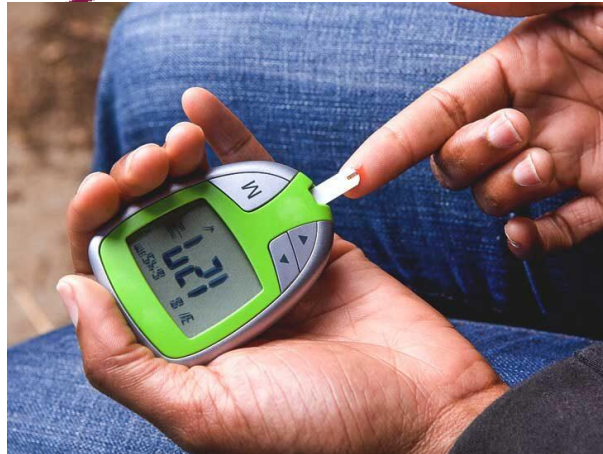# BLOOD GLUCOSE MEASUREMENT LAB: 4

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Human Physiology Lab

First semester

Week 4

Date 29/10/2025

# Outline

- **Blood sugar**

- **Maintenance of blood sugar**

- **Hyperglycemia**

- **Hypoglycemia**

- **Diabetes**

- **Blood Sugar measurement**

# Objectives

○ Understanding the basics of blood sugar

○ Understanding the homeostasis of blood sugar

○ Understanding the differences between type1 and type 2 diabetes Miletus

○ Ability to measures blood sugar

- **Blood glucose** refers to the amount of sugar (glucose) present in the bloodstream. Glucose is a type of sugar that comes from the food we eat and is an important source of energy for the body's cells.

- **Fasting blood glucose (after at least 8 hours without eating):**
    - 🩸 70–100 mg/d

- **Postprandial (2 hours after eating):**
    - 🩸 Less than 140 mg/dL (7.8 mmol/L)

- **Random (any time of day):**
    - 🩸 Usually less than 140 mg/dL

- **In healthy individuals, blood sugar rises to about 120–140 mg/dL after eating and returns to around 90 mg/dL within 2–3 hours.**

**Too much or too little glucose in the blood can be a sign of a serious medical condition.**

➤ High blood glucose levels (**hyperglycemia**) may be a sign of **diabetes**, a disorder that can cause serious, long-term health conditions.

➤ **Hypoglycemia** - Levels below the normal range

• **The maintenance** of glucose level in blood within narrow limits is very efficiently regulated system.

• This is important , because it is essential to have continuous supply of glucose to the brain, and other orans  and preventing the body from damaging effect of high blood sugar
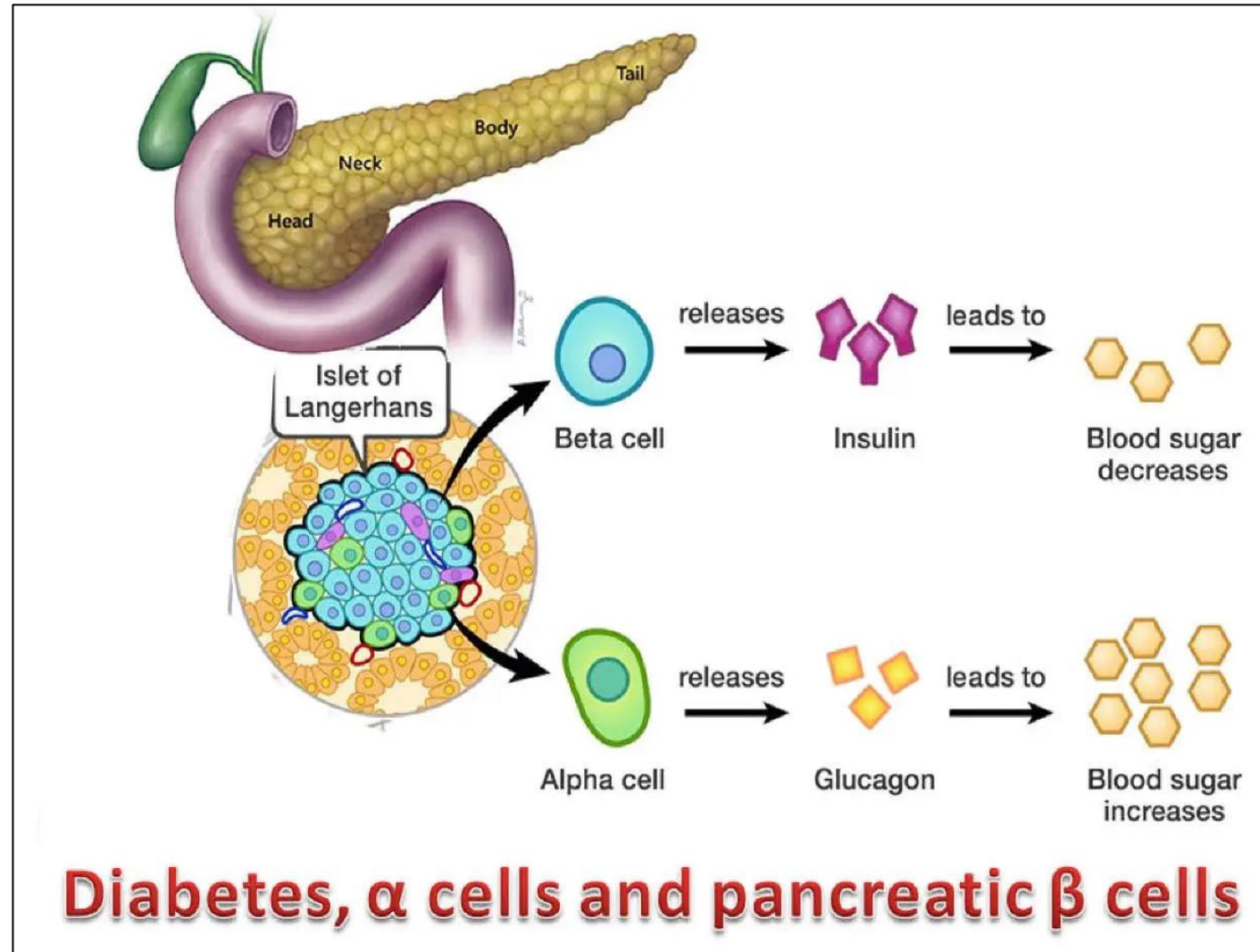
# This homeostasis of blood glucose level

- This homeostasis of blood glucose level is maintained by the balance between glucose entering and leaving the blood.

- This balance is managed by hormones – mainly

  1. **Insulin**

  2. **Glucagon**

Which re secreted by pancreatic **beta** and alpha cells respectively

# When glucose increases in blood stimulate Insulin(hypoglycemic hormone)

Hypoglycemic hormone – insulin which stimulate

1. Utilization of glucose by tissues for energy

2. Glycogenesis – Synthesis of glycogen from glucose)

3. Prevent of gluconeogenesis

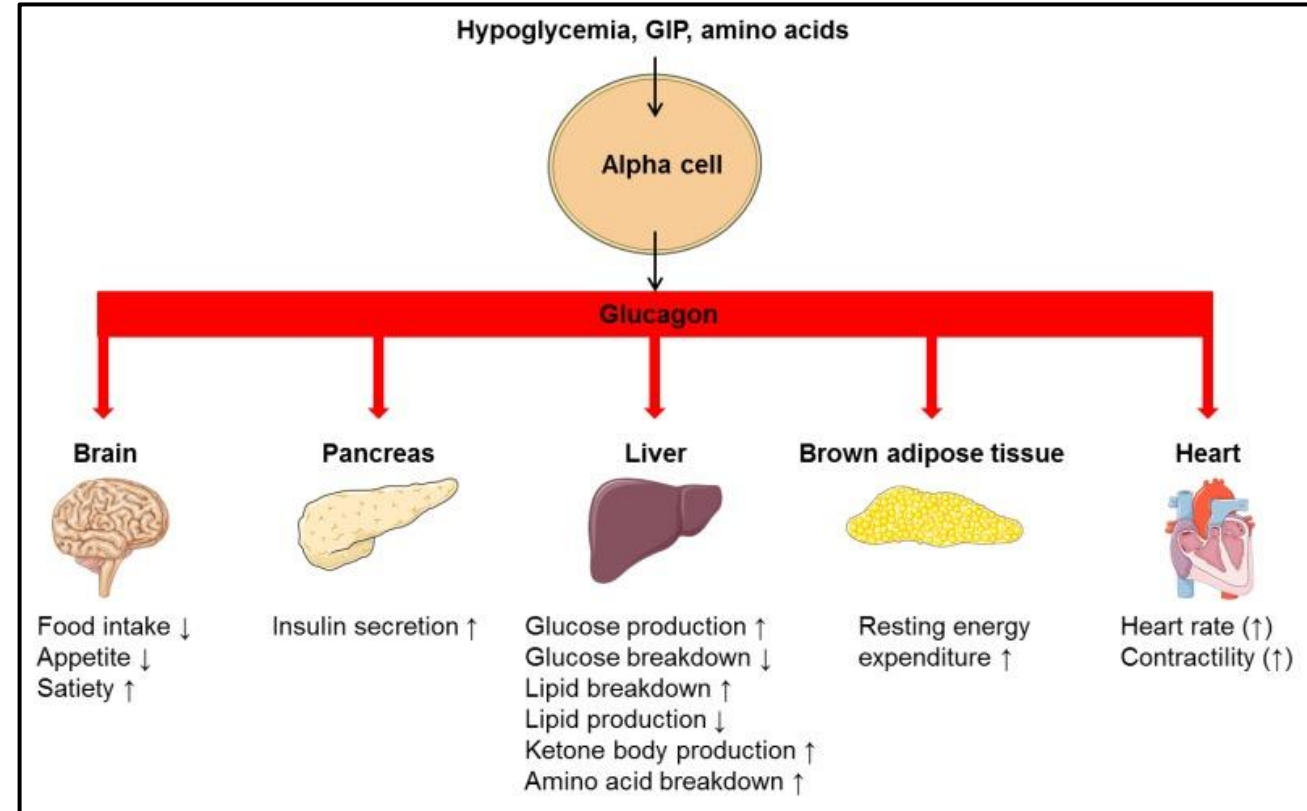4. Lipogenesis – conversion of glucose to fat
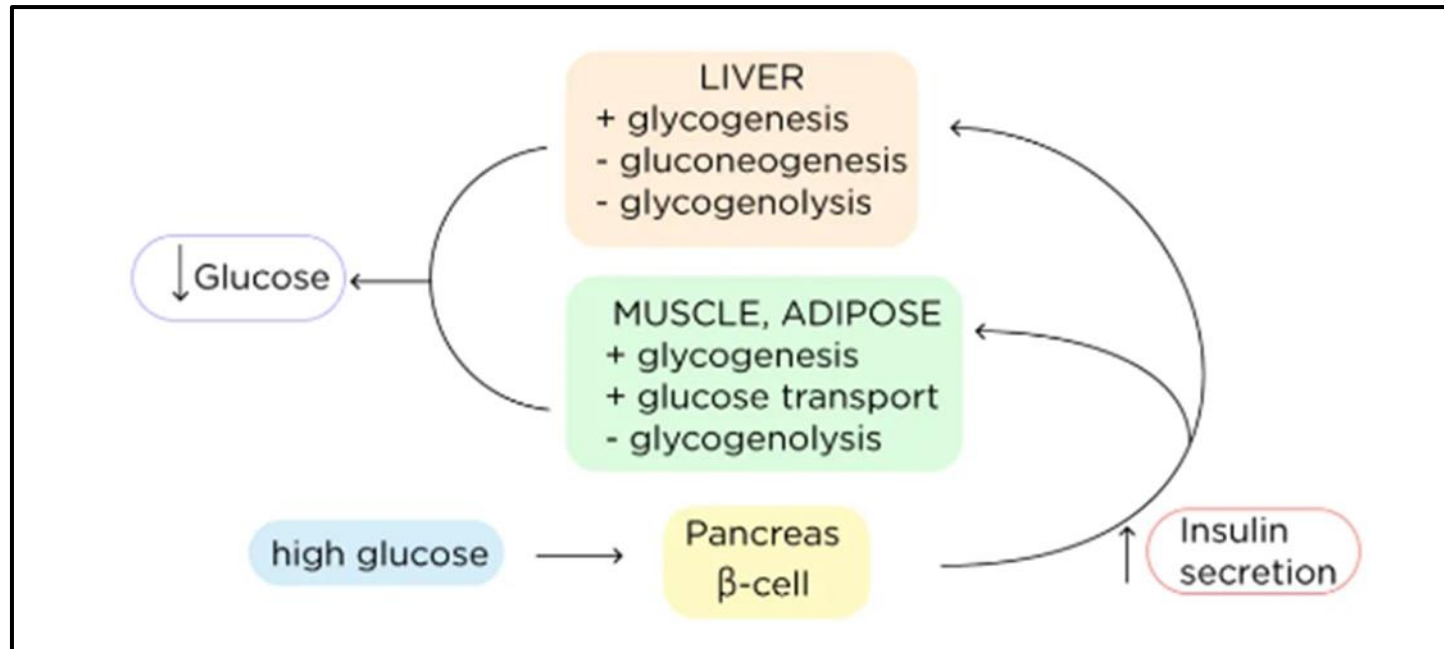
Depletion of glucose stimulate
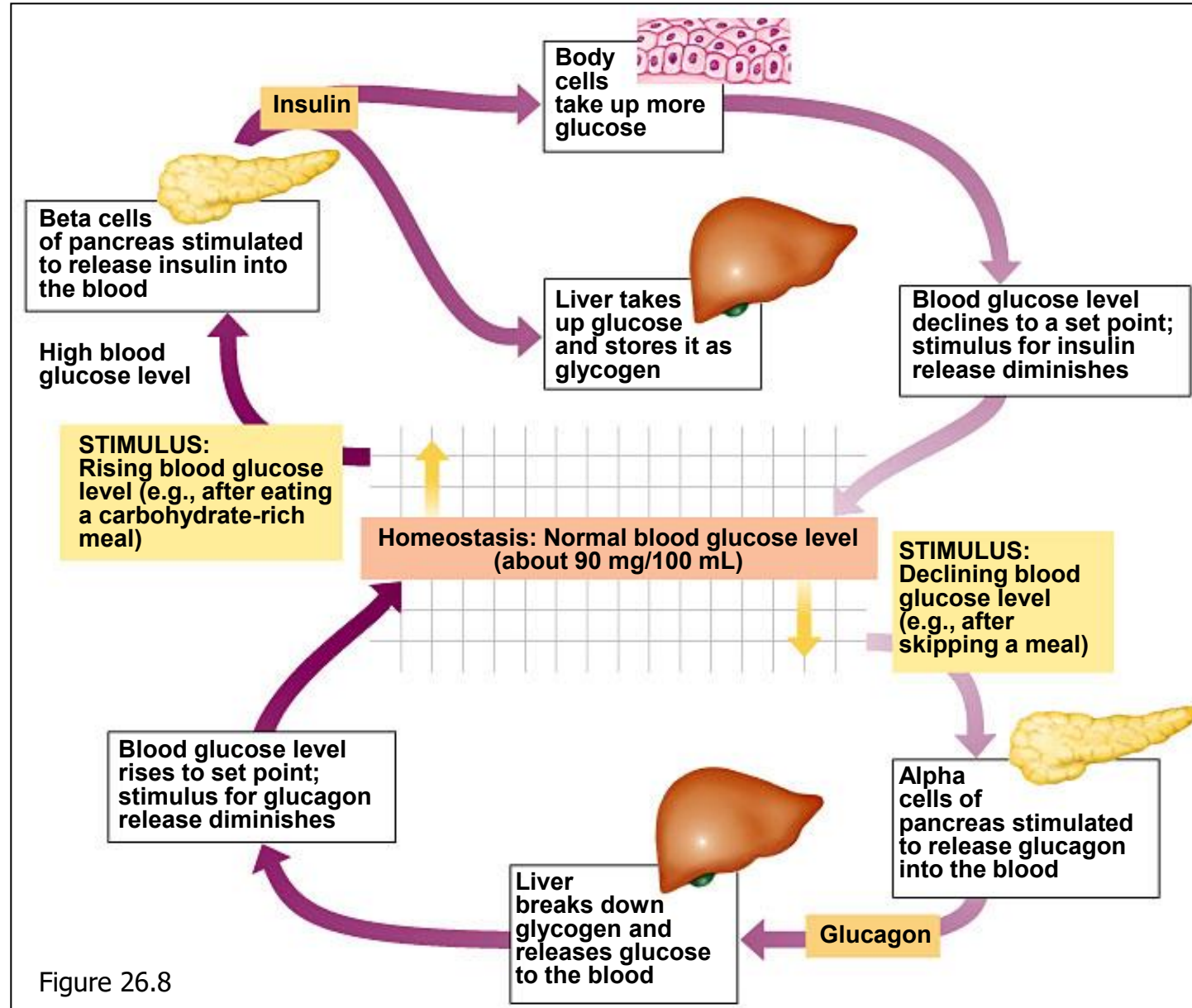Secretion of Glucagon(hyperglycemic hormone) by alpha cells which stimulate

1. Glycogenolysis (breakdown of glycogen to glucose)

2. Gluconeogenesis

3. Promotes **lipolysis** – breakdown of fat into fatty acids

**Overall body effect** Increases **blood glucose** and **fatty acids** in the blood (Maintains energy during fasting

# Glucose homeostasis – Putting it all together



**Insulin**

Body cells take up more glucose

Beta cells of pancreas stimulated to release insulin into the blood

High blood glucose level

Liver takes up glucose and stores it as glycogen

Blood glucose level declines to a set point; stimulus for insulin release diminishes

**STIMULUS: Rising blood glucose level (e.g., after eating a carbohydrate-rich meal)**

Homeostasis: Normal blood glucose level (about 90 mg/100 mL)

**STIMULUS: Declining blood glucose level (e.g., after skipping a meal)**

Blood glucose level rises to set point; stimulus for glucagon release diminishes

Alpha cells of pancreas stimulated to release glucagon into the blood

Liver breaks down glycogen and releases glucose to the blood

**Glucagon**

Figure 26.8

# Hypoglycemia Condistion

➢ Blood glucose level of 80 or less

➢ Most calls for diabetic emergency

➢ Signs and symptoms:

- Hunger
- Nervousness or shakiness
- Perspiration
- Dizziness or light-headedness
- Sleepiness or weakness
- Confusion
- Difficulty speaking
- Unresponsiveness

# Hyperglycemia Condition

Symptoms of diabetes and <u>high blood sugar</u> include:

- Feeling very thirsty (polydipsia).
- Frequent urination(polyuria).
- Fatigue.
- Feeling very hungry (polyphagia).
- Unexplained weight loss.
- Blurred vision.
- Slow healing of cuts or sores.

# Diabetes Mellitus

Chronic high blood [glucose].

**3** forms of diabetes mellitus:

1. Type I: insulin dependent diabetes (IDDM).

2. Type II: non-insulin dependent diabetes (NIDDM).

3. .
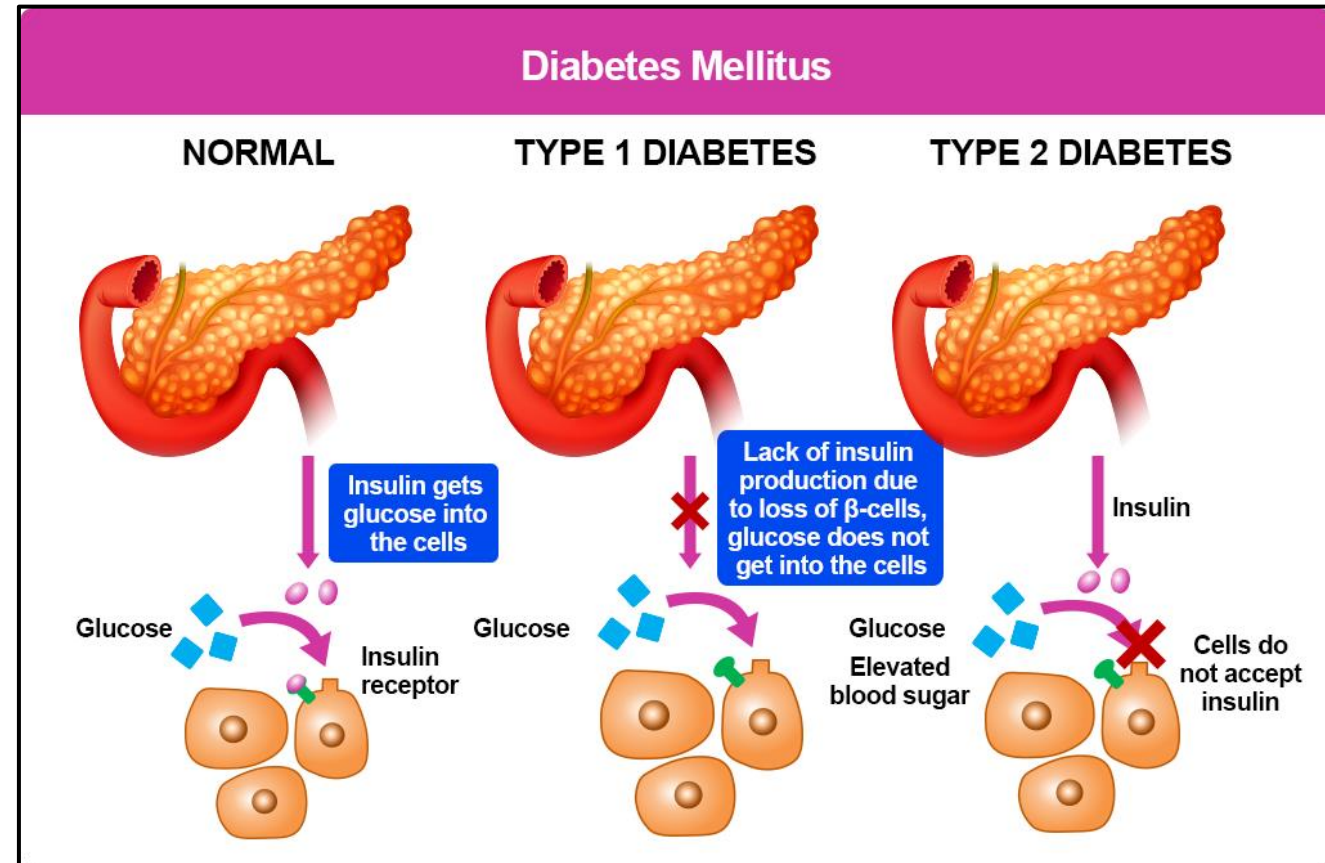
# Comparison of Type I and Type II Diabetes Mellitus

**Table 19.6 Comparison of Type 1 and Type 2 Diabetes Mellitus**

| Feature | Type 1 | Type 2 |
|---|---|---|
| Usual age at onset | Under 20 years | Over 40 years |
| Development of symptoms | Rapid | Slow |
| Percentage of diabetic population | About 10% | About 90% |
| Development of ketoacidosis | Common | Rare |
| Association with obesity | Rare | Common |
| Beta cells of islets (at onset of disease) | Destroyed | Not destroyed |
| Insulin secretion | Decreased | Normal or increased |
| Autoantibodies to islet cells | Present | Absent |
| Associated with particular MHC antigens* | Yes | Unclear |
| Treatment | Insulin injections | Diet and exercise; oral stimulators of insulin sensitivity |

# Glucometer or glucose meter

# OPERATION STEPS

**Step 1**

Insert Test Strip

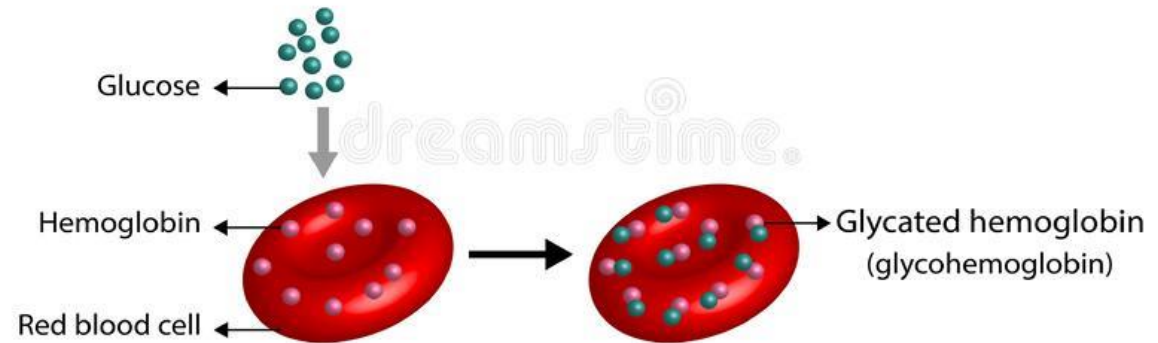**Step 2**

Take Blood Sample

**Step 3**

Apply Blood

**Step 4**

Result in Seconds

| Normal | Below 5.7% |
|--------|-----------|
| Prediabetes | 5.7% to 6.4% |
| Diabetes | 6.5% or above |

# Hemoglobin A1C (HbA1c)



Glucose

Hemoglobin

Red blood cell

Glycated hemoglobin (glycohemoglobin)

https://www.youtube.com/watch?v=HJGjNTJgf48&t=642s

https://www.youtube.com/watch?v=XfyGv-xwjlI

# References

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◦ Hall, J. E., & Hall, M. E. (2020). Guyton and Hall Textbook of Medical Physiology. Elsevier.

◦ Saladin, K. (2020). Anatomy & Physiology: The Unity of Form and Function. McGraw-Hill Education.