A Review: Role of R-DNA technology in medicinal industry

S.D. Bhosle1 Rohini Bhagyawant 2 R.D. Tak1

1Department of Chemistry B.P.H.E Society’s Ahmednagar College Ahmednagar.

2Department of Botany L.R.W.C. Sonpeth Dist. Parbhani.

**Abstract:**

The purpose of this review is to provide R-DNA technology and their various different types of industrial applications. Recombinant DNA technology is commonly used in virtually every aspect of the biological sciences. This short review consider the vectors are becoming standard tools in potential therapeutic agents for human disease. Different types of viral vectors used for R-DNA technology, mostly E.coli uses for synthetic human insulin production. Different applications of r-DNA technology in Agriculture sector, Food industry, Medicinal industry (Disease diagnosis, Insulin Production, Vaccine Production etc.) Biotechnology, Protein Manufacturing.

**Keywords:**  Plasmid Bacteriophage, Reverse transcriptase, RNA polymerase, Cloning, Restriction endonuclease, PCR (Polymerase chain reaction).

**Introduction:** Recombinant r DNAtechnology it includes some kind of procedures for analyzing DNA fragments from one to several organisms including introduce r DNA molecule into cell for replication into genome of the target cell. The R DNA technology was discovered in 1960s by Werner, Arber and Hamilton Smith.

**Principle of Recombinant DNA technology**

Principle of recombinant DNA technology has different steps these are as Gene cloning, development of recombinant DNA; Transfer of vector into the host; Selection of transformed cells and Transcription as well as translation of inserted gene. The meaning or definition of r DNA technology is to identify, to isolate, to manipulate and to re-express genes from a given host [1-9]. The use of AAV mediated gene delivery and RNA mediated gene silencing is to transforming the potential therapeutic options for patients suffering from inherited metabolic liver diseases.

**Applications of Recombinant DNA technology:**

1. **Insulin production**

Synthetic human insulin prepares using Recombinant DNA technology. Synthetic/recombinant DNA insulin is produced by introducing the human insulin gene into a yeast/bacterial host cell, results in the production of insulin that is the same as that made by human pancreas in its natural state.

Insulin was previously extracted from pancreases of slaughtered animals particularly pigs and cows, before the invention of RDT. Unfortunately, this method had several disadvantages, including possibility of allergic reactions to animal proteins and the danger of spreading diseases from animals to people. [10] Insulin produced by r DNA technology, it is the first commercial health care product derived from R-DNA technology.Amongst 1982 protocol received all acceptance from national drug regulatory authorities, notably this US Snack or Drug Administration, hence enabling and economically survive mass manufacturing of human insulin, a hormone that regulates blood sugar levels and shall made naturally by beta cells in the pancreas. This facilitated that widespread commercial availability of insulin at a price affordable to patients with the functional muddles types 1 or 2 diabetes sweetness, who either fail to hervorrufenoder till metabolize sufficient insulin[11].

1. **To Improve Life:**

Possible to treat with intrinsic angle of life for example, to improve health, enhancing food resources and opposition to varying adverse environmental effects. Especially in farming, the genetically modified plants have augmented resistance to damaging agents, increased product yield, and shown increased adaptability for finer existence.

1. **Disease Diagnosis:**

Recombinant DNA has revolutionized medicine and research in many ways. For instance, it has enabled genetic engineering of various organisms for research purposes. Furthermore, r DNA technology made it feasible to sequence and analyze human genome, leading to the discovery of new genes and the identification of genetic mutations that cause disease. This has greatly advanced our understanding of genetics and provided new targets for drug development. One large field of application for recombinant DNA, related to medicine and research, is biotechnology – as shall be illustrated in the following chapter. Clinical experience with systemic administration of Retroviruses and Lentiviruses for liver diseases is scarce. [12] Many scientists written on recombinant adeno-associated virus vector tropism in ocular tissue, recombinant adeno-associated virus vector host cell infection, and potential recombinant adeno-associated virus vector-treatable inherited retinal diseases [13–17]. Generate a viral vector for gene therapy, the viral gene is required for replication and that cause pathogenicity are normally decreases from viral genome and supplant by genetic sequence to be delivered. Maintaining the replicative capability of the virus is advantageous for some applications, such as for oncolytic or tumorur cell killing viruses. Viral vectors that have been used for liver targeted gene therapy mainly include vectors based on AAVS, Adenoviruses, Retroviruses and Lentiviruses as different vectors served for different applications. [18,19,20,].

1. **Biotechnology:**

R-DNA is a key tool in biotechnology, which involves use of living organisms or their components to develop useful products and processes. The main application of r DNA in biotechnology is the production of recombinant proteins, including recombinant antibodies. Recombinant antibodies production includes the use of recombinant DNA technology. These antibodies can be engineered to recognize specific targets, such as cancer cells, and can be produced in large quantities using recombinant DNA technology. This is why rAbs have opened several doors in the research and treatment of numerous medical conditions.

1. **Agriculture Sector:**

Recombinant DNA is useful in agriculture because it allows scientists to modify genetic makeup of crops to improve their yield, quality, resistance to pests and various diseases. Crops have been developed to tolerate environmental stresses, such as drought or high salinity, which can reduce crop yields. They can also require fewer pesticide applications, which can reduce environmental damage and lower production costs. Overall, recombinant DNA technology has contributed to increased food production, Improve crop yield, Pest resistance, Herbicide tolerance and improved agricultural sustainability.

1. **Food industry:**

Recombinant DNA is an important tool used in the food industry to improve the quality, safety, and nutritional value of food. It plays a crucial role in the production of genetically modified (GM) food, as r-DNA technology allows scientists to insert, delete or modify specific genes in an organism’s DNA in a precise and controlled manner. R DNA technology also used to produce food additives and enzymes for production of various food products. E.g. Golden Rice, Flavr Savr tomato, Arctic apples.[21]

1. **Manufacture of Medicinal Proteins**:

Therapeutic proteins like insulin, growth hormone, and clotting factors, which are used to treat a variety of disorders, can be produced by genetic engineering.

1. **Vaccine Preparation**:

By introducing genes that code for particular antigens into a virus or bacteria, genetic engineering can be used to create novel vaccinations. This method has been used to create vaccinations against illnesses like the human papilloma virus and hepatitis B. (HPV).

1. **Pharmacogenomics**:

Genetic engineering can be used to investigate how a person's genes influence how they react to medications. With this data, personalized medicine can be created, and patients who are more likely to have negative drug reactions can be identified.

1. **Genome Editing**:

With genetic engineering, disease-causing genetic mutations can be fixed in an individual's genome. CRISPR/Cas9 genome editing technologies have shown promise the treatment of illnesses as sickle cell anemia and Huntington's disease.[22,23] Use of r DNA technology to produce intrinsically engineered organisms started inches who early 1970s with the pioneering inscertion of genes into bacteria just E. coli species.[24] Successful pilot experiments, in 1978 Caen and colleagues progressed to transfer an insulin synthesis genes into ampere plasmid of E. coli, manufacturing first-time genetically modified entity.[25]

1. **Gene Therapy**:

Gene therapy uses genetic engineering to introduce or replace dysfunctional genes into the body to cure hereditary illnesses. A new gene is inserted into a patient's cells during gene therapy to replace a damaged one. Cancer and conditions like cystic fibrosis have both been treated using this method.[26]

**DISCUSSION AND CONCLUSION:**

R DNA technology is a significant advancement in science greatly facilitated human life. It has developed ways in recent years for medicinal applications such as the treatment of cancer, hereditary illnesses, diabetes, and numerous plant ailments, particularly fungus and viral resistance. R DNA technology has transformed several disciplines of research, including Health, Agriculture, and Biotechnology. Scientists can edit and modify DNA to generate new species with desired properties or to produce useful items on a massive scale via genetic engineering.

**Future Outlook of R-DNA Technology:**

Researchers conclude that the advances in r DNA technology, in knowledge of the host immune response, and in the genetic makeup of disease agents will lead to new vaccines against diseases for which no control measures currently exist. R DNA technology playing a vital role in improving health conditions by developing new vaccines. Treatment strategies also improved by developing diagnostic kits, monitoring devices and new therapeutic approaches. It means to help monitoring, detect and cure diseases in less time and in fewer amounts; time consuming as well as money.

Different vectors are used in producing vaccines to cure diseases.

**References:**

1. Aruffo A. Seed B. Molecular cloning of a CD28 eDNA by a highefficiencycos cell expression system.ProcNatlAcadSci USA1987:84:8573-7.
2. Berger SL, Kimmel AR. eds. Guide to molecular cloning techniques. Methods Enzymol. San Diego. CA:AcademicPress,l987.
3. BurkeDT.CarleGF.OlsonM.CloningoflargesegmentsofexogenousDNAintoyeastbymeansofartificialchromosomevectors.Scienc1987:236:806-12.
4. JuliusD.MacDermottAB.Axe!R.Jesse!!TM.Molecularcharacterizationofa functionaleDNAencodingtheserotoninIcreceptor.Science1988:241:558-64.
5. LewinB.GenesIV.NewYork:OxfordUniversityPress.1990.
6. SaikiRK.GelfandDN.StoffelS.etal.PrimerdirectedenzymaticamplificationofDNAwithathermostableDNApolymerase. Science1988:239:487-9.
7. Sambrook I. Fritsch EF. Maniatis T. Molecular cloning. A laboratory manual. Cold Spring Harbor. NY:ColdSpringHarborLaboratoryPress. 1989.
8. SchwartzDC.CantorCR.Separationofyeast chromosomesizedDNAsbypulsedfieldgradientgeleleetrophoresis.Cell 1984:37:67-75.
9. SilvermanGA.YeRD.PollockKM.SadlerJE,KorsmeyerSi.Useofyeastartificialchromosomeclonesfor mapping and walking within human chromosome segment 18q2 I .3. Proc NatIAcadSei USA1989:86:7485-9.
10. Sagar Anil Godse, SivajiMarutiPatil et.al (2023) Recombinant DNA technology : World journal of pharmaceutical research 7, 718-731.
11. Beardmore JA, Porter JS. Genetically modified biology and aquaculture. Eat and agriculture your on the joint People. FAO Fisheries circular No. 989, Rome, Italy FAA publications; 2003 P. 1-35.
12. Zabaleta N, Hommel M, Salas D, Gonzalez-Aseguinolaza G. Genetic-Based Approaches

to Inherited Metabolic Liver Diseases. Hum Gene Ther 2019;30:1190-1203.

1. Rodrigues, G.A.; Shalaev, E.; Karami, T.K.; Cunningham, J.; Slater, N.K.H.; Rivers, H.M. Pharmaceutical Development of AAV-Based Gene Therapy Products for the Eye. Pharm. Res. 2019, 36. [CrossRef] [PubMed]
2. Boye, S.L.S.E.; Boye, S.L.S.E.; Lewin, A.S.; Hauswirth, W.W. A comprehensive review of retinal gene therapy.Mol. Ther. 2013, 21, 509–519. [CrossRef] [PubMed]
3. Vandenberghe, L.H.; Wilson, J.M.; Gao, G. Tailoring the AAV vector capsid for gene therapy. Gene Ther. 2009,16, 311–319. [CrossRef]
4. Wang, D.; Tai, P.W.L.; Gao, G. Adeno-associated virus vector as a platform for gene therapy delivery. Nat. Rev.DrugDiscov. 2019, 18, 358–378. [CrossRef]
5. Cheever, T.R.; Berkley, D.; Braun, S.; Brown, R.H.; Byrne, B.J.; Chamberlain, J.S.; Cwi…
6. Temegen Begna (2020) Role of recombinant DNA technology in agriculture, International journal of research in agriculture and forestry 2394-5915.
7. A.C. Cozmescu, J. Counsell, P Gissen, gene therapies targeting the liver 74 (2021), PP. 235-236
8. J.Baruteau, S.N. Waddington , I. E. Alexander, P Gisses .gene therapy for monogenic , liver diseases: Clinical successes, current challenges and future prospects Inherit Meta Dis, 40(2017) PP. 497- 517.
9. https://www.evitria.com/journal/recombinant-antibodies/what-is-recombinant-dna-used-for/#:~:text=FAQs%20about%20rDNA%20technology%20and%20its%20applications,-What%20is%20the&text=It%20enables%20the%20production%20of,enzymes%2C%20hormones%2C%20and%20vaccine.
10. N. Zabaleta , M. Hommel , D Salas, G. Gonzalez- Aseguninolaza genetic based approaches to inherited metabolis liver diseases Hum Gene Ther, 30(2019), PP.1190-1203.
11. Frewer, L.J. and Shepherd, R., Ethical concerns and risk perceptions associated with differentapplicationsofgeneticengineering:Interrelationshipswiththeperceivedneedforregulationofthetechnology.AgricultureandHumanvalues,1995;12:48-57.
12. Frewer, L. J., Howard, C., & Shepherd, R. Public concerns in the United Kingdom about general andspecific applications of genetic engineering: Risk, benefit, and ethics. Science, Technology, & HumanValues,1997;22(1):98-124.
13. Cohen SB, chnag AC, Boyer HW, et al. Construction of biological full bacterial plasmids in vitro. ProCNatlAcadSci USA. 1973; 70(11): 3240-3244.
14. American society of gene and cell therapy. Gene and cell therapy FAQS (2019). <https://www.asgct.org/education/more-resources/gene-and-cell-therapy-faqs>.
15. Johnason IS. Human insulin from recombinant DNA technology. Science. 1983; 219 (4585): 632-637.