



## 03e – HOMEOSTASIS

### *Glucoregulation & Adrenaline*



# Controlling Glucose Levels

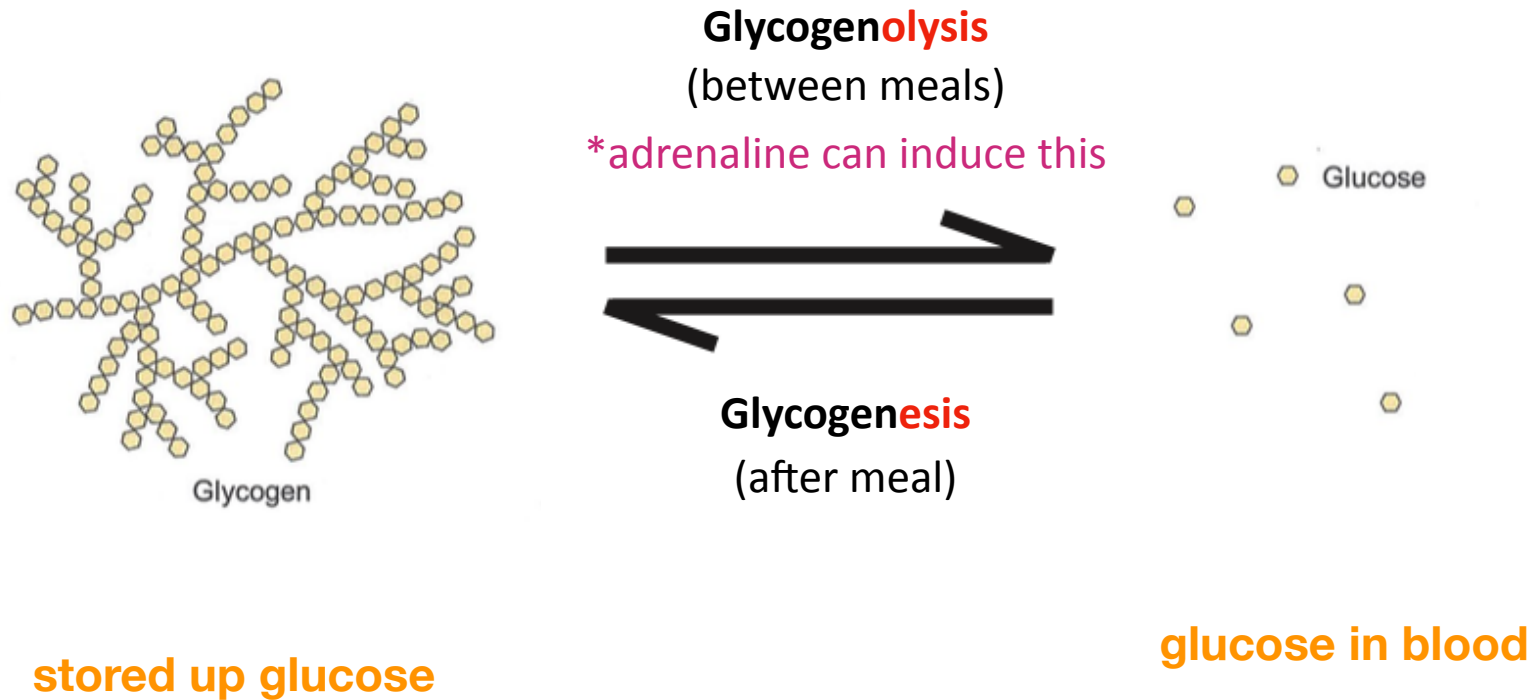


**3.3.3** Hormones can alter the **metabolism** of target cells, tissues, or organs.

- Compare the action of **insulin** and **glucagon** in blood sugar regulation.
  - Describe how **diabetes mellitus** can result from a hormonal imbalance.
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# Controlling Glucose Levels

## 1. Glycogen



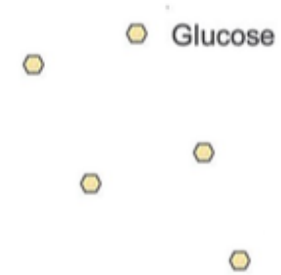
# Controlling Glucose Levels

## 2. Gluconeogenesis

**Proteins  
& fats**



**Gluconeogenesis**



# Controlling Glucose Levels

## 3. Pancreas: insulin & glucagon (to control glucose levels in blood)

Insulin	Glucagon
Stimulates absorption of glucose from blood by cells in the muscles, liver and fatty tissue.	Stimulates release of glucose from blood by cells in the muscles, liver and fatty tissue.
Stimulates glycogenesis	Stimulates glycogenolysis
Inhibits gluconeogenesis	Stimulates gluconeogenesis
Inhibits glycogenolysis	Inhibits glycogenesis

**antagonistic hormones**

# Controlling Glucose Levels

## 3. Pancreas: insulin & glucagon

### INSULIN

- promotes cells absorbing sugar from blood which lowers blood sugar levels
- stimulates glycogenesis
- inhibits \_\_\_\_\_
- inhibits \_\_\_\_\_

### GLUCAGON

- promotes cells releasing glucose into the blood which increases blood sugar levels
- stimulates \_\_\_\_\_
- stimulates \_\_\_\_\_
- inhibits \_\_\_\_\_



# Controlling Glucose Levels

## Negative Feedback

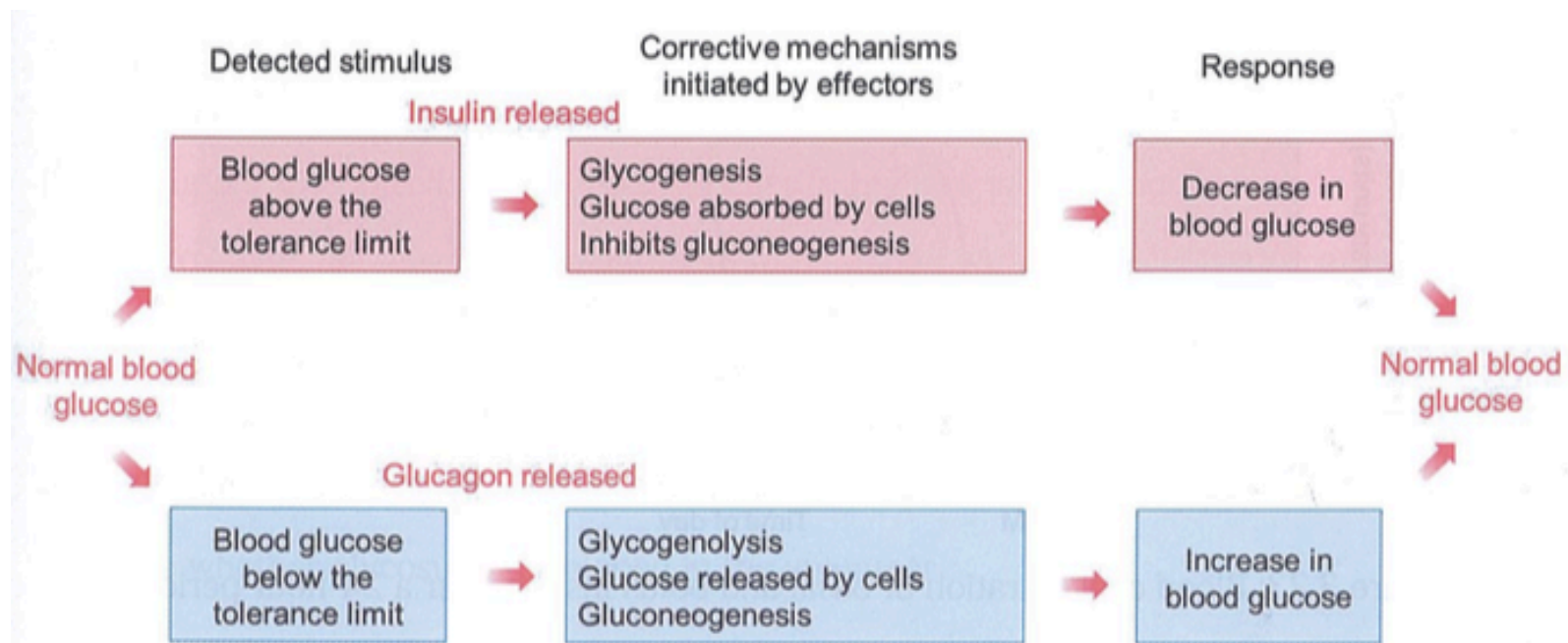
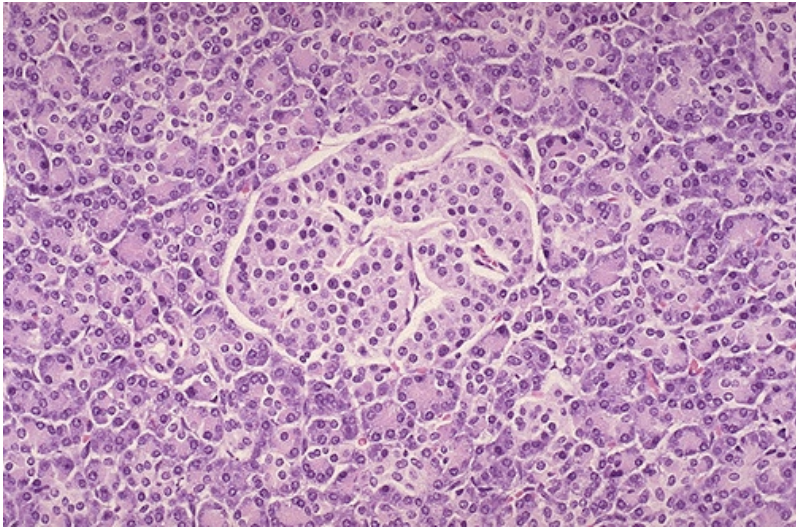


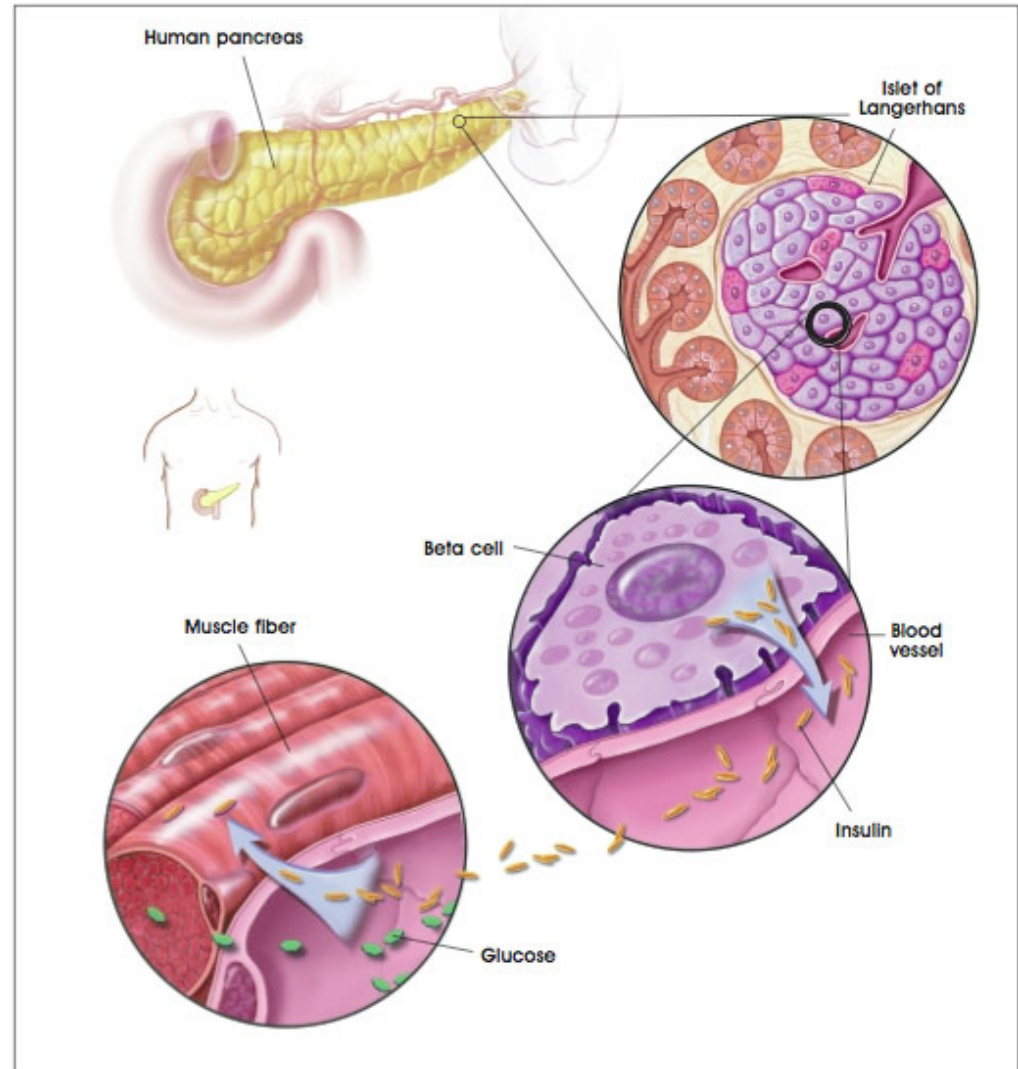
Figure 3.22: Negative feedback (blood glucose)

# Regulating Glucose Levels



Beta cells secrete INSULIN

Alpha cells secrete GLUCAGON





# Diabetes mellitus

- ☑ Describe how **diabetes mellitus** can result from a hormonal imbalance.

**Diabetes** = disorder of the endocrine system

1. Not enough insulin produced
2. Cells don't respond to insulin

Diabetes mellitus	Summary
Type 1 (insulin-dependent)	<ul style="list-style-type: none"><li>• Pancreatic beta cells do not produce sufficient insulin to regulate blood glucose level.</li><li>• Typically develops in childhood and accounts for 5–10% of cases of diabetes mellitus.</li><li>• Treatment involves multiple injections of insulin daily or a continuous infusion of insulin from a pump.</li></ul>
Type 2 (non-insulin dependent)	<ul style="list-style-type: none"><li>• Tissue cells become resistant to insulin which interferes with the regulation of blood glucose level.</li><li>• Develops at any stage of life and accounts for 90% of cases of diabetes mellitus.</li><li>• Treatment involves weight loss, exercise, modification of diet and the use of medications, including insulin.</li></ul>

# Diabetes Treatment

- ☑ Describe how **diabetes mellitus** can result from a hormonal imbalance.

**Type 1** = injection of insulin

**Type 2** = change diet, exercise, and use medications

# Fight or Flight Response

(For example - how adrenaline works!)

Key:  
nerves + hormones

Stimulus:  
threat/stress

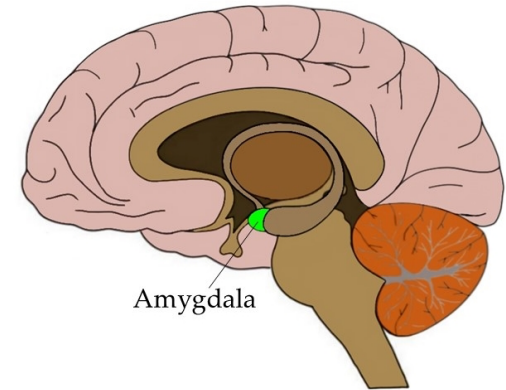
Detection:  
Amygdala

Hypothalamus

Adrenal gland

adrenaline  
(into blood)

- dilate pupils
- increase heart rate
- dilate blood vessels in skeletal system
- increase blood pressure
- reduce blood flow to non-essential organs
- dilate air passages
- increase breathing rate
- increase blood sugar levels (stimulate glycogenolysis)



# Nervous & Endocrine Achieving Homeostasis

Factor	Nervous system	Endocrine system
<b>Body Temperature</b>	<ul style="list-style-type: none"> <li>* thermoreceptors in hypothalamus detect and respond to changes</li> <li>* nerve impulses to skeletal muscles, sweat glands, arterioles to initiate response</li> </ul>	<ul style="list-style-type: none"> <li>* pituitary produces TSH</li> <li>* thyroid produces hormones (thyroxine) to up metabolism</li> <li>* produce adrenaline and insulin to up rate of respiration</li> </ul>
<b>Osmolarity</b>	<ul style="list-style-type: none"> <li>* osmoreceptors in hypothalamus that detect and respond to osmolarity</li> <li>* send nerve impulse to pituitary to modify rate of ADH production</li> </ul>	<ul style="list-style-type: none"> <li>* pituitary produces ADH to increase water reabsorption</li> </ul>
<b>Blood Glucose Levels</b>	<ul style="list-style-type: none"> <li>* chemoreceptors in pancreas detect blood sugar levels</li> <li>* nerves stimulate adrenal gland to increase sugar levels in blood</li> </ul>	<ul style="list-style-type: none"> <li>* pancreas secretes insulin and glucagon to regulate blood sugar levels</li> </ul>
<b>Blood pH</b>	<ul style="list-style-type: none"> <li>* chemoreceptors in brain and heart detect changes in pH</li> <li>* stimulate medulla oblongata to change rate of breathing</li> </ul>	<ul style="list-style-type: none"> <li>* altering thyroxine (thyroid gland) and adrenaline levels (adrenal gland) to impact rate of respiration and body activity.</li> </ul>