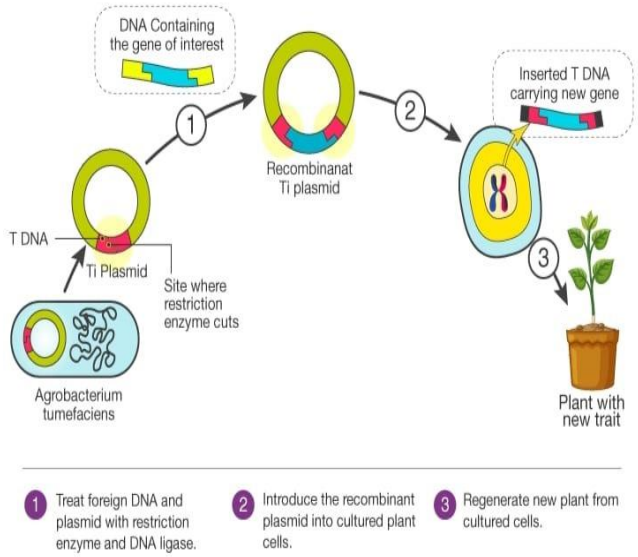

Fig :- Steps Involved In The Process of Recombinant DNA Technology.

Medicinal and Clinical Applications of Recombinant DNA Technology

Drugs for medicine production that are based on bacteria and virus as hosts could become destructive if they transformed into pathogen or remained in unpurified condition or unstable. Genetic reversion is necessary in case of some experimental procedures of gene therapy for treatment and prevention of incurable genetic and acquired diseases. Thus the proper identification of desired system for safe and efficient delivery of an altered desired gene is the primary way as this technology is advancing day by day from laboratory research to clinical purposes, trials. A remarkable advancement is noticed in Recombinant DNA technology for understanding the molecular genetics in human beings and other eukaryotic organisms.

Recombinant DNA technology brings multiple ways of treatment and prevention of diseases, production of vaccines, hormones production, research advantage in clinical laboratories, medicinal uses etc. Some of its important applications are given below :-

In development of Vaccines :-

The biological substance prepared from weak or dead cells of pathogens and is injected in the body for production of antibody against the specific antigens, this substance is known as vaccines. By Recombinant DNA Technology scientists prepared and improved vaccines with the help of cloned gene utilised for protective antigen protein. Recombinant vaccines have comparatively more efficacy and specificity than recombinant vaccines. A peaceful no, fear and painless procedure for transferring vectors of adenovirus that encodes pathogen antigens through nasal transfer is a quick and protective way against mucosal pathogens. This plays as drug vaccine by one can survive from influenza for anti-influenza form which is inserted with the help of transgene. In this way many viral vaccines are developed through this technology for as such Herpes, Hepatitis, mouth and foot infections.

Growth Hormones production :-

The polypeptide hormone responsible for growth, reproduction and regeneration of cells in humans are called as growth hormone both in human and animals. The somatotroph of pituitary gland secretes these hormones. Follicle-stimulating hormone can be produced through recombinant DNA technology in humans. FSH is a complex heterodimeric protein. Luteinizing hormone (L.H) recombination also prepared in order to enhance the pregnancy and ovulation. In this way many scientists prepared and developed many growth hormones using recombinant DNA technology and were resulted into successful treatment.

Production of antibodies :-

A foreign object when enters in a body, body's immune system releases a specific protein to fight against the antigen known as antibody. Monoclonal antibody can be produced by Hybridoma technology. the lymphocytes or B cells are combined together with myeloma cells to produce the substance called as Hybridoma. These kind of antibodies are utilised against various viral infections.

In drug investigation :-

Proper drug metabolizing enzymes are difficult to be detected and is a complex process for accurate efficacy and impacts of drugs. Through recombinant DNA by heterologous expression drug can be detected by in vitro or in vivo gene transfer.

Interferon protein formation :-

Interferon is a kind of glycoprotein that has the ability to obstruct or block the virus multiplication or division in those cells or neighbouring cell. This protein interferon is used in treatment of cancer like hairy cell leukaemia. By recombinant DNA technology this protein can be produced by *E.coli.* Interferon alpha is used in treatment of lymphoma and myelogenous leukaemia.

Diagnosis of infectious diseases :-

By recombinant DNA technology many tests can be performed for diagnosis of some infectious or communicable diseases like TB, cancer, and also measles, hepatitis and small pox. In the diagnosis process, certain pathogens are isolated and identified, and diagnostic kits are prepared when the specific pathogenic genome is known to destroy or obstruct the activity of pathogens.

Conclusion

Recombinant DNA technology is a super effective process that brings large advancement and improvement in human, animals and plants life. Using this technologies, research and inventions from all corners and needs of life are increasing day by day giving birth of new advantages in every fields. The technique is highly recommendable and utilised in agricultural , pharmaceuticals , medical , environmental , applications . By recombinant DNA technology vaccines production is developed, interferon protein can be produced, treatment of not only human and animal diseases but also plants diseases can also be performed, diagnosis of infectious diseases, gene therapies, cancer treatment etc. Thus it is largely applicable from every spheres. But somewhere a thought is always remaining for cost effective and side effects due to genetically involved process. This must be overcome in order to survive the completely free healthy life.

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