Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6390

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (2):** 25-30 (2018)

Review Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

An Overview: Current Revolutions in the Field of Genetic Engineering

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Received: 10.03.2018 | Revised: 16.04.2018 | Accepted: 20.04.2018

ABSTRACT

Genetic engineering is a best technology which is promoting the world and this technology is applied on many plants, animals and microorganisms. It has wider applications in the field of Biology, Medicine, Industry, Research, Agriculture and many other fields of science. This new technology of genetic engineering has given a new high ranked status to Biotechnology. This new technology gives a chance to alter the genetics of an organism through DNA incorporation. To get maximum results and success in, Food, Animals and Plants etc. Genetic engineering has no boundaries and limitations, it is a vast field and there is a road of success in it. In this review paper, promotions in the field of Genetic engineering will be genetic engineering, it is necessary to be expert in proceedings and there should be fine tools. When, we are able to apply this technique very attentively, and then we can easily solve the problems of Health discussed briefly.

Key words: *Genetic Engineering, DNA, Biotechnology*

INTRODUCTION

Everybody knows well to the term 'Gene' because there are different genes which are responsible for numerous traits of any living organism. So, the question arises that why do we need genetic engineering? The reply is very easy because through it we want to incorporate our desired traits and characteristics in to living organism. Genetic engineering is a set of different techniques which are used for direct genetic alteration of the organisms or different populations of living organisms using recombination of DNA. It is now possible to direct insert foreign DNA particle into the genome or remove the DNA particle for the goodness of mankind.

General Techniques Used in Genetic Engineering:

According to Zuker *et al*.[19], there are various techniques which are used in genetic engineering.

Cite this article: Aslam, M., Saeed, M.S., Sattar, S., Sajad, S., Sajjad, M., Rehan, M., An Overview: Current Revolutions in the Field of Genetic Engineering, *Int. J. Pure App. Biosci.* **6(2):** 25-30 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6390

Some of these techniques are explained below:

Recombinant DNA Technology: this is very old method used in genetic engineering. In this technique, plasmids or vectors are utilized to enter the genetic material in to the host cell. Usually, viruses and bacteria are used for vector purposes. Bacteria contain an extra chromosomal DNA in it in the form of circular DNA which is called plasmid. In recombinant DNA technology, gene of interest forms a circular shape when incorporated in to the plasmid. Then, this plasmid starts multiplying inside the bacteria and produces numerous genetic copies of these plasmids aside with its own genetic makeup. It is further transferred to the host cell where it finds the nucleus and discharges its gene of interest in the nucleus. This gene of interest combines with the genetic material of host cell and then easily shows its properties through the process of transcription and translation. Normally, the Insulin product is prepared through this technique.

Bioballistics Technique: It is another technique of genetic engineering in which metals silver coated with desired gene are used. These metals silver coated along with gene which is smaller than a cell are loaded in the shot gun. This shot gun straightly targets the cells and incorporates its genetic material into host cells. It locates nucleus and finds the genome of host cells and performs its desired function.

Microinjection Technique: In this technique, glass micropipette is taken to transfer the desired gene into the human or animal cell. This technique does not require any plasmid or vector to transfer the gene of interest but in this method, gene of interest is inserted into glass micropipette which is in size equal to the animal, plant or human cell. Then, the DNA finds its way inside the host cell and easily finds nucleus where foreign DNA performs its function.

Electro and Chemical Poration Technique: It is another technique used in genetic engineering in which cells are prepared porous because through this genes can be entered easily. The pores are made into the cells by bathing them into special chemicals or by bathing them with electric currents. By these pores, genetic material enters into the pores of cells and finds nucleus and adds with host cell genome and then, performs its function and shows desired traits in the genetically engineered organisms.

Revolutions in the Field of Genetic Engineering

There have been many revolutions in the field of genetic engineering. Some of these revolutions are described below:

There made many attempts to transfer the textile properties into the microorganisms in which textile properties are transferred inside the microorganisms. Then, these are more rapidly reproduced through fermentation process. The DNA is transferred inside the bacteria which is spider type and prepares the bacteria to produce proteins with strength properties to produce silk for usage in vests.

According to Montaldo Hugo[4, 12, 18], Cystein is an amino acid which is limiting for wool synthesis. Then, there was made first attempt to increase its production from transferring cystein production genes from bacteria to the sheep genome where it modified the wool of sheep for getting high quality fiber.

Viruses are also engineered to create infections and alterations the DNA of special cells of human body. So, it can synthesize its own medicine. Due to this ability inside the human body, every disease can be cured easily. Haemophilia is treated through gene therapy which is a revolution in the field of genetic engineering.

Crops are also genetically engineered for drought environments. According to Ortiz *et al*.[1, 8, 14, 17], by successful engineered crops like maize, rice, and wheat etc. can be synthesized through genetic engineering by utilizing *DREB* like genes. There is now good news for future of cereals crops because through genetic engineering scientists will be capable to produce such varieties of cereals which will be highly drought resistant and farmers will be able to grow them in drought environment. This will be very attractive for growers because this is such a trait which is

tough to do to transfer in plants because of its genic nature as it is controlled by polygenes.

Human Embryonic Stem Cells can be genetically engineered through utilizing Lentiviral vectors. A *hES* present very valuable Human Embryonic Cell has strong role in disease treatment. They are such cells which are used inside the body when the cells or tissues of body get damaged, and then they are used as repairing source. These cells have the ability to form and to differentiate in vitro to manufacture hematopoietic, neural and endothelial, cardiac and trophoblasts cells. A major hindrance in their consumption is that there is slower efficacy of site directed differentiation into differentiated cells.

There is another revolution in the field of Livestock due to genetic engineering. Laible[3,9] studied that expression of the monoclonal antibodies identifying special pathogens is easily utilized to incorporate disease tolerant characters into the livestock. By using these antibodies, there is a good way to conserve the immunity of livestock and through these methods we are able to cure different diseases in livestock like neurological diseases etc.

Another disease Mastitis, the infection through bacteria in mammary glands is one of the devastating diseases and is very serious in agricultural industry. The animals are strongly affected and then are died at once. It is caused by *Staphylococcus aureus* in dairy cattle. It is very dangerous pathogen and is very tough to control it through antibiotic treatment because it survives in intracellular ways. Laible[3, 9] observed that Lysostaphin is an enzyme which occurs naturally in Staphylococcus simulans which is endopeptidase which cuts or cleaves the cell wall part of Staphylococci. It has characters of antimicrobial effects and can be used for the treatment of Mastitis. This enzyme application test was first practiced in mouse successfully. Through the genetic engineering, the cattle produce Lysostaphin in their milk and there observed enhanced degree of safety against *S. aureus*.

Trees are also genetically engineered to produce environmental as well as economic benefits. According to Pena and Seguin[15] viral sequence can be easily introduced inside the trees by which plants get ready against viral infections and they have strong immunity against viral infections. We will take example here that coat protein gene of Plum Pox virus *PPV* that utilized in the Prunus plant gives higher levels of tolerant against this virus. This is because of posttranscriptional gene silencing. There are much more techniques that are used in this regard.

Chen *et al*.[4, 12, 18] observed that defense system of antimicrobial peptides which are usually over expressed in insects, plants and mammals. These are very important part of the human immune system. Getting peptides is very expensive and its presence is very limited. Human defensins are prepared through genetic engineering. This method is preferred for producing defensins. There is lot of efforts to make improvements in expression efficacy of human defensins.

Genetic engineering is also used to modify biomass characters. There efforts have been made to produce more bioethanol from *Zea mays* (Maize). According to Torney *et al*.[1, 8, 14, 17]; two main parts of maize plant can be shifted towards bioethanol. These parts are kernel and stover. Kernel is composed of starch and stover is made up of cellulose or lignin. To obtain ethanol, these parts are converted into the fermentable sugars. For this efficient work, there are many efforts made to use genetic engineering to get more bioethanol. One system is to alter the characters of cellulose and lignin or starch. Through this way, we can get more by-products readily. Other strategy is introducing biomass conversion enzyme into plants, then these can help the conversion process much well.

Abiotic stresses cause enhanced levels of salty soil, less amount or high amount of water availability and different temperature systems. These abiotic stresses cause big loss of plant biomass. It adversely affects the plant yield as when we will get reduced plant biomass, then directly we will get reduced yield. According to Grover *et al*.[7], transgenic

tobacco plants were cultivated to combat with the abiotic stress like increased cold and salt stress. Now, the transgenic plants have been produced which are resistant to water stress, drought stress and temperature stresses. Through genetic engineering, we can also increase the osmolytes quantity inside the cell to combat with abiotic stress situations.

Milk is very useful diet for human health and is utilized in body functioning. There are some components which are present in dairy milk. These components are modified through genetic engineering to enhance the quality of milk. In adults, a milk sugar roots to the intestinal disorder because of lacking of an enzyme called intestinal lactosehydrolyzing enzyme to digest milk after milk drinking. Laible[3, 9] observed that there are two strategies to overcome these problems. One is gene knockout and other is gene knockdown. In gene knockout strategy, expression of α-lactalbumin is completely disrupted which causes lactose free milk but in other strategy, its expression is decreased by RNA interference *RNAi* resulting in lack of lactose but some lactose is present in milk. This all is done through genetic engineering process which is a well-practiced technique by humans.

Why genetic engineering is important?

Genetic engineering is the field of biotechnology that deals with genes. There are sets of techniques which are used in genetic engineering. We take genes from one organism and are then incorporated into another organism. So, effects of these inserted genes are checked. It is a very good field for human beings to get innovations inside the human body too. Suppose, we take genes from bacteria and these genes in bacteria produce proteins for any beneficial characters and then these are inserted inside the human body, there these genes will express and show best characters and directly mankind will get benefits. So, different genes are inserted in human beings to improve human organs and body.

Genetic engineering is also used to transfer specific traits into the plants. It has the power and ability to produce such fruit producing plants that will grow fast due to genetic engineering. These plants will grow fast in less fertile soils to give better yield and these plants will be more resistant to diseases and insect pest attack. These techniques are not so much easy because they need several attempts to be done.

It has the ability to slowdown the aging process in humans and can increase the human lifespan but possible through genetic engineering. This technology can be used to heal the body parts and inserting them into the human body. Along with this, genetic engineering has also provided us with alleviated illness, cleaning up the environment and increased crop yields. Ananda prepared a first genetically engineered a bacteria into *Burkholderia cepacia* which is a variable form and digests the petroleum products and this bacteria cleanses the oil plants and is quite safe and advantageous. Genetic engineering has provided chances for humankind to create researches in the field of medicine, agriculture, livestock, zoology and many other fields of science. To cure human disease diabetes genetically engineered bacteria produce insulin.

Production of insulin without genetic engineering is more expensive. So, through genetic engineering insulin is produced.

The first genetically engineered mouse was patented for utilization as a model mouse in the medical research against cancer disease was *Onco Mouse*. Many knockout processes of genes have been inserted in this mouse to test the cancer diagnostics and treatment criteria. This mouse proved a better source because through this mouse we are able to test drugs and other treatments for human genetic diseases without any side effects on human life. Gene therapy is used to correct genetic diseases and defects in fully matured humans. In this method, viruses deliver repairing to somatic cells that contain genetic defects.

Conclusion and Future Viewpoint

Genetic engineering has both aspects as it has advantages and disadvantages too. We know well that the misuse of gene is very dangerous but at the same time its applications in food, science and industry are very amazing. Making and using clones may create issues of culture, ethics and government policies but we should be well-known to them.

Now, researchers are trying their best to map out the human DNA. When they will completely able to map out complete genome of plants, animals and humans, then our computers will have the information of our body formation. Then, they will be able to modify our traits safely through genetic engineering because they will know that this gene has this specific function.

The only need in genetic engineering's field is to progress powerful tools and techniques. Once this issue will be solved, the life will be beyond the imagination. Our lifestyle will get changed and will be able to enjoy happy life. No doubt this is possible through genetic engineering.

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