

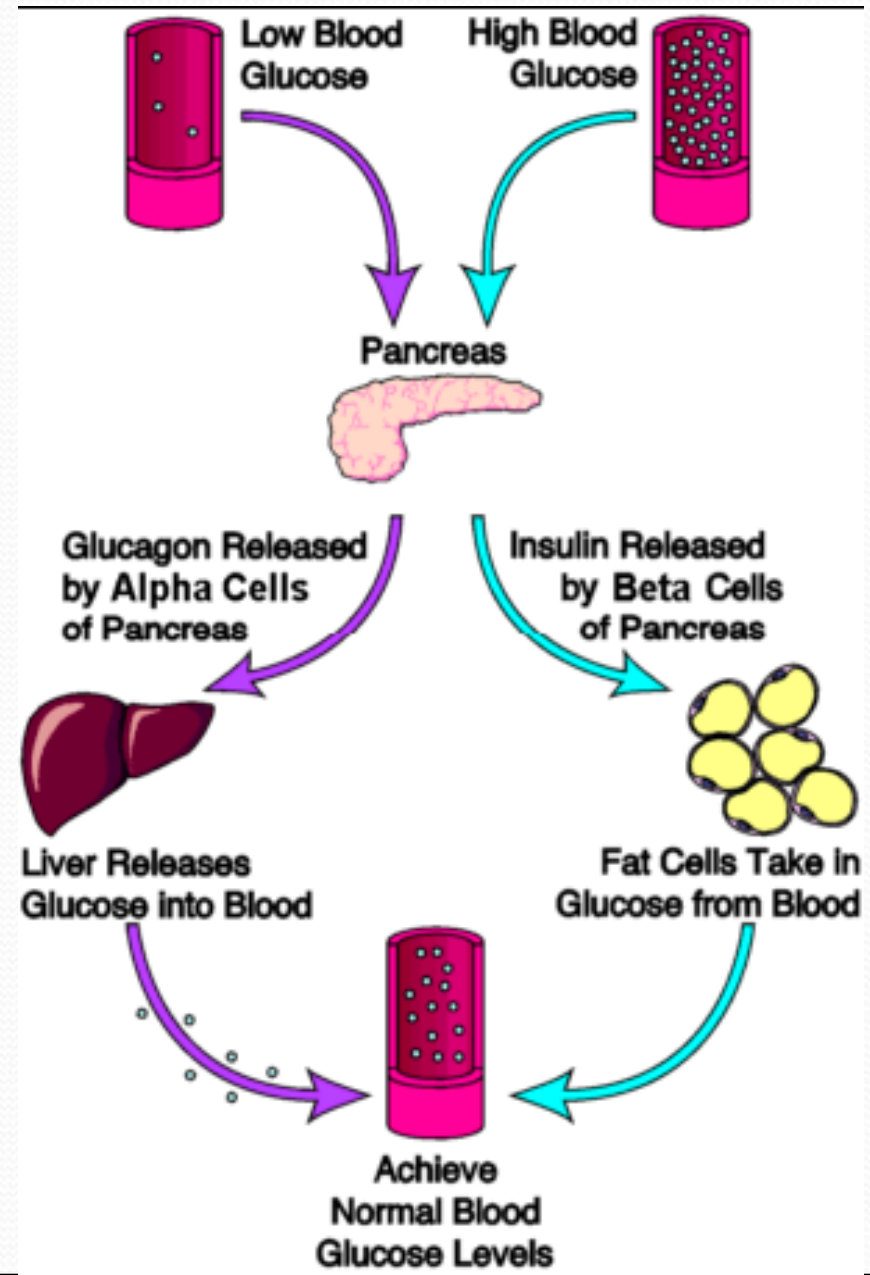


Diabetes mellitus

- **Diabetes mellitus** is a group of metabolic diseases characterized by high blood glucose levels – **Hyperglycemia**.
- This results from defects in insulin secretion, action, or both.
- Normally, blood glucose levels are tightly controlled by insulin, a hormone produced by the **β cells** in the pancreas.

- In patients with diabetes mellitus, the absence or insufficient production of insulin causes **hyperglycemia**.
- Hyperglycemia lead to spillage of glucose into the urine, **hence the term Diabetes-sweet urine**.

- Normally, blood glucose levels are tightly controlled by insulin, a hormone produced by the β cells in the pancreas.
- Whenever there is an elevation of blood glucose insulin is released from the pancreas to normalize the glucose level.
- In patients with diabetes mellitus, the absence or insufficient production of insulin causes hyperglycemia.



Regulation blood glucose

- Glucose is the key regulator of insulin secretion by the pancreatic beta cells
- When there is an elevation of blood glucose insulin is released from the pancreas to normalize the glucose level.
- When blood glucose level is decreased glucagon is released from pancreas to increase glucose level.

Insulin and Carbohydrates

Influences glucose metabolism in most tissues.

- **Liver**

- Inhibits glycogenolysis
- Inhibits gluconeogenesis
- Stimulates glycogen synthesis
- Increases glucose utilization- glycolysis

- **Muscles**

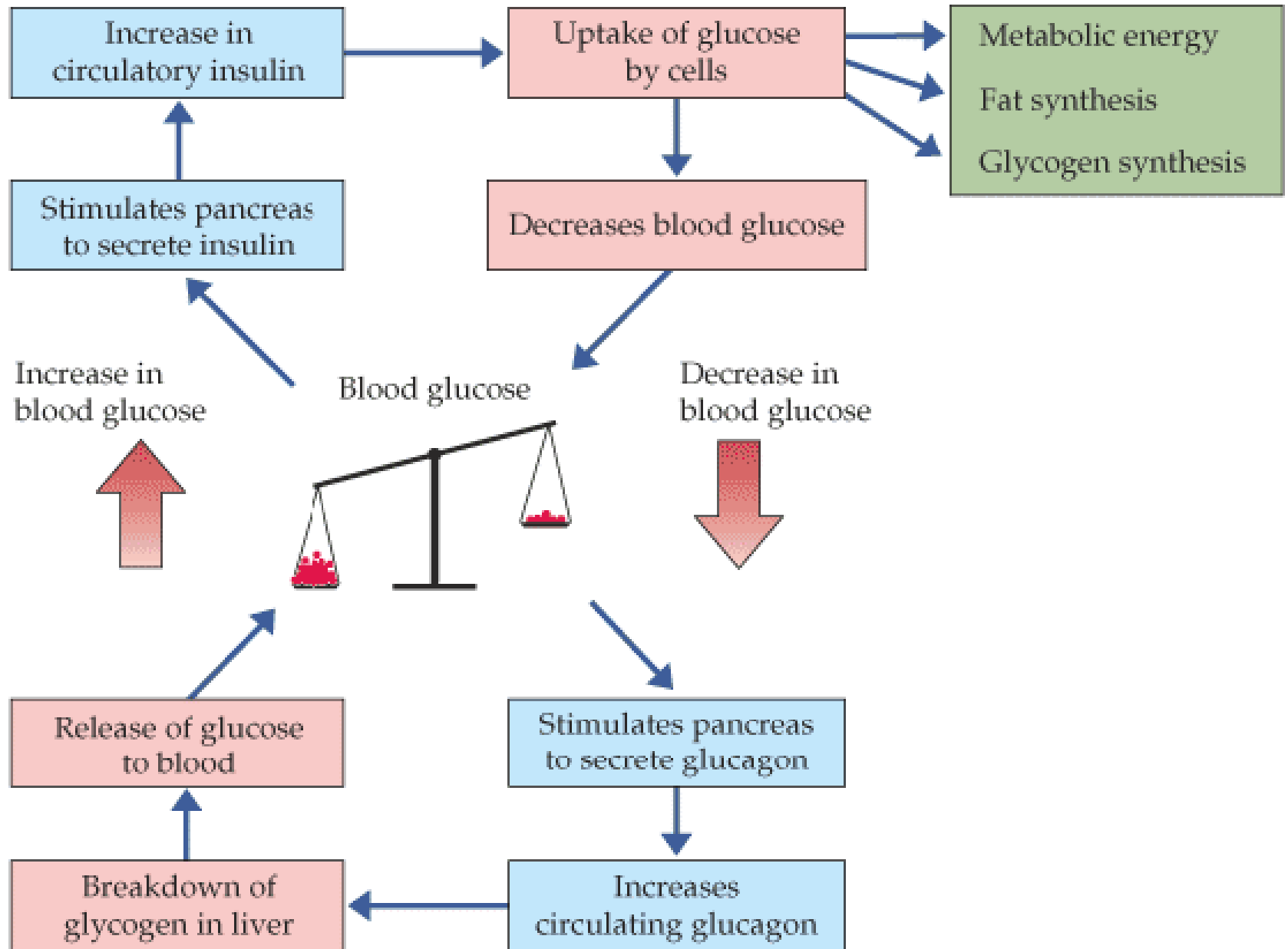
- Increase glucose uptake by muscles
- Stimulates glycogen synthesis and glycolysis

- **Adipose tissue**

- Glycerol is formed that esterifies with fatty acids to form triglycerides.

Role of glucagon

- Glucagon helps maintain the level of glucose in the blood.
- Liver cells (**hepatocytes**) have glucagon receptors. When glucagon binds to the glucagon receptors, the liver cells convert the glycogen polymer into individual glucose molecules, and release them into the bloodstream, in a process known as **glycogenolysis**.
- As these stores become depleted, glucagon then encourages the liver to synthesize additional glucose by **gluconeogenesis**.
- Glucagon also regulates the rate of glucose production through **lipolysis**.



Classification

Most cases of diabetes mellitus fall into three broad categories:

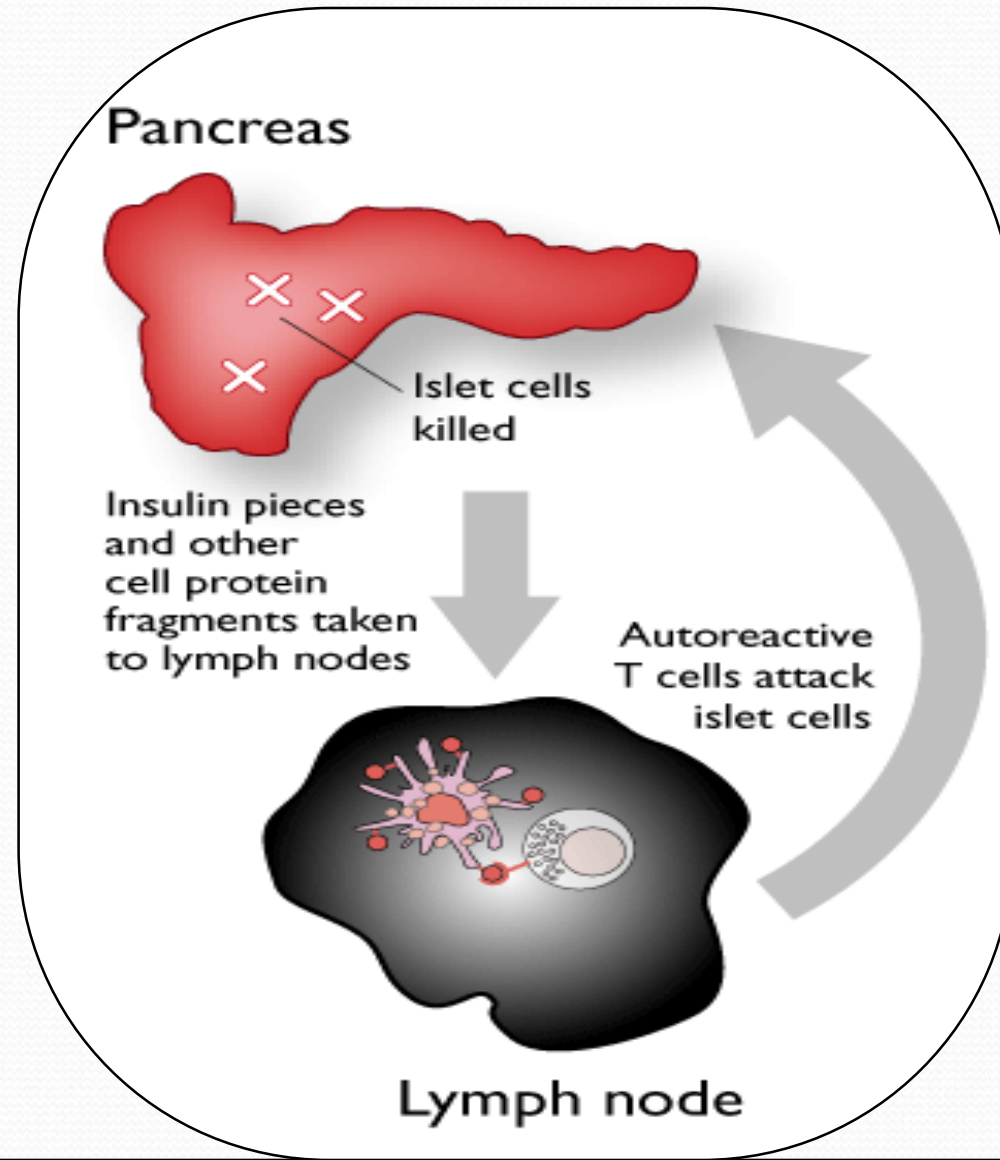
- Type 1
- Type 2
- Gestational diabetes.

Type 1 diabetes

- Type 1 diabetes mellitus is characterized by loss of the insulin-producing beta cells of the islets of Langerhans in the pancreas leading to insulin deficiency.
- Most affected people are otherwise healthy and of a healthy weight when onset occurs.
- Sensitivity and responsiveness to insulin are usually normal, especially in the early stages.
- Type 1 diabetes can affect children or adults but was traditionally termed "juvenile diabetes" because it represents a majority of the diabetes cases in children

Type 1 diabetes

- This type of diabetes can be further classified as immune-mediated or idiopathic.
- The majority of type 1 diabetes is of the immune-mediated nature, where beta cell loss is a T-cell mediated autoimmune attack.



Type 2 diabetes

- Type 2 diabetes mellitus is characterized by insulin resistance which may be combined with relatively reduced insulin secretion.
- The defective responsiveness of body tissues to insulin is believed to involve the insulin receptor.
- In the early stage of type 2 diabetes, the predominant abnormality is reduced insulin sensitivity.
- At this stage hyperglycemia can be reversed by a variety of measures and medications that improve insulin sensitivity or reduce glucose production by the liver.
- Type 2 diabetes is due primarily to lifestyle factors and genetics

Gestational diabetes

- Gestational diabetes mellitus (GDM) resembles type 2 diabetes in several respects, involving a combination of relatively inadequate insulin secretion and responsiveness.
- It occurs in about 2%–5% of all pregnancies and may improve or disappear after delivery.
- Gestational diabetes is fully treatable but requires careful medical supervision throughout the pregnancy. About 20%–50% of affected women develop type 2 diabetes later in life.

Gestational diabetes

- Even though it may be transient, untreated gestational diabetes can damage the health of the fetus or mother.
- Risks to the baby include
 - Macrosomia (high birth weight)
 - Congenital cardiac and central nervous system anomalies
 - Skeletal muscle malformations.

Other types

- Pre-diabetes indicates a condition that occurs when a person's blood glucose levels are higher than normal but not high enough for a diagnosis of type 2 diabetes.
- Genetic mutations (autosomal or mitochondrial) can lead to defects in beta cell function.
- Any disease that causes extensive damage to the pancreas may lead to diabetes (for example, chronic pancreatitis).
- Many drugs impair insulin secretion and some toxins damage pancreatic beta cells.

Signs and symptoms

- The early symptoms of untreated diabetes mellitus are related to elevated blood sugar levels, and loss of glucose in the urine (glycosurea).
- High amounts of glucose in the urine can cause increased urine output and lead to dehydration.
- Increased thirst and water consumption.

Signs and symptoms

- The inability to utilize glucose energy eventually leads to weight loss despite an increase in appetite.
- Patients with diabetes are prone to developing infections of the bladder, skin, and vaginal areas.
- Fluctuations in blood glucose levels can lead to blurred vision.
- Extremely elevated glucose levels can lead to lethargy and coma (diabetic coma).

Signs and symptoms

● Common Symptoms

- Polyuria (Frequent urination)
- Polydipsia (Excessive thirst)
- Polyphagia (Extreme hunger)
- Unexplained weight loss
- Increased fatigue
- Irritability
- Blurry vision
- Frequent infections
- Dry, itchy skin
- Numbness or tingling in hands or feet
- Red, swollen or tender gums

Consequences of Hyperglycemia

- Hyperglycemia (random blood glucose concentration more than 200 mg/dL) results when insulin deficiency leads to uninhibited gluconeogenesis and prevents the use and storage of circulating glucose.
- The kidneys cannot reabsorb the excess glucose load, causing glycosuria, osmotic diuresis, thirst, and dehydration.
- Increased fat and protein breakdown leads to ketone production and weight loss.
- Without insulin, a type 1 diabetic wastes away and eventually dies from diabetic **ketoacidosis** (DKA).

Diagnosis

- The fasting blood glucose test is the preferred way to diagnose diabetes.
- After the person has fasted overnight (at least 8 hours), a single sample of blood is drawn and analyzed.
- Normal fasting plasma glucose levels are less than **110** (mg/dl).

- Fasting plasma glucose levels of more than **126** mg/dl on two or more tests on different days indicate diabetes.
- If the overnight fasting blood glucose is greater than **126** mg/dl on two different tests on different days, the diagnosis of diabetes mellitus is made.
- When fasting a blood glucose stays above 110 mg/dl, but in the range of **110-126**mg/dl, this is known as impaired fasting glucose (IFG).

Oral Glucose Tolerance Test

- Normal blood values for a 75-gram oral glucose tolerance test used to check for type 2 diabetes:
- Fasting: 60 -100 mg/dL
- 1 hour: less than 200 mg/dL
- 2 hours: less than 140 mg/dL.

- Between 140 - 200 mg/dL is considered impaired glucose tolerance (sometimes called "prediabetes").
- This group is at increased risk for developing diabetes.
- Greater than 200 mg/dL is a sign of diabetes mellitus.



Thank you for Listening