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Role of Recombinant DNA Technology in Medicine

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Abstract: ***Recombinant DNA (rDNA) is a type of artificial DNA that is made by joining together two or more DNA segment usually originating from different organisms. More specially, a recombinant DNA molecule is a vector, (most commonly ESCHERICHIA COLI) into which the desired DNA regiment has been inserted to enable its cloning in an appropriate host. This is achieved by using specific enzyme (restriction enzyme) for cutting the DNA into suitable regiment and then for joining together the appropriate regiments (ligation). Ligation plays a major role as it is the key to proper results. In this manner gene may be produced which contain the coding region from one organism joined to regulatory sequence from another organism; such a gene is called chimeric gene. Multiple varieties of proteins are created from recombinant DNA technology and it is used for medications. Some can be extracts from humans, such as human growth hormone (rHGH), human insulin, follicle-stimulating hormone (FSH) and factor VIII. Other proteins, when used as medication, only have recombinant DNA as a source, such as with erythropoietin. It has brought many revolutionary changes in the field of medicine and introduced such methods of treating diseases and delivering the drug. Genetic factors are of great importance in adult-onset diseases such as atherosclerosis, cancer and neuro-degenerative diseases. Advance in recombinant DNA technology has made it almost easy to identify those persons who are at high-risk of acquiring some of these diseases. Thus recombinant DNA technology has lead to development in predictive medicine.***

Keywords: Recombinant DNA, Restriction enzyme, Ligation, Vector

1. Introduction

Steps involved in recombinant technology:

- DNA fragments coding for proteins of interest are synthesized chemically or isolated from an organism.
- These DNA fragments are inserted into an endonuclease cleavage site of the vector that does not inactivate any gene that is required for the vector's maintenance and selective marker.
- The recombinant DNA molecules are then introduced into a host to replicate using the replication origin of the vector.
- Recipient host cells that have acquired the recombinant DNA are selected. The selection pressure is applied to enrich bacteria with a selectable marker.
- Desired clones are then are characterized to make sure that they maintain true copies of the DNA that was originally cloned.

Application of Recombinant DNA Technology

Recombinant DNA technology has made it possible to treat many diseases by replacing damaged and diseased genes in the body with new genes.It has brought revolutionary changes in the field of medicine and introduced such methods of treating diseases and delivering drugs that were once just imaginary.

Human Insulin

Insulin is basically a hormone, which is made up of proteins. This hormone is secreted in cells of the pancreas that are commonly referred to as the 'Islets Of Langerhans'. This hormone plays important role in controlling the glucose level in body, because decreased level of insulin may cause diabetes. Recombinant DNA technology has allowed the scientists to develop human insulin by using the bacteria as a host cell. A variety of different recombinant insulin preparations are in widespread use. Recombinant insulin is synthesized by inserting the human insulin gene into E. coli, which then produces insulin for human use. This is supposed to be safer than traditionally prepared drugs.

Human Growth Hormones

Human growth hormone is a polypeptide hormone. It is responsible for growth, reproduction of the cells and regeneration in humans as well as animals. It is secreted by somatotroph cells present in the pituitary glands. Before recombinant HGH became available, HGH for therapeutic use was obtained from pituitary glands of cadavers. This unsafe practice led to some patients developing Creutzfeldt-Jacob disease. Recombinant HGH eliminated this problem, and is now used therapeutically. It has also been misused as a performance enhancing drug by athletes and others. In recent days biotechnology has helped scientists to produce many growth hormones. The dwarfism disease is successfully treated with this hormone.

Vaccines

Vaccine is a biological substance that is prepared from the suspension of weak or dead pathogenic cells. It is injected in the body to enhance the production of antibodies against a particular antigen. Recombinant DNA technology has made it easier for scientists to develop vaccines by cloning the gene used for protective antigen protein. Viral vaccines are mostly developed from this technique, for example Herpes, Influenza, Hepatitis, Foot and Mouth disease.

Monoclonal Antibodies

When a foreign object enters the body, the immune system of the body produces a specific protein called antibody. Hybridoma technique has made it possible to produce monoclonal antibodies. In this technique, the lymphocytes or B cells are joined with myeloma cells; the resulting substance is called as Hybridoma. This hybridoma produces unlimited antibodies in culture. The antibodies produced are called monoclonal antibodies. These antibodies are used to produce vaccines against different viral infections.

Interferon
A glycoprotein that has the ability to block the multiplication or division of viruses in the cells or nearby cells are called interferons. It can be used to treat cancer like hairy cell leukemia. Recombinant DNA technology produces this protein using E.coli. Interferon alpha isused to treat lymphoma and myelogenous leukemia.

Antibiotics
Antibiotics are the chemical substances that are used against bacterial infections. They can be produced by microorganisms as well as in the laboratory. They have the ability to destroy microbes that cause harmful infections in the body. Alexander Fleming discovered Penicillin in 1928 using recombinant DNA technology. Other biotechnological techniques are also being used to produce antibiotics.

Diagnosis of infection with HIV:
Each of the three widely used methods for diagnosing HIV infection has been developed using recombinant DNA. The antibody test (ELISA or western blot) uses a recombinant HIV protein to test for the presence of antibodies that the body has produced in response to an HIV infection. The DNA test looks for the presence of HIV genetic material using reverse transcriptase polymerase chain reaction (RT-PCR). Development of the RT-PCR test was made possible by the molecular cloning and sequence analysis of HIV genomes.

2. Conclusion

Recombinant proteins are widely used as reagents in laboratory experiments and to generate antibody probes for examining protein synthesis within cells and organisms. Thus the use of this advanced technology, Recombinant DNA technology produces variety of products which are used for medical purposes. It is a challenging field, and play a key role in preventing genetic diseases, producing targeted medicines, and providing patients with less toxic pharmaceuticals. Hence it is gaining tremendous significance in the field of medicine today.

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