

# Biology

ENGLISH MEDIUM



UNIT  
**05**

**Animal Form and Function**

**Homeostasis**

**SAMPATH**  
**LANKADHEERA**

B.Sc. (Hons), M.Sc.



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New Syllabus

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Unit  
**05** **Animal Form and Function**  
**Homeostasis**

ADVANCED LEVEL

# Biology

Unit - 05  
**Animal Form and Function**

o Homeostasis

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ADVANCED LEVEL

# Biology

**THEORY**

in English Medium

**New Syllabus**



**Unit  
05**

**Animal Form and Function**

○ Homeostasis

**Smart Note**

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## Homeostatic regulation of body temperature in humans 2010/2015

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- If the body temperature is outside the normal range, a group of nerve cells in the hypothalamus of the brain (“body’s temperature control center”) functions as a thermostat and responds to the temperature increase or decrease by activating heat loss mechanisms or promoting heat gain mechanisms respectively until the body temperature reaches the preset level.
- High peripheral temperature (Eg. When the person is in hot surroundings) is detected by warm receptors in the skin.
- High deep body temperature (Eg. due to high body heat generation after exercise) is detected by hypothalamic temperature sensitive nerve endings when warm blood pass through the hypothalamus.
- These nerve impulses are sent to the “body’s temperature control center” (thermostat) in the hypothalamus.

### Increase in Body Temperature

- In response to the increase in body temperature above the preset level, the ‘thermostat’ in the hypothalamus sends impulses to activate heat loss mechanisms and to inhibit heat gain mechanisms that lower the body temperature until the set point.
- The following heat loss mechanisms promote the decrease in body temperature.

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- When body temperature is within the normal range again, the warm temperature sensitive receptors are no longer stimulated and their signals to the ‘hypothalamic thermostat’ stops due to the negative feedback mechanism.

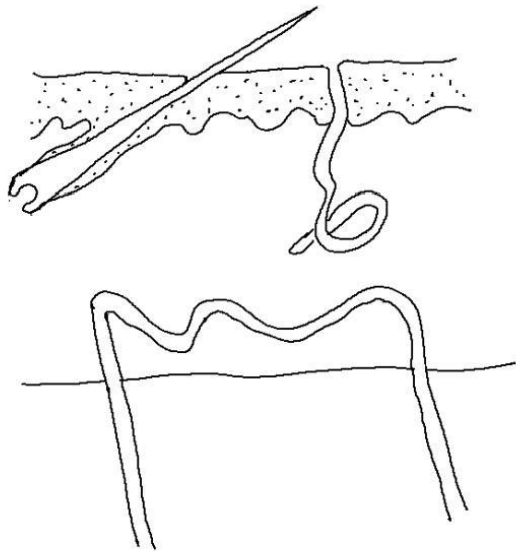
### Decrease in body temperature

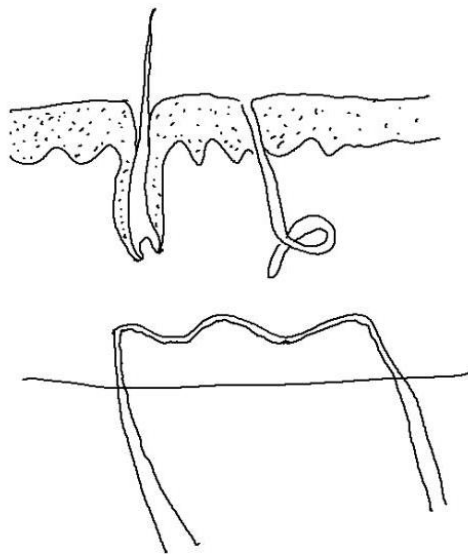
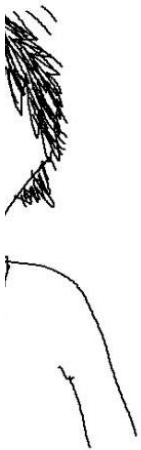
- Then, additional heat loss mechanisms stop and blood flow to the peripheries returns to normal.
- Low peripheral temperature (when in cold surroundings) is detected by cold receptors in the skin.
- Low deep body temperature (due to more heat loss and low heat generation in the body) is detected by temperature sensitive nerve endings in the hypothalamus.
- These nerve impulses are sent to the body’s temperature control center (thermostat) in the hypothalamus.

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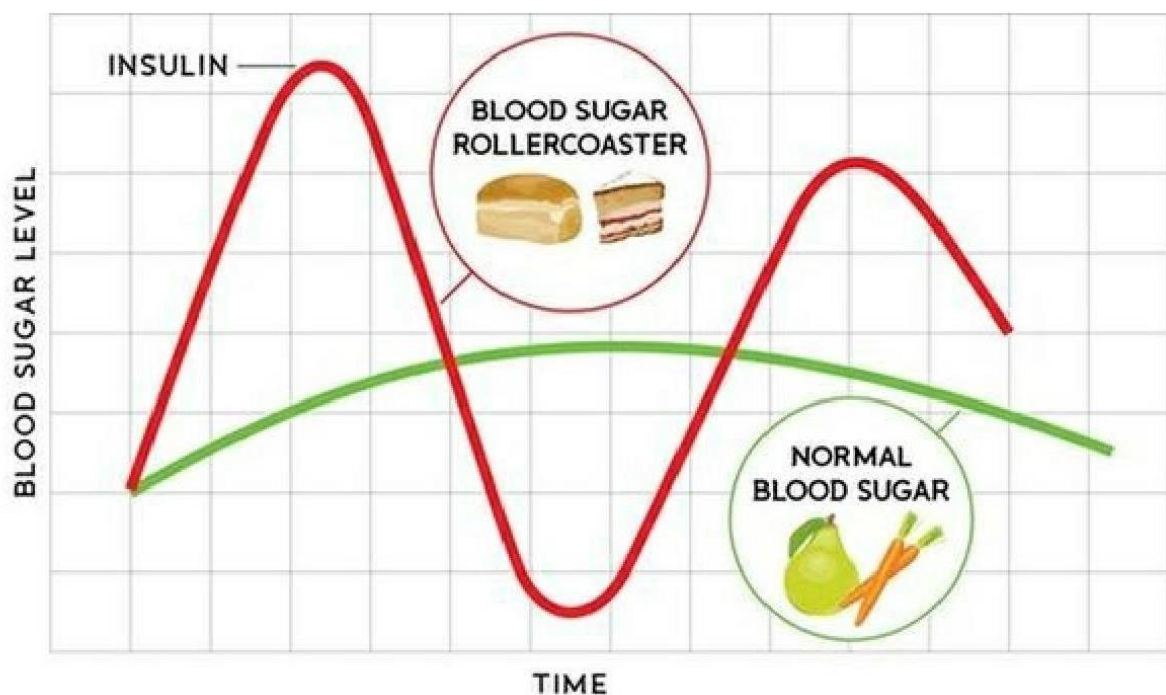


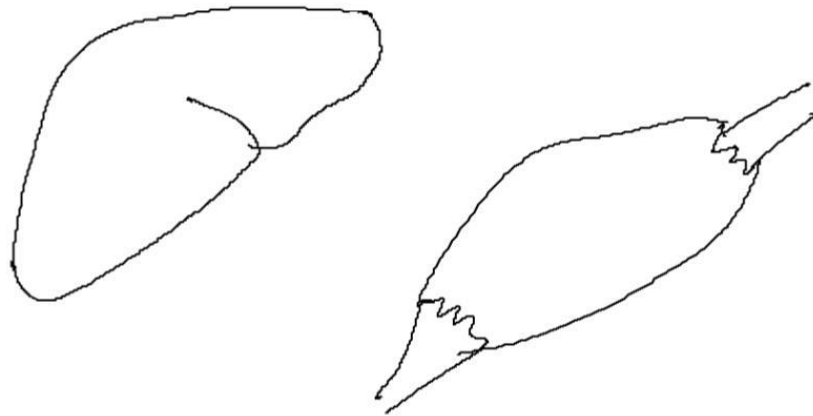
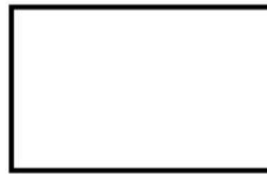
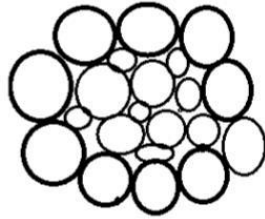


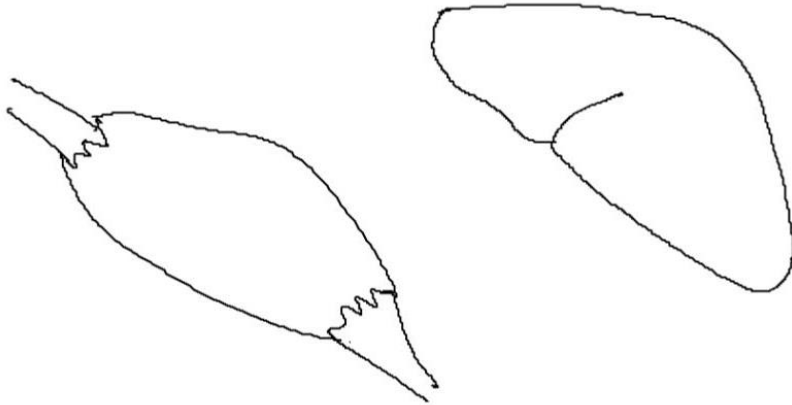
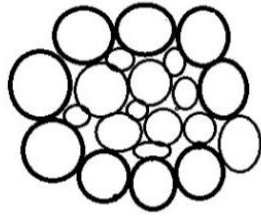




- This mechanism prevents further lowering of the glucose level in the blood beyond the normal limits.
- Low blood glucose levels below the normal limit, stimulate the secretion of glucagon from alpha cells of the islets of Langerhans into the circulating blood.
- Glucagon acts on specific target tissues to promote increase of the blood glucose level.
- Glucagon promotes the breakdown of glycogen in the liver and skeletal muscles and release of glucose into blood.
- When glucose level in the blood reaches normal range, blood glucose level can in turn directly control the secretion of glucagon levels from the pancreas through negative feedback which prevents further increasing of the glucose level in the blood beyond the normal limits.









### Role of the liver in homeostasis.

- Liver is an active organ and plays an important role in maintaining homeostasis of the human body. The functions of the liver include the following.
- **Carbohydrate metabolism:** The liver plays an important role in maintaining blood glucose levels within normal ranges. When blood glucose is increased (e.g. after a meal), glucose is stored as glycogen under the stimulation of insulin. If blood glucose level is reduced (e.g. starvation), glycogen is converted back to glucose under the influence of glucagon hormone.
- **Fat metabolism:** When the body needs excess energy, fats that are stored in the liver cells are metabolized to produce ATP
- **Protein metabolism:** In the liver cells, nitrogen part of some amino acids that are not needed for new protein synthesis are removed (deamination) and excreted in urine or transferred to carbohydrates to synthesize new nonessential amino acids (transamination). Liver also synthesizes plasma proteins (e.g. albumin, globulins) from amino acids.
- **Breakdown of erythrocytes and defense against microbial infections:** In humans, liver is a site for red blood cell breakdown. Macrophages located in the liver are involved in microbial defense.
- **Detoxification of drugs and toxicants:** The liver plays an important role in detoxification.
- **Production of heat:** Liver is the major heat producing organ of the body as it has a high metabolic rate.



## MCQ

- Which one of the following statements is correct regarding the regulation of body temperature in man?  
(1) Lowering of the environmental temperature stimulates the thermoregulatory centre in the cerebellum.  
(2) Rise in body temperature inhibits the secretion of hormones that increase the metabolic rate.  
(3) Rise in environmental temperature contracts the hair erector muscles in the skin.  
(4) Decrease in body temperature produces more sweat.  
(5) Lowering of environmental temperature dilates the superficial blood vessels in the skin (AL/2000 Bio)
- Which statement regarding human skin is incorrect?  
(1) It contains all four basic types of tissues (2) It synthesizes vitamin A.  
(3) It acts as an excretory organ. (4) It prevents entry of microorganisms into the body.  
(5) It helps in thermoregulation. (AL/2002)
- Which of the following is not homeostatically regulated in the internal environment of man  
(1) Glucose (2) Temperature (3) Urea (4) Carbon dioxide (5) Water (AL/2005)
- Which of the following statement/statements is/are true regarding human kidney?  
(A) It is involved in the production of red blood cells. (B) It regulates the pH of blood.  
(C) Its tubules secrete glucose. (D) It is the major osmo-regulatory organ of the body.  
(E) It synthesizes urea. (AL/2005)
- Which one of the following is an **incorrect** statement regarding human liver?  
(1) It is the largest gland in the body. (2) It is the main storage centre of the body.  
(3) It aids in the digestion of lipids. (4) It is involved in temperature regulation.  
(5) The secretion of bile from it is stimulated by cholecystokinin. (AL/2006)
- Which of the following statement/s is/are correct regarding homoeothermy in man?  
(A) It is regulated by negative feedback mechanisms. (B) Hypothalamus is essential for homoeothermy.  
(C) Elevation of temperature is sensed by Krause's bulbs. (D) Erection of hair plays a major role in reducing heat loss  
(E) Homoeothermy is achieved mainly by involuntary mechanisms. (AL/2008)
- Which of the following statements is / are correct regarding regulation of blood glucose level in man?  
(A) Fasting blood glucose level is 70-110 mg/100 ml blood.  
(B) Blood glucose level is regulated by negative feedback mechanisms.  
(C) Rise in Blood glucose level inhibits insulin secretion.  
(D) Glucagon stimulates conversion of glycogen to glucose.  
(E) Distal convoluted tubule of nephron plays an important role in glucose homoeostasis. (AL/2009)
- Which of the following statements regarding human skin is / are incorrect?  
(A) All four types of basic tissues can be seen in the dermis. (B) It excretes salts and urea.  
(C) Nerve endings do not penetrate in to the epidermis.  
(D) Epidermis is a stratified squamous epithelium containing glands.  
(E) It synthesizes vitamin D. (AL/2011 new)
- In man, which one of the following does not occur in response to rise in environmental temperature?  
(1) Stimulation of Rufovani corpuscles (2) Sweating  
(3) Contraction of erector pilli muscles of the skin (4) Dilation of skin blood vessels  
(5) Reduction in metabolic rate (2012 Old/19)
- Which of the following statements regarding homoeostasis in man is incorrect?  
(1) It is the maintenance of a constant internal environment.  
(2) It is mediated via negative feedback mechanisms. (3) Blood urea level is homoeostatically regulated.  
(4) Liver plays an important role in homoeostasis. (5) Homoeostatic mechanisms are mainly involuntary. (2013/20)



**5.7.2: Investigates how a constant internal environment is maintained within a range in the body**

**2012 AL**

A (i) What is homeostasis?

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(ii) What are the hormones involved in osmo-regulation in man?

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(iii) What are the essential components of a negative feedback mechanism?

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(iv) Name the hormones which increases the blood glucose level in man.

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**2016 AL**

i) What is homeostasis?

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ii) State three factors that are homeostatically regulated in man

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iii) State two advantages of homeostasis in man

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iv) State one disadvantage of homeostasis in man

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v) Human liver plays a variety of roles in homeostasis. State four such roles

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vi) Give two examples of positive feedback mechanisms operating in man.

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