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Trends in Biogenetics in Human Diseases

The term *Biogenetics* may sound like a lab that makes medical equipment or conducts research in genetics. But it is actually a production of living organism or tissues or organs from living organisms and not from nonliving matter. Studying living organisms and inheritance organisms comes the under umbrella of *Biogenetics.*

In order to understand nature, man was very inquisitive of all living organisms and that led to the development of the subject biology. Genetics is a part of biology. Biogenetics is the branch of biology concerned with altering the genomes of living organisms. Although it relates to the production of living organisms from other living organisms one can suppose that it is a recurrence of the evolutionary stages of species during the embryonic development and differentiation of member of that species.

People have been altering the genomes of plants and animals for many years using traditional breeding techniques. Artificial selection for specific, desired traits has resulted in a variety of different organisms, ranging from carrot to hairless cats. But this artificial selection, in which organisms that exhibits specific traits are chosen to breed subsequent generations, has been limited to naturally occurring variations. In recent decades, however, advances in the field of genetic engineering have allowed for precise control over the genetic changes introduced into an organism. Today, we can incorporate new genes from one species into a completely unrelated species through genetic engineering, optimizing cures for disease or facilitating the production of valuable pharmaceutical substances. Crop plants, farm animals, and soil bacteria are some of the more prominent examples of organisms that have been subject to genetic engineering under biogenetics.

Today, an enormous amount of genetic information is viable which is continuously fed by worldwide genome sequencing programs. Every day the human genome-sequencing program alone provides new information about human genes with potential therapeutic value. Therefore, the impact of Biogenetics on everyday life has increased enormously over the last two decades.

Specially in medical diagnosis of human diseases, pharmaceutical and pharmaceutical industries and lately even agricultural applications of Biogenetics have become standard. New trends in studies on different mechanisms for transporting DNA into the living cells, compact of DNA and compacted DNA get attached to the cell surface, barriers to efficient gene transfer, tissue sourcing and understanding of bio artificial organs.

With the progress of Biogenetics, new remedies for many human diseases are being discovered. Basically organs and cells of animal origin are manipulated genetically to cure some of the common genetic diseases like diabetes. Transplant of bio artificial livers for liver infections and hearts for cardiovascular disease are the new horizon of Biogenetics.

Living organs and cells are considered as a source of tissue for xenotransplantation. The islet of liver cell transplantation has become a widespread treatment for Type 1 diabetes. The solution must be found for increasing the availability of insulin-producing tissue and for overcoming the need for continuous immunosuppression. Insulin-producing cells being considered for clinical transplantation include porcine and bovine islets, fish-Brockman bodies, genetically engineered insulin-secreting cell lines and in vitro produced “human” beta-cells.

Both primary tissue and cultured cell lines have been employed in small animal xenotransplantation, including cells that have been genetically modified. Substantial efforts have also been made in the isolation of primary tissue, especially for pancreatic islets, though further improvements are necessary for practical, large-scale processing. The most urgent problem in transplantation is the shortage of donor organs and tissue.

Xenotransplantation could offer some advantages over the use of human organs. Xenotransplantation could be planned in advance; the organ would be transplanted while it is still fresh and undamaged. In addition, a planned transplantation allows the administration of therapeutic regime that call for the pretreatment of the recipient. Another advantage is the possibility that animal sources could be genetically engineered in order to lower the risk of rejection by expressing specific genes for the benefit of the patient.

Scientists are now concentrating on alternative tissue sources. Recently islets have been isolated from primates and xenografted into immunosuppressed, diabetic rodents, with short-term reversal of diabetes. However, there are ethical issues surrounding the use of primates for these studies. Other promising islet sources are porcine, bovine and rabbit islets, all of which function remarkably well in diabetic rodents. Long-term human, bovine and porcine islet xenograft survival have been documented in nude mice and rats, suggesting that, in the absence of an immune response, sufficient islet-specific growth factors are present in xenogeneic recipients.

Tissue engineering involves the *in vitro* or *in vivo* generation of organoids such as cartilage, skin or nerves. More enthusiastic seeks to recognize the quality of life of the diseased or injured patients and reduce the economic burden of treatment.

The biological organ or the bioartificial organs involve an *in vitro* prepared tissue-material interface fabricated into a durable device. A typical example is the bio artificial pancreas. The extra-corporeal bio artificial liver and the bio artificial kidney14 are examples of the transient replacement of organ functions, the former intended as a bridge to stabilize comatose patients until a whole organ can be procured.

Transplanting bioartificial organs need continuous immunosuppression. Encapsulation technology prior to the application of this bioartificial organ has experienced in in situ insulin production. The main motive of cell encapsulation technology is to overcome the existing problem of graft rejection in tissue engineering applications and thus reduce the need for long-term use of immunosuppressive drugs to reduce the side effects. Basically cells are immobilized within a polymeric semi-permeable membrane that permits the diffusion of molecules like oxygen, nutrients and other growth factors essential for cell metabolism. At the same time, the semipermeable nature of the membrane prevents immune cells and antibodies from destroying the encapsulated cells regarding them as foreign invaders. Recent studies have demonstrated that when these microencapsulated islets were implanted into diabetic rats, the cells remained viable and controlled glucose levels for several months.

Gene therapy is another domain where the efficient transfer of genes is essential. Many severe human diseases are caused by a genetic defect leading to the mal /over/ under-expression of the corresponding protein. Patients could be permanently cured if the missing genes could be transferred in a functional form into the concerned organs. Delivery of genes to specific tissues could become the most efficient medical treatment in the future, but for obvious reasons, the establishment of a very safe and well-controlled method for gene delivery is an imported fact.

What are the barriers for Biogenetics?

DNA is the common carrier of the genetic information for all living entities of the planet that inspires variability in different organisms. All living organisms are exposed to large quantities of foreign DNA in the form of food or bacterial infections. Under these circumstances, nature had to provide powerful barriers against the spontaneous insertion of foreign DNA sequences into the genomic DNA of cells. Barriers are the plasma membrane of the cell, the envelope of the cell's nucleus, but also the possibility for DNA degradation in lysosomes and the cytoplasm. These protective mechanisms work rather well and even under optimized conditions. It is by no means easy to genetically modify a eukaryotic cell. However, the necessity to transfect cells for research purposes, the discovery of new and efficient reporter systems to verify the success of a transfection experiment (luciferase, green fluorescent protein) as well as the availability of powerful transfection reagents have spurred research in the area for many years. Several methods to transfer genes into cells have been developed during the last 30 years. However, considerable efforts to develop new techniques or to improve the efficiency of old ones are still being made.

Transfection reagents help to overcome the natural barriers to gene transfer by various strategies. The steps involved in the transfer of a "gene" from the outside into the genome of the cell comprise of the following steps; compact of the DNA, attachment to the cell surface, transport into the cytoplasm, import into the nucleus and insertion into the chromosomal DNA. Biogenetics has turned a new era on the planet.