

* Metabolites

→ A metabolite is any substance that is produced during metabolism or that takes part in metabolism.

→ Metabolism is the conversion of one body chemical compound into another compound in the body. The resulting compound is called a metabolite.

* Primary Metabolites

→ We know that all primary metabolites have essential functions in our body for proper functioning.

→ All living organisms require some chemical compounds that are essential to the structure and function of the cell. These compounds are referred as primary metabolites.

→ Some of the primary metabolites act as building blocks of macromolecules and some act as coenzymes.

- Example of primary metabolites -
- Carbohydrates
- Amino acids
- Organic acids
- Purines
- Pyrimidines and
- Vitamins

→ Metabolism of these compounds is known as primary metabolism.

* Secondary Metabolites

→ Secondary metabolites are organic compounds produced by bacteria, fungi or plants which are not directly involved in the normal growth, development or reproduction of the organism.

→ The secondary metabolites are compounds which are not essential for the structure and function, but necessary for maintaining the proper health and state of the cell or body.

→ Secondary metabolites play an important role in humans as various important therapeutic products.

like medicines, pigments, flavoring and recreational drug.

→ Secondary metabolites also play a role in host such as protection, competition and species interactions but not survival.

→ Secondary metabolites are specific to an individual species, there is an evidence that horizontal gene transfer across species of entire pathways plays an important role in bacterial evolution also in fungus.

→ There are many secondary metabolites that are produced inside the animal cells as well as we take it from outside as some therapeutic products, hormones, etc.

→ Interferons, growth hormones, insulin and other metabolites acts as secondary metabolites because they do not directly involve in our metabolic process. Either it plays a role in according to need of the body.

* INSULIN

→ Insulin is the most important body hormones or cellular hormone present inside the pancreas or pancreatic cell of where β -cell of Islet of Langerhans produces this hormone.

→ This hormone maintains the blood glucose level inside the living cell especially mammalian cell.

→ It Insulin is required for normal glucose homeostasis.

* Structure of Insulin

→ Insulin is composed of two (2) polypeptide chains called α -chain and β -chain.

→ α and β -chains are linked together by two disulphide bonds. Also an additional disulphide bond is present within the α -chain.

→ α -chain consists of 21 amino acids and β -chain consists of 30 amino acids.

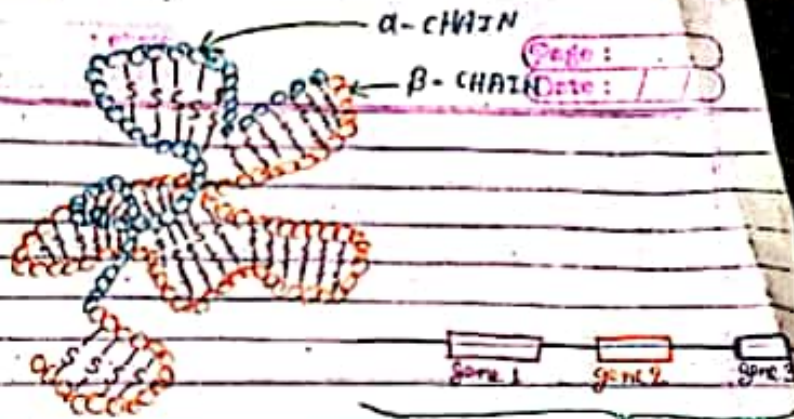


Fig.:- INSULIN CHAIN

STRUCTURAL GENE OF INSULIN

Figure:- STRUCTURE OF INSULIN

→ Insulin gene is present on chromosome number 11.

* Production of Insulin Hormone

→ Insulin is generally produced inside the living cell according to need.

→ We know that it maintains the blood glucose level of the body, that's why when excess glucose increases in our body then insulin decrease its amount.

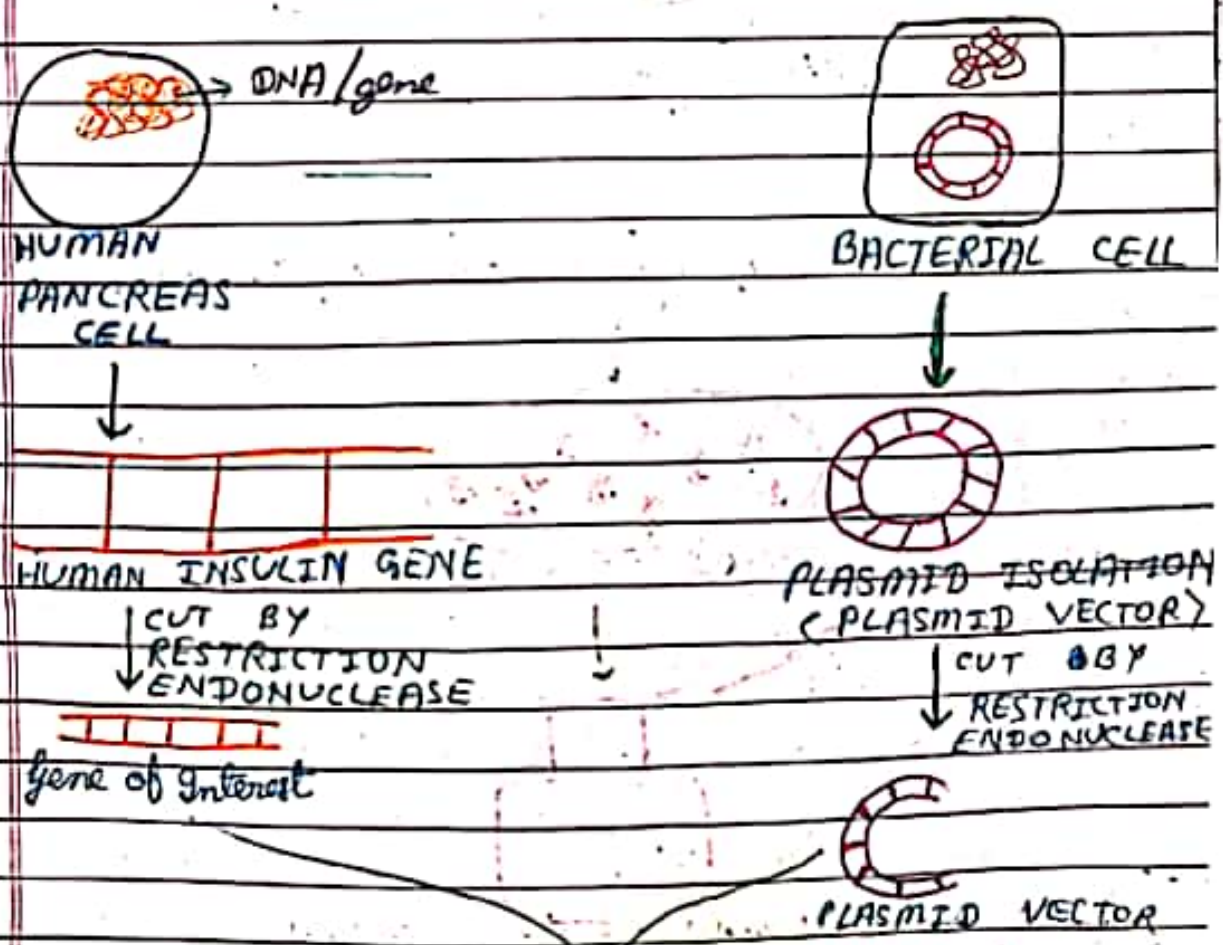
→ Due to this function of insulin scientists has established a method for production of insulin in 'in vitro' condition.

→ So, now a days insulin is produced at a large scale through recombinant DNA Technology.

→ A special form of Insulin called Humulin is made from recombinant DNA which is human insulin.

* Protocol or Procedure for Production of Insulin through Recombinant DNA Technology

- Recombinant DNA Technology plays a vital role for the production of insulin.
- In this technique we select a healthy cell that continuously produces insulin (by β -cell of pancreas).
- A healthy bacterial cell is selected for the isolation of its Plasmid.



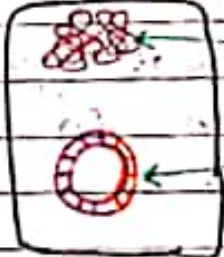
Insertion of gene in the Plasmid Vector.

Insertion of gene in the Plasmid Vector.



RECOMBINANT PLASMID
OR
RECOMBINANT VECTOR

Transfer of Recombinant vector to target cell



NUCLEOID

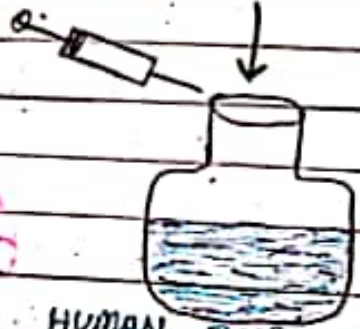
RECOMBINANT PLASMID VECTOR

BACTERIAL TARGET CELL

Cloning of this Target Cell



CULTURE OF THE BACTERIAL CELL (CLONING)



HUMAN INSULIN EXTRACT

Fig.:- PRODUCTION OF INSULIN BY R.D.T.

* Procedure

- ① → In this technique, first we select a desired gene of ~~insulin~~ ^{insulin} contained cell and a plasmid vector containing ~~bacteria~~ ^{bacterial} cell.
- ② → We isolate the desired gene of insulin from cell (human or from other sources) and also isolate plasmid from bacterial cell.
- ③ → Then we digest (cut) the desired gene of insulin as well as plasmid vector by Restriction enzymes.
- ④ → Now desired gene of insulin is inserted inside the plasmid vector and ligates to the gene with it (plasmid vector) by the enzyme DNA ligase. Now this plasmid is called Recombinant Plasmid.
- ⑤ After that, we select a suitable target cell (bacterial cell) and transfer the recombinant plasmid inside the target cell.

⑥ After transfection, plasmid containing desired gene of insulin replicates inside the target cell and able to produce a insulin.

⑦ These target bacterial cells are cultured at large scale having capacity to produce desired insulin at large scale.

Finally we extract the insulin from these growing cells. These products are utilized for human welfare purposes.

* Application of Insulin

(I) Insulin is used to control high blood sugar level in people with diabetes.

(II) By this way it also prevent kidney damage, blindness, nerve problems, etc. heart attack, etc.

(III) Insulin protects from hypoglycemia (too high blood sugar level) or hypoglycemia (too low blood sugar level).

* Growth Hormone

→ Growth hormone (GH) is also called somatotropin or human growth hormone (hGH or HGH) in its human form.

→ It is a peptide hormone that stimulates growth.

→ It stimulates growth, cell

- i) growth
- ii) cell reproduction &
- iii) cell regeneration

→ Growth hormone is important in human development.

→ Growth hormone