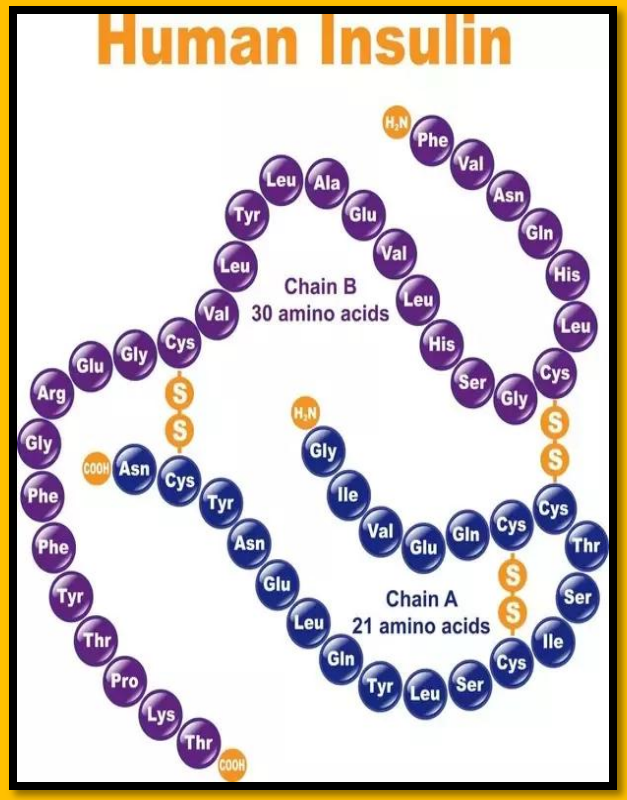
SHRIMATI INDIRA GANDHI COLLEGE

ENDOCRINE FUNCTION OF INSULIN



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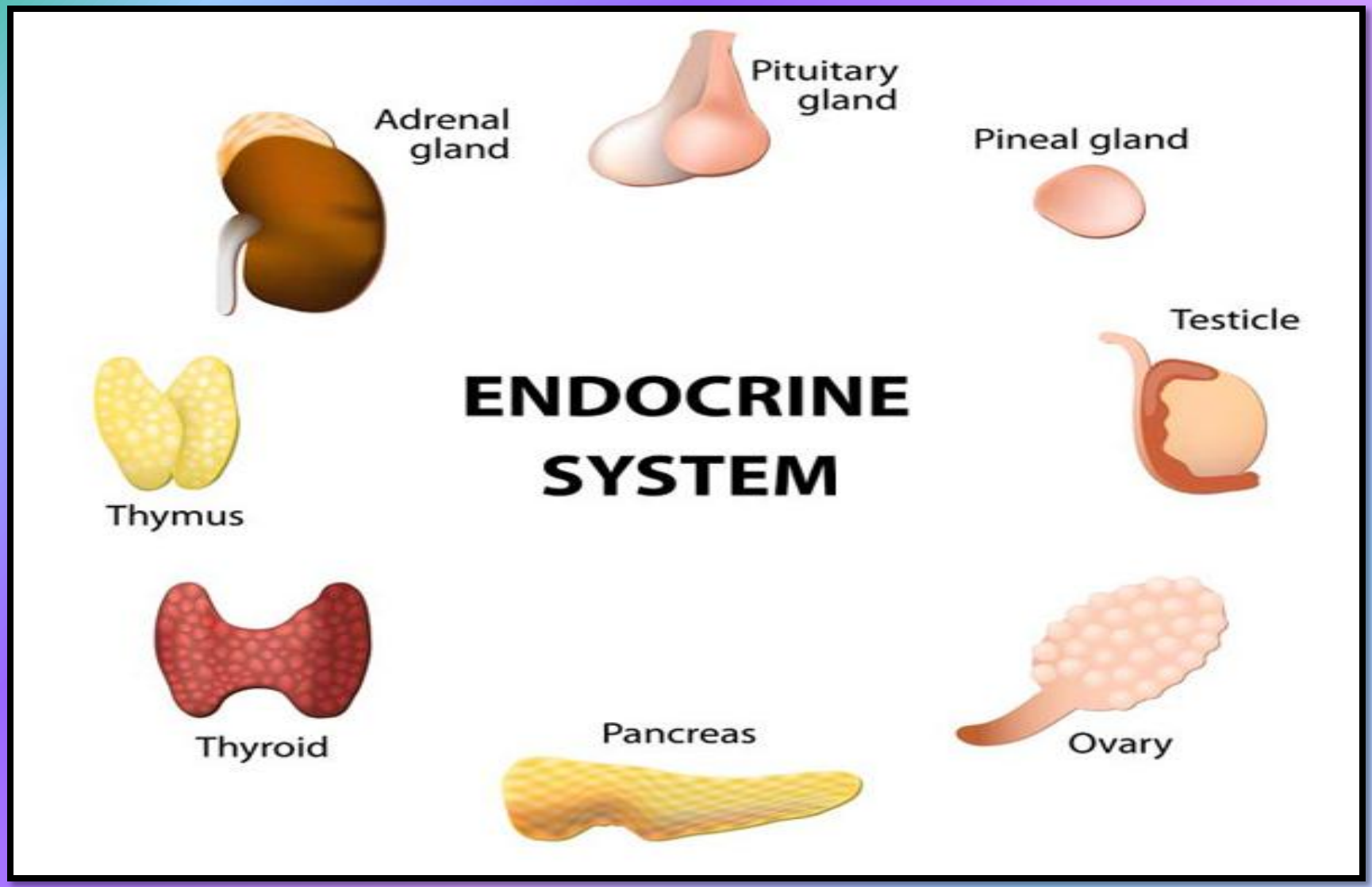
III B.Sc. BIOCHEMISTRY

- SUBJECT: ENDOCRINOLOGY
- SUBJECT CODE:16SMBEBC2
- SEMESTER: VI

CONTENTS

- Introduction
- Histology of Pancreas
- Pancreatic Hormone
- Synthesis of insulin
- Insulin Receptor
- Function
- Deficiency Disease
- Treatment

ENDOCRINE GLAND



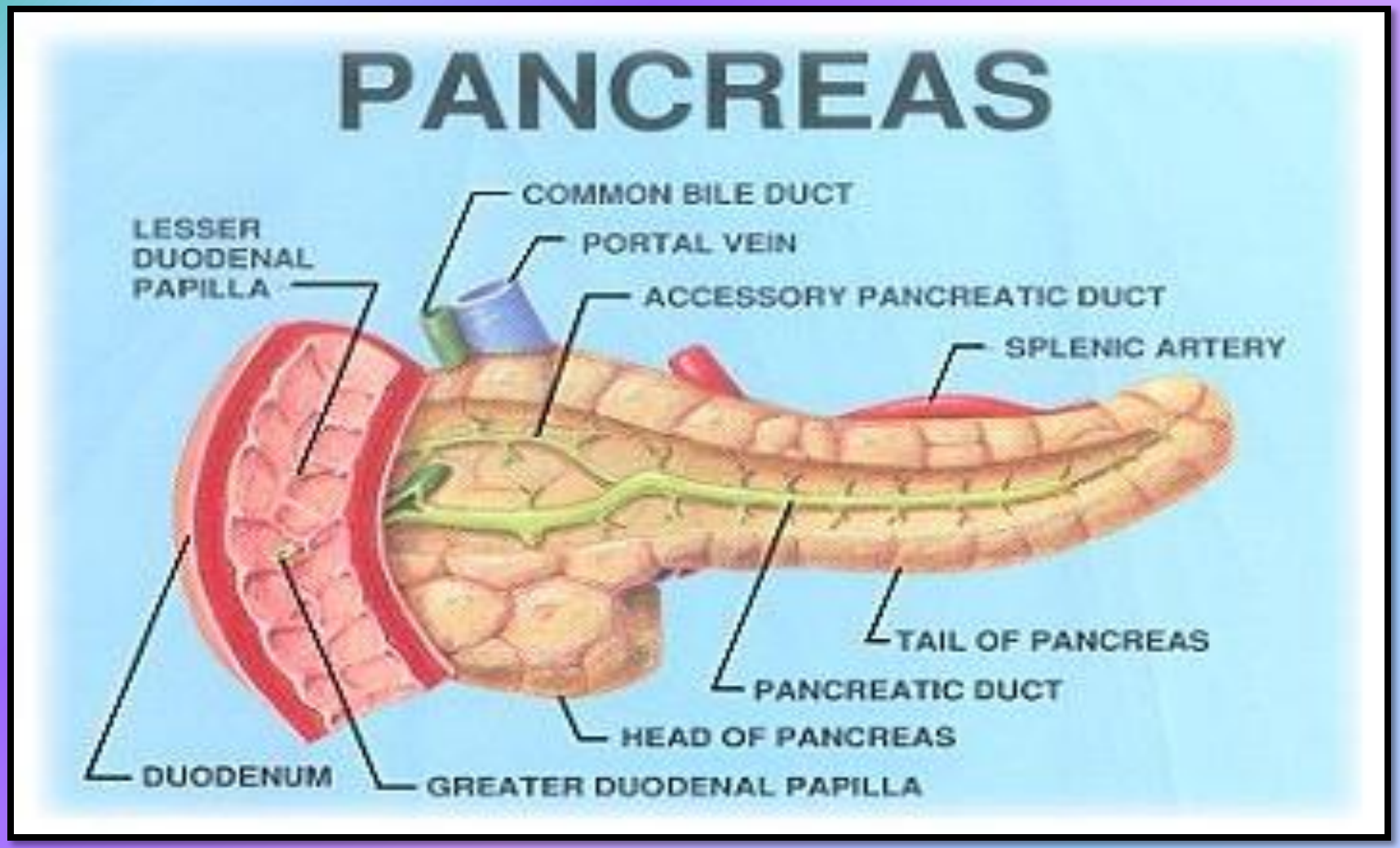
INTRODUCTION

- The **endocrine system** is the collection of glands that produce hormones directly enter into the circulatory system.

Its regulates

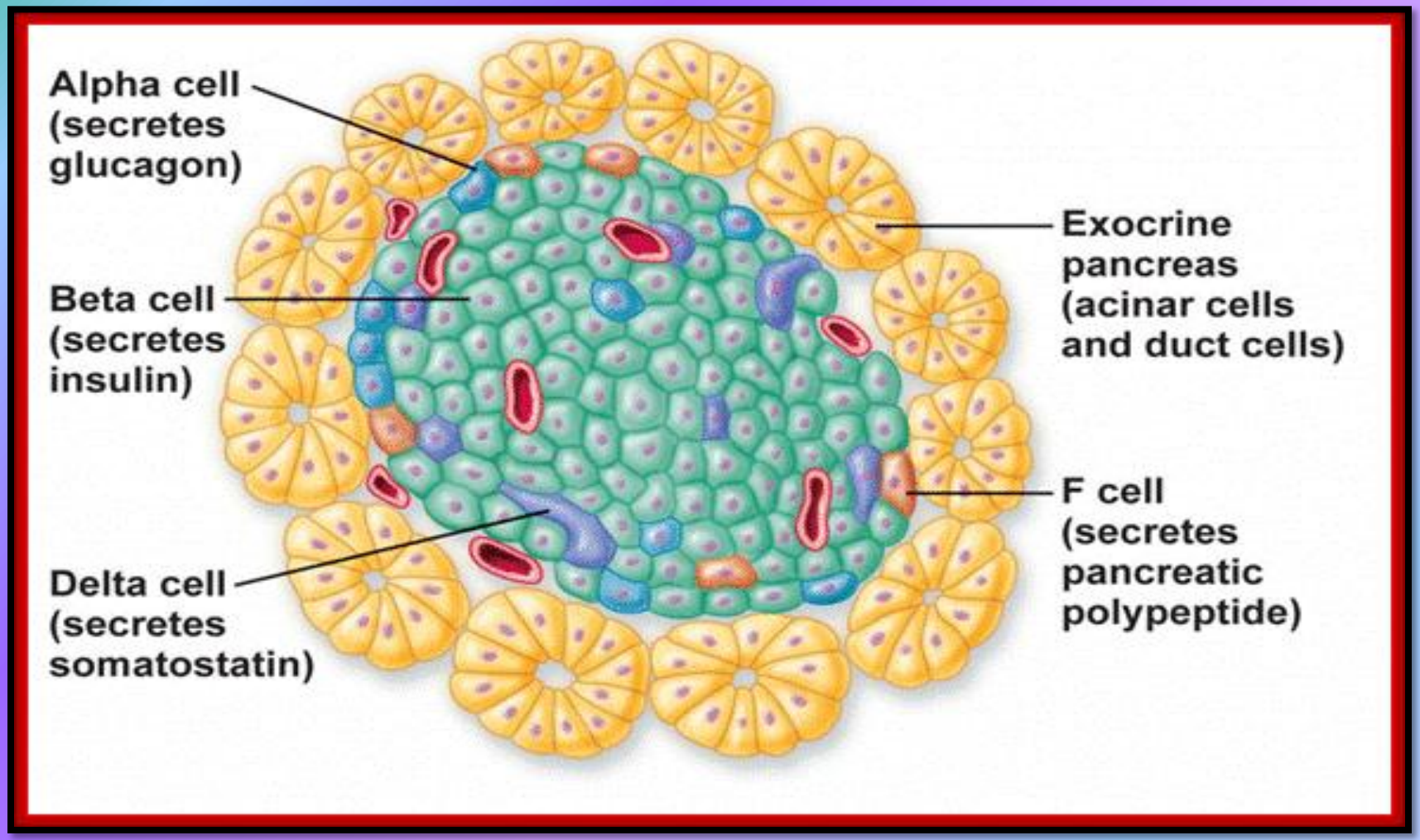
- Metabolism,
- Growth and Development,
- Tissue function & reproduction,
- Sleep and Mood.

ANATOMY OF PANCREAS



- The **pancreas** is a long, slender organ, located at posterior to the bottom half of the stomach.
- The pancreas is considered as mixed gland.
- Its act as both exocrine and endocrine gland. The exocrine part secretes pancreatic fluid into the duodenum after a meal.

HISTOLOGY OF PANCREAS



TYPES OF ISLETS OF LANGERHANS

- The endocrine part secretes various types of hormones. The specialized tissue is called Islets of Langerhans.

Types of islets cells

- **A cells** – Glucagon -25%.
- **B cells** – Insulin -60%
- **D cells** – Somatostatin -10% .
- **F cells** – Pancreatic polypeptide -5%.

PANCREATIC HORMONE

Glucagon

- Glucagon stimulate glycogenolysis and gluconeogenesis.

Insulin

- Insulin stimulate glycogenesis and glycogenesis in liver and muscles.

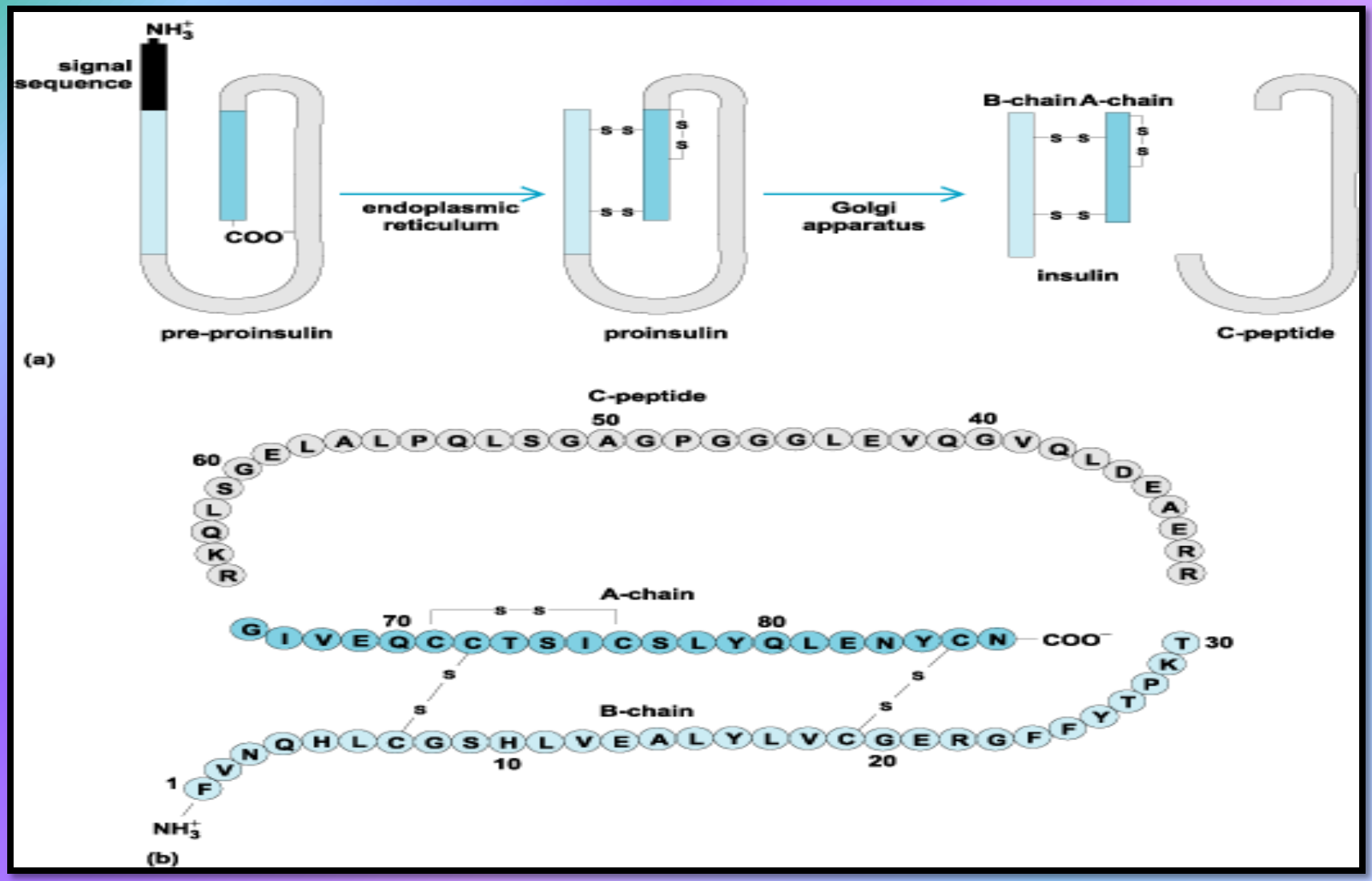
Somatostatin

- It inhibit the release glucagon of both glucagon and insulin.

Pancreatic Polypeptide

- It inhibit pancreatic exocrine secretion.

SYNTHESIS OF INSULIN

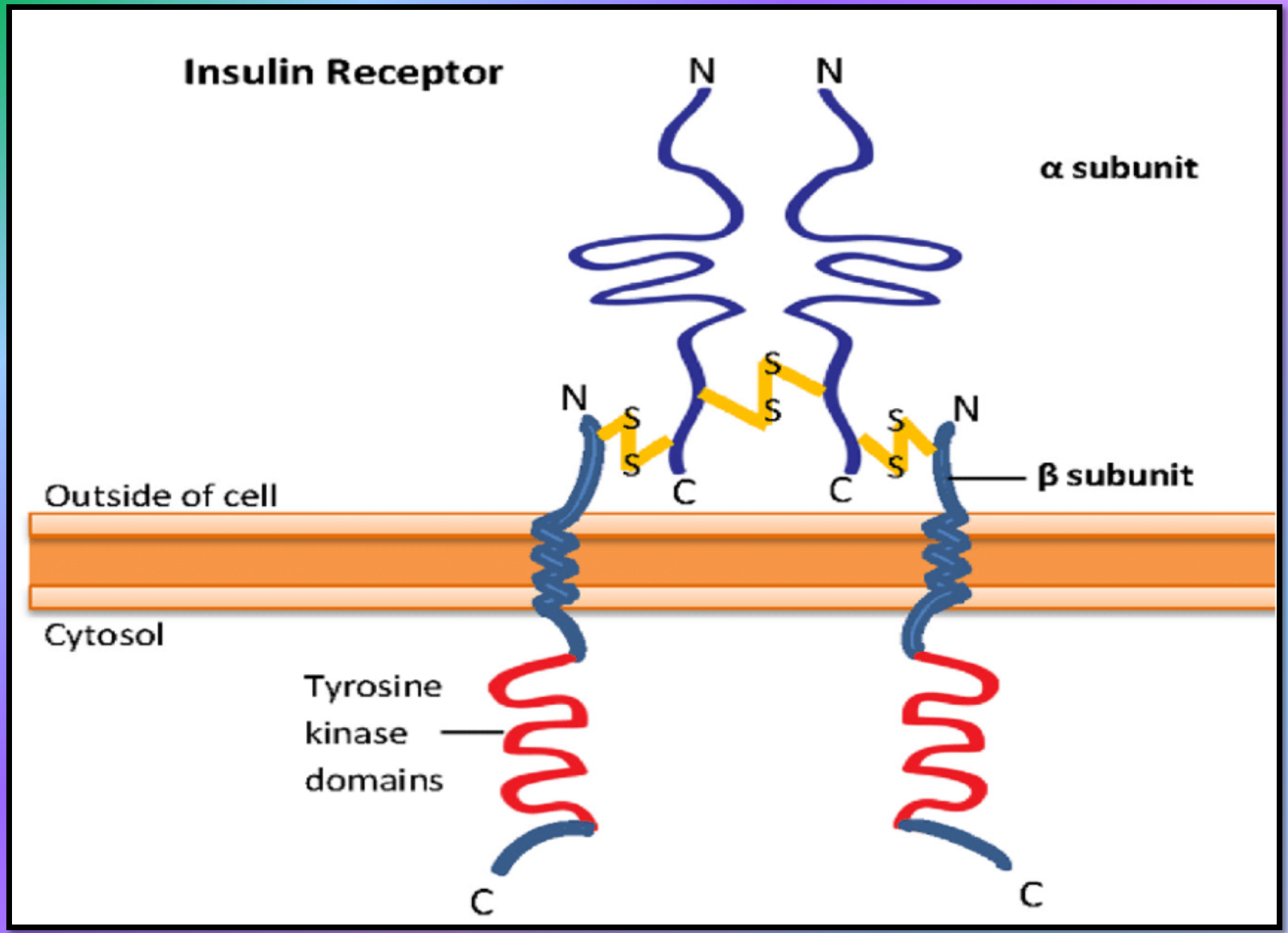


SYNTHESIS OF INSULIN

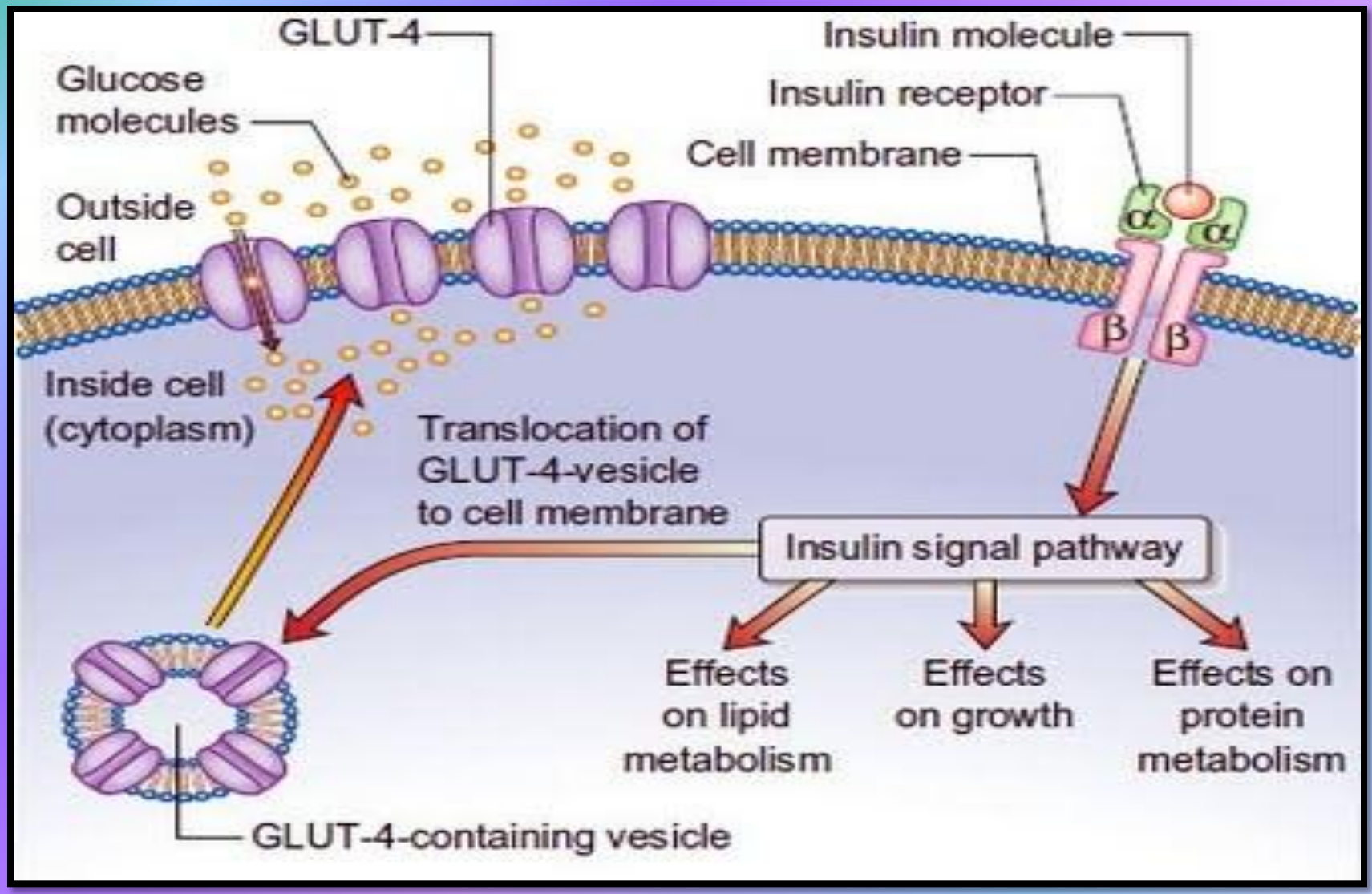
- Preproinsulin mRNA is synthesised by transcription(RER) and converted into proinsulin.
- Proinsulin is transported through the Golgi apparatus and packaged into immature Catherin-coated granules.
- Proinsulin is processed into insulin and c-peptide. The immature granules can then become mature granules containing insulin.

INSULIN RECEPTOR

- The insulin receptor is a tyrosine kinase and acts as an enzyme that transfers phosphate groups from ATP to tyrosine residues on intracellular target proteins and activates receptor.
- The activated receptor then phosphorylates a number of intracellular proteins, which in turn alters their activity thereby generating a biological response.


Insulin Receptor
N
N
α subunit
S
S
N
S
S
S
S
N
β subunit
C
C
Outside of cell
Cytosol
Tyrosine
kinase
domains
C
C

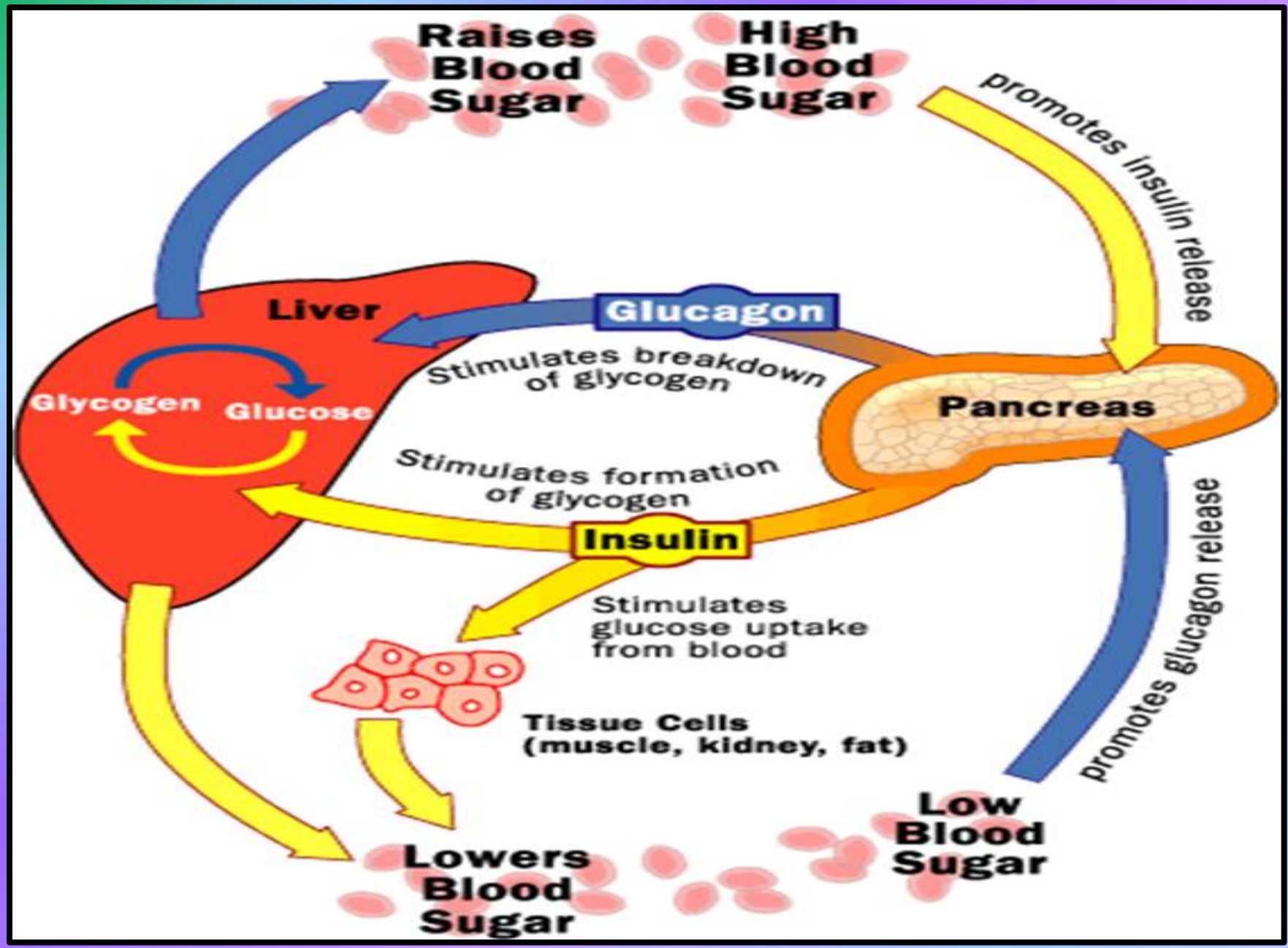
MECHANISM ACTION OF INSULIN



EFFECT ON CARBOHYDRATE METABOLISM

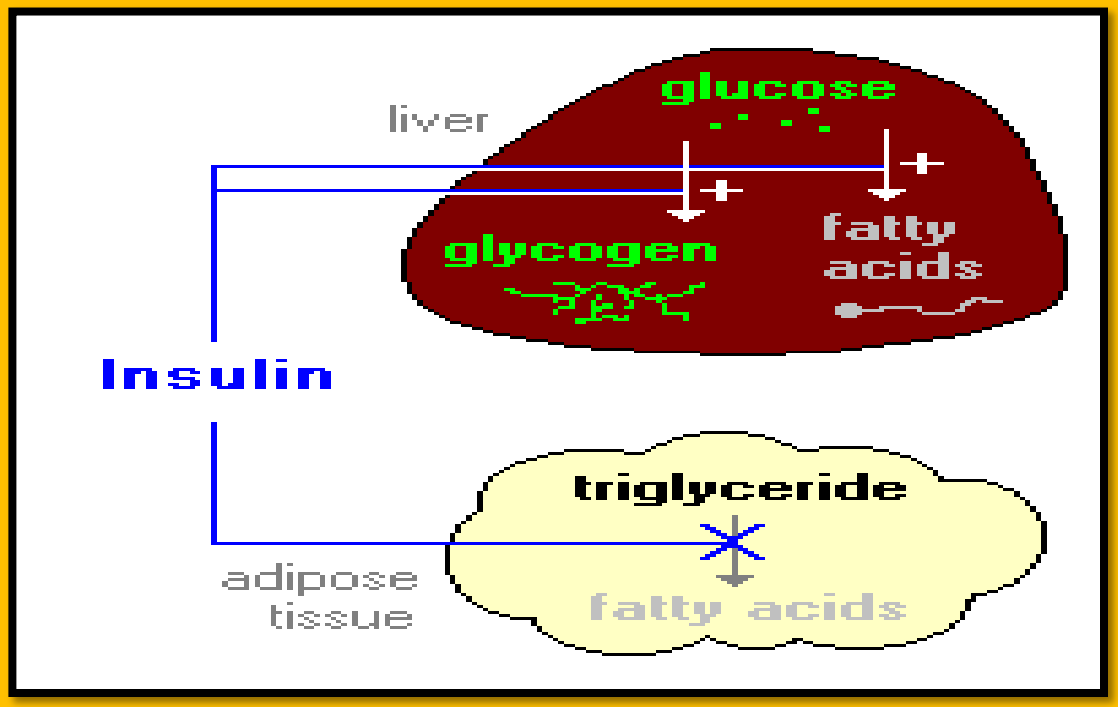
It has the following effects

- Increases the rate of transport of glucose across the cell membrane in adipose tissue and muscle.
- Increases the rate of glycolysis in muscle and adipose tissue.
- Stimulates the rate of glycogenesis and decreases the rate of glycogenolysis.


Raises Blood Sugar
High Blood Sugar
promotes insulin release
Liver
Glucagon
Stimulates breakdown of glycogen
Glycogen
Glucose
Pancreas
Stimulates formation of glycogen
Insulin
Stimulates glucose uptake from blood
Tissue Cells (muscle, kidney, fat)
promotes glucagon release
Low Blood Sugar
Lowers Blood Sugar

EFFECT ON LIPID METABOLISM

- Insulin promotes synthesis of fatty acids in the liver.
- Insulin inhibits breakdown of fat in adipose tissue.



EFFECT ON PROTEIN METABOLISM

- It has the following effect on Protein metabolism:
- Increases the rate of transport of some amino acids into tissues.
- Increases the rate of protein synthesis in muscle, adipose tissue, liver, and other tissues.
- Decreases the rate of protein degradation in muscle and perhaps other tissues.
- Decreases the rate of urea formation.

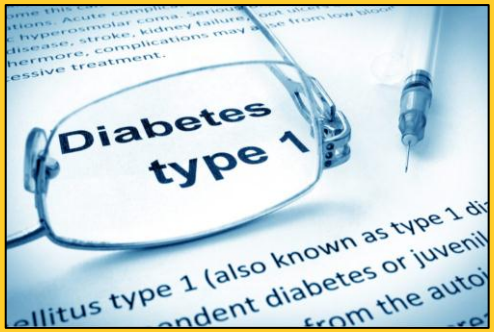
DEFICIENCY DISEASE OF INSULIN

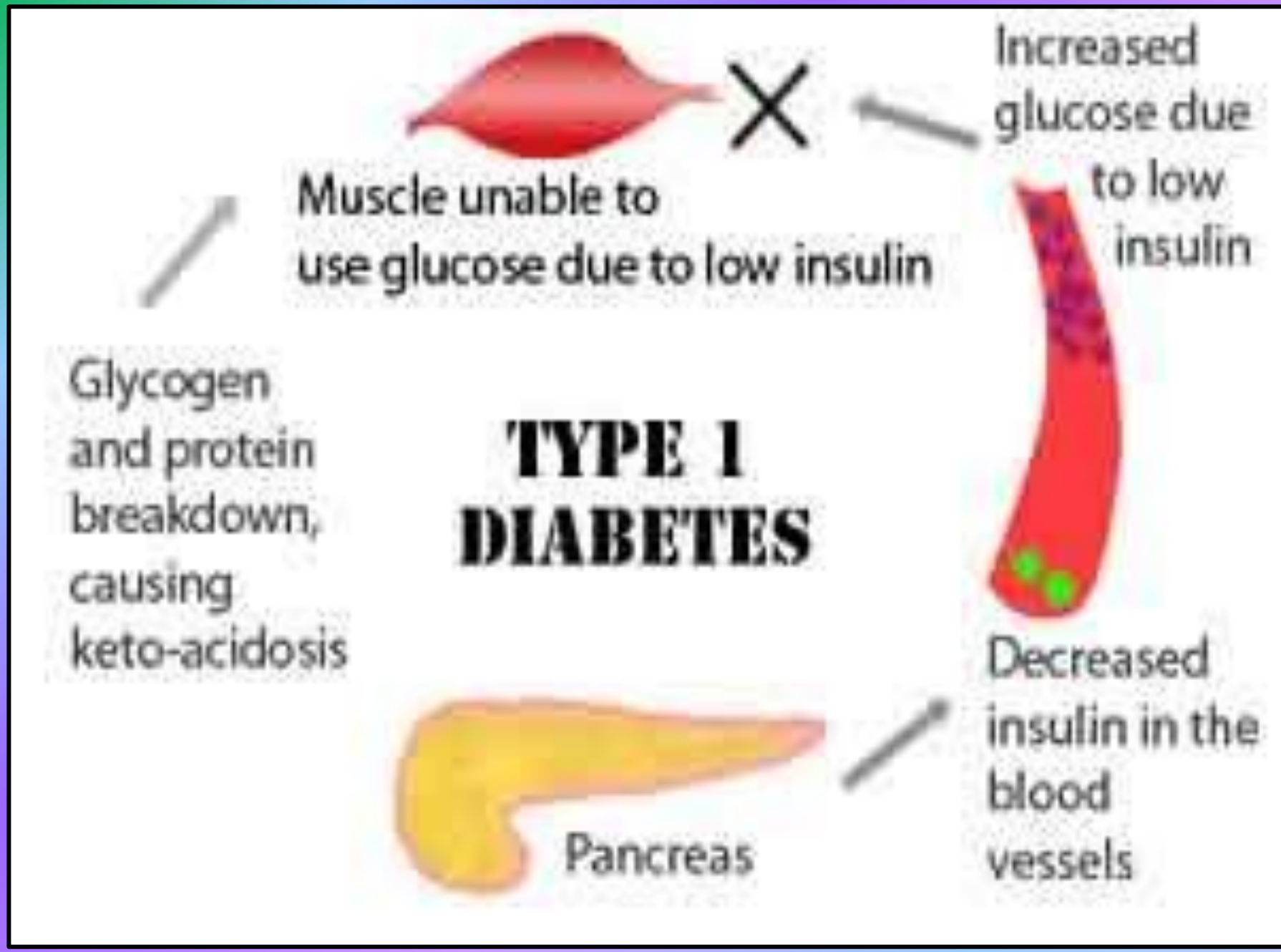
- **Diabetes mellitus** (DM), commonly known as **diabetes**, is a group of metabolic disorders characterized by high blood sugar levels over a prolonged period.

- **Type I diabetes**
- **Type II diabetes**

TYPE 1 DIABETES

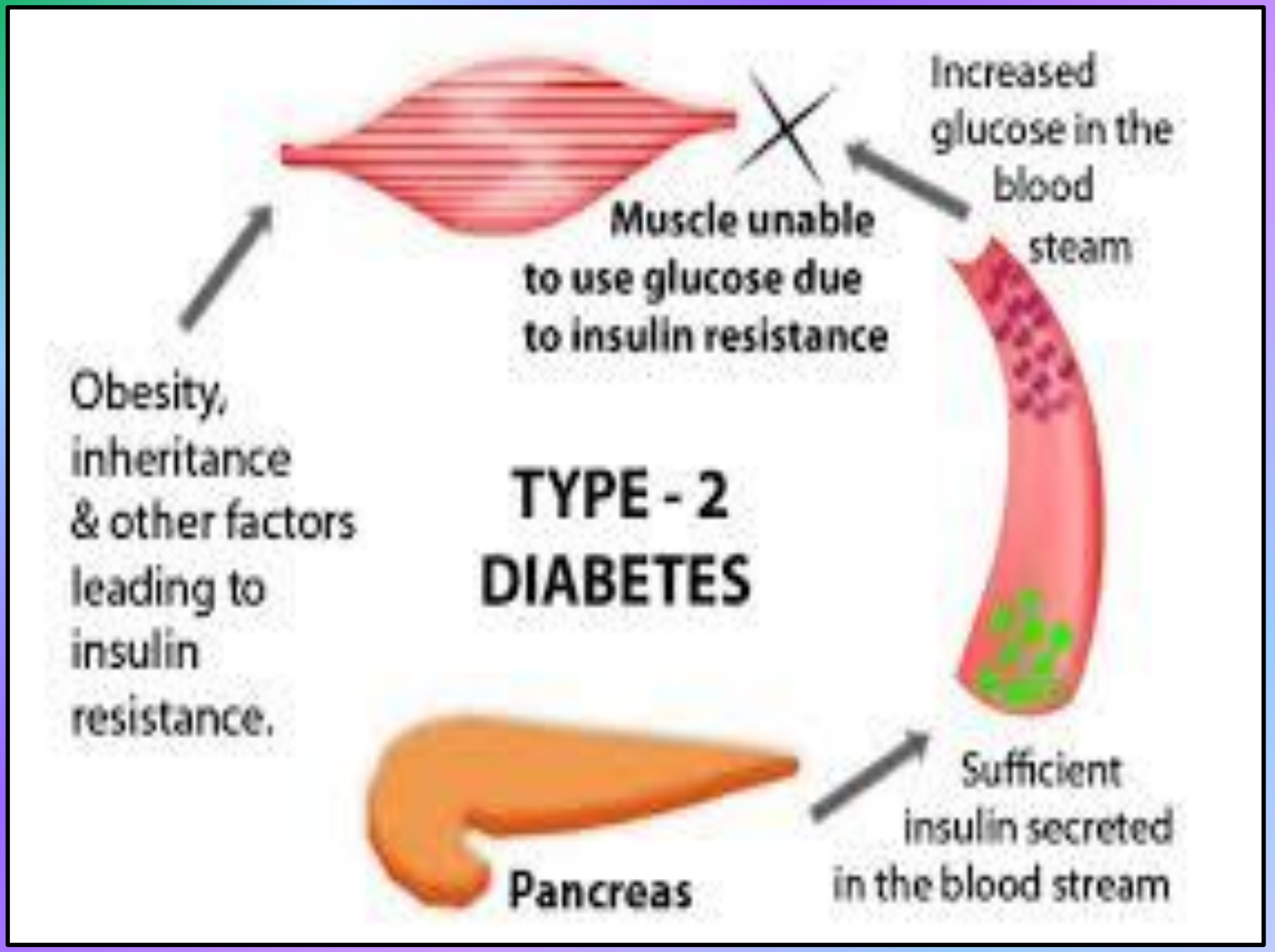
- Type 1 diabetes, known as juvenile diabetes or insulin-dependent diabetes, is a chronic condition in which the pancreas produces little or no insulin.
- Insulin is a hormone needed to allow sugar (glucose) to enter cells to produce energy.




Increased glucose due to low insulin
Muscle unable to use glucose due to low insulin
Glycogen and protein breakdown, causing keto-acidosis
TYPE 1 DIABETES
Decreased insulin in the blood vessels
Pancreas

TYPE 2 DIABETES

- Type 2 diabetes is the most common form of diabetes. It happens when blood sugar levels rise due to problems with the use or production of insulin.
- It can be caused by:
- Being overweight,Lack of activity (sedentary behavior),Lack of exercise
- Stress and stress hormones,Genetics


Increased glucose in the blood steam
Muscle unable to use glucose due to insulin resistance
Obesity, inheritance & other factors leading to insulin resistance.
TYPE - 2 DIABETES
Sufficient insulin secreted in the blood stream
Pancreas

SYMPTOMS

- Increased thirst
- Frequent urination
- Extreme hunger
- Unintended weight loss
- Irritability and other mood changes
- Fatigue and weakness
- Blurred vision

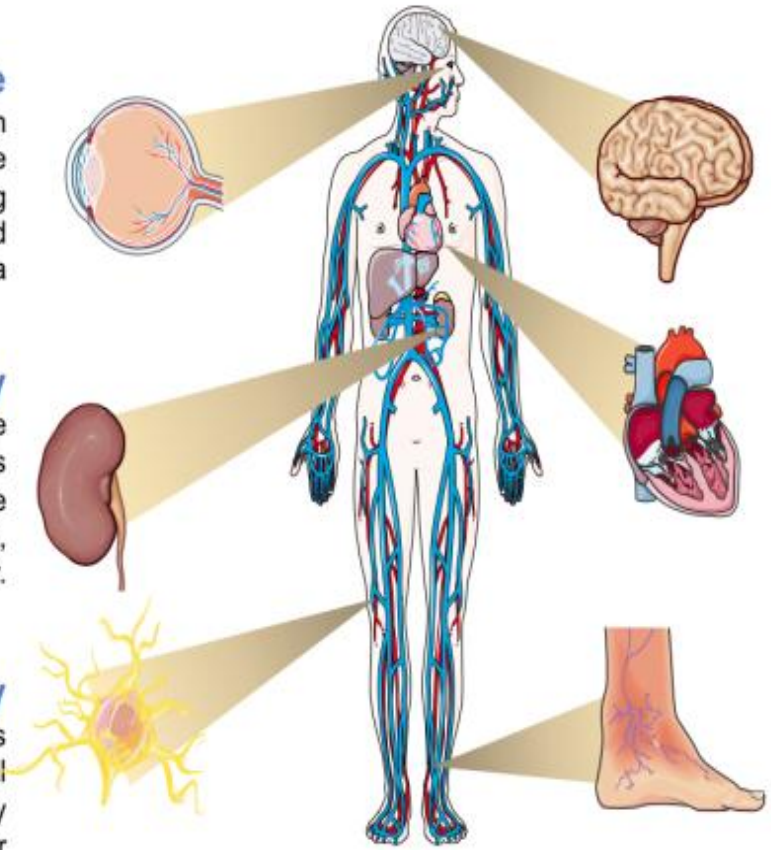
Major Complications of Diabetes

Microvascular

Eye
High blood glucose and high blood pressure can damage eye blood vessels, causing retinopathy, cataracts and glaucoma

Kidney
High blood pressure damages small blood vessels and excess blood glucose overworks the kidneys, resulting in nephropathy.

Neuropathy
Hyperglycemia damages nerves in the peripheral nervous system. This may result in pain and/or numbness. Feet wounds may go undetected, get infected and lead to gangrene.



Macrovascular

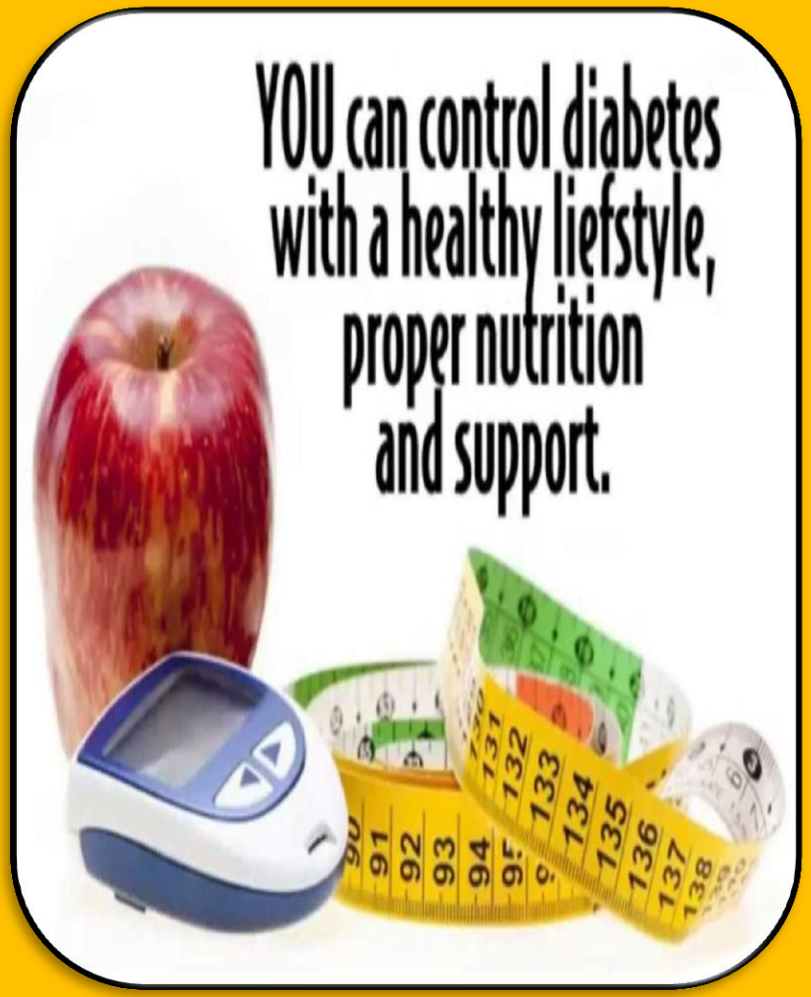
Brain
Increased risk of stroke and cerebrovascular disease, including transient ischemic attack, cognitive impairment, etc.

Heart
High blood pressure and insulin resistance increase risk of coronary heart disease

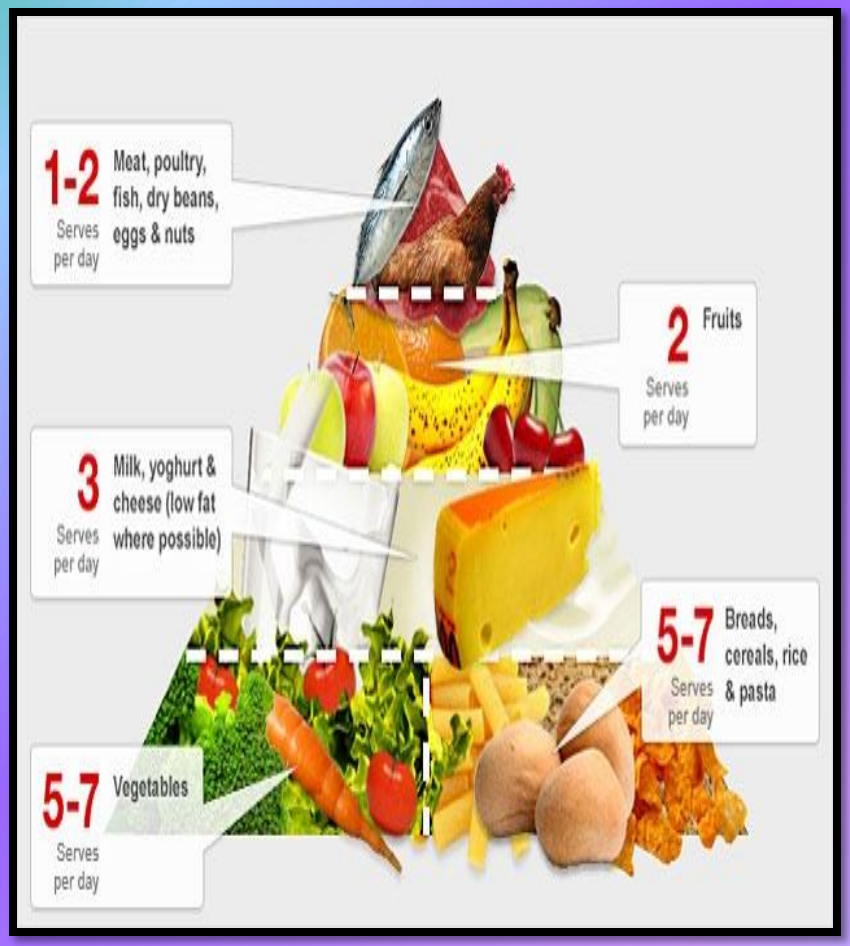
Extremities
Peripheral vascular disease results from narrowing of blood vessels increasing the risk for reduced or lack of blood flow in legs. Feet wounds are likely to heal slowly contributing to gangrene and other complications.

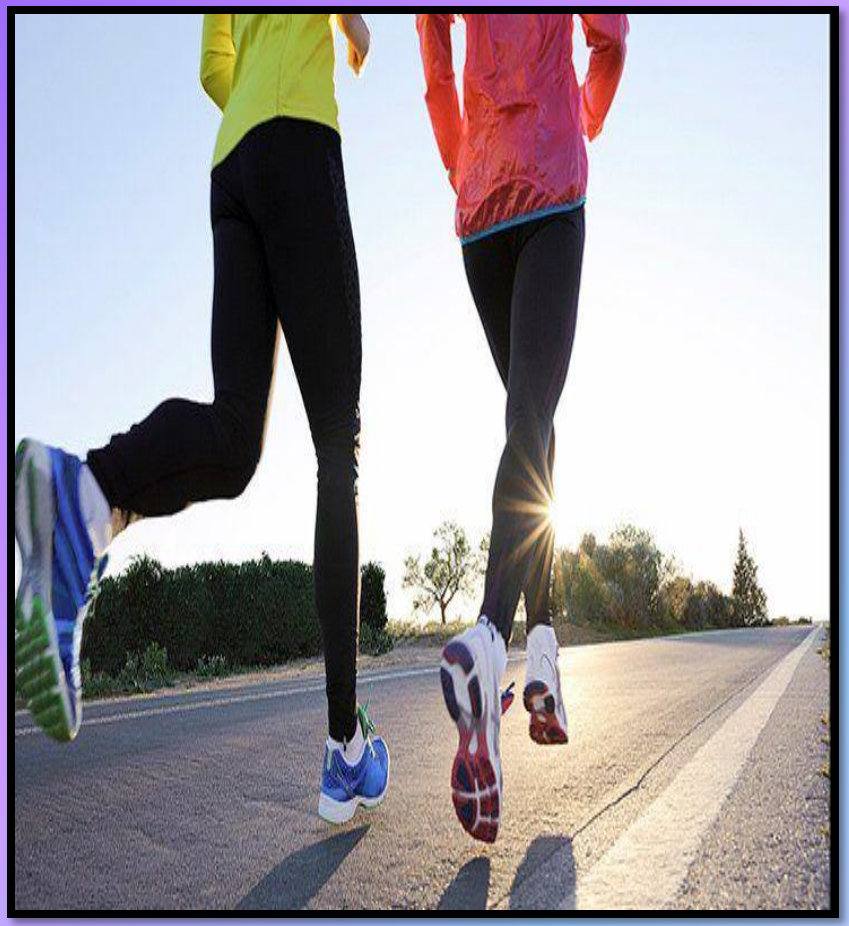
TREATMENT

- **Diet**
- **Exercise**
- **Oral Diabetic Drug**
- **Insulin Therapy**



DIET & EXERCISE





INSULIN THERAPY &ORAL DIABETIC DRUG

QUESTIONS?

- Explain-Pancreatic Hormone
- What are the type of pancreatic cell?
- Give a short note on themetabolic function of Insulin.
- Discuss about Insulin receptor.
- What are the deficiency diseases of insulin?
- Brief account on treatment of Diabetes Mellitus.


Thank
You