NCERT Solutions for Class 11 Biology Chapter 16: Chapter 16 of Class 11 Biology, Excretory Products and Their Elimination, explores the vital process of waste removal in organisms to maintain homeostasis. It explains the formation and excretion of nitrogenous wastes like ammonia, urea, and uric acid in different animals.

The chapter delves into the human excretory system, covering the structure and function of kidneys, nephrons, and urine formation. Regulatory mechanisms like osmoregulation and hormonal control of kidney function are discussed. Disorders such as uremia, kidney stones, and dialysis are highlighted. Understanding this chapter is crucial for grasping how organisms eliminate metabolic wastes and maintain internal balance for survival.

NCERT Solutions for Class 11 Biology Chapter 16 Overview

Chapter 16 of Class 11 Biology, Excretory Products and Their Elimination, highlights the importance of waste removal in maintaining the body's homeostasis and health. It explains the formation of nitrogenous wastes like ammonia, urea, and uric acid, and their elimination in various organisms.

The chapter provides detailed insights into the human excretory system, focusing on kidneys, nephrons, and the process of urine formation. Regulatory mechanisms like osmoregulation and hormonal control of kidney functions are emphasized. Understanding these concepts is vital to appreciate how organisms maintain internal balance, prevent toxic accumulation, and manage disorders like kidney failure and uremia.

NCERT Solutions for Class 11 Biology Chapter 16 Excretory Products and Their Elimination

Below is the NCERT Solutions for Class 11 Biology Chapter 16 Excretory Products and Their Elimination -

1. Define Glomerular Filtration Rate (GFR).

Solution:

The amount of filtrate produced by both kidneys (nephrons) each minute is known as the Glomerular Filtration Rate (GFR). A healthy individual has a GFR of about 125 millilitres per minute. Water and other components such amino acids, glucose, potassium, salt, urea, uric acid, and ketone bodies make up the majority of the GFR.

2. Explain the autoregulatory mechanism of GFR.

Solution:

The kidneys use an auto-regulatory system to control the glomerular filtration rate. The juxtaglomerular apparatus, a tiny structure located between the vascular pole of the renal corpuscle of the same nephron and the returning distal convoluted tubule, is involved in its activity.

It controls renal blood flow and glomerular filtration rate. The juxtaglomerular cells are triggered to release renin when the glomerular filtration rate drops. The glomerular blood flow is triggered by this, and the GFR returns to normal. Renin triggers the renin-angiotensin pathway, which returns GFR to normal.

3. Indicate whether the following statements are true or false.

(a) Micturition is carried out by a reflex.

(b) ADH helps in water elimination, making the urine hypotonic.

(c) Protein-free fluid is filtered from blood plasma into the Bowman's capsule.

(d) Henle's loop plays an important role in concentrating urine.

(e) Glucose is actively reabsorbed in the proximal convoluted tubule.

Solution:

(a) Micturition is carried out by a reflex. – True

(b) ADH helps in water elimination, making the urine hypotonic. – False

ADH helps in the reabsorption of water, causing the urine to be hypotonic.

(c) Protein-free fluid is filtered from blood plasma into the Bowman's capsule. – True

(d) Henle's loop plays an important role in concentrating urine. – True

(e) Glucose is actively reabsorbed in the proximal convoluted tubule. – True

4. Give a brief account of the counter-current mechanism.

Solution:

The chief adaptation for the conservation of water is the counter-current mechanism that is functional inside the kidney. In the kidney, there are two counter-current mechanisms, namely

1. Henle's loop

2. Vasa recta

- Henle's loop is a U-shaped part of the nephron. The flow of blood in the two branches of the tube is in the opposite direction, which gives rise to the counter currents.
- Vasa recta, on the other hand, is an efferent arteriole that forms a capillary network around the tubules in the renal medulla, which tracks parallel to the Henle's loop. Vasa recta are also U-shaped. The flow of blood is in opposite directions in the two limbs of the vasa recta. Hence, the blood that enters the renal medulla in the descending limb comes in close proximity with the outgoing blood in the ascending limb
- The concentration gradient is maintained by the countercurrent process, which raises the osmolarity in the cortex from 300 mOsmolL-1 to roughly 1200 mOsmolL-1 in the inner medulla. Water can therefore flow more easily from the collecting tubules as a result. The flow of urea and NaCl is what causes the concentration gradient.

5. Describe the role of the liver, lungs and skin in excretion.

Solution:

The role of the liver, lungs and skin in the process of excretion is as follows:

Liver

- It is the chief site for the removal of inactivated products of steroid hormones, cholesterol, drugs and vitamins.
- Dead erythrocytes possess haemoglobin. This haemoglobin is also disintegrated into bile pigments – biliverdin and bilirubin, which are treated wastes.
- Bile carries substances to the intestine, which along with the wastes, are eliminated.

Lungs

- Carbon dioxide is expelled from the body by the lungs.
- Approximately it eliminates 200ml of carbon dioxide every minute.
- Water in the form of water vapour is also eliminated.
- Loss of water increases in colder conditions and declines in humid, hot conditions.
- During the process of expiration, several volatile materials are also ejected.

Skin

- It is primarily in charge of the body's thermoregulation, or cooling.
- The skin eliminates perspiration. There are nitrogenous wastes in it. Sweat is only expelled when it's required, as when the body needs to chill down.
- The sweat glands emit perspiration, which contains lactic acid, urea, and sodium chloride.
- The sebaceous glands extract waxes, sterols, and hydrocarbons from the sebum.
- Sebum provides the skin with an oily, protective layer.

6. Explain micturition.

Solution:

Micturition is the process of releasing urine. Micturition is caused by a neural mechanism known as the micturition reflex.

The pee that is produced is momentarily stored in the bladder. When the bladder fills with urine, it has a tendency to expand. The receptors in the bladder walls respond to this signal by sending messages to the central nervous system (CNS), which is triggered by this stretching. Micturition, or the passing of urine, is caused by the contraction of the smooth muscles of the bladder and the relaxation of the urethral sphincters, which are both initiated by motor instructions sent by the central nervous system.

7. Match the items of column I with those of column II.

Column I	**Column II**
(a) Ammonotelism	**(i) Birds**
(b) Bowman's capsule	**(ii) Water reabsorption**
(c) Micturition	**(iii) Bony fish**
(d) Uricotelism	**(iv) Urinary bladder**
(d) ADH	**(v) Renal tubule**

Solution:

Column I	**Column II**
(a) Ammonotelism	(iii) Bony fish
(b) Bowman's capsule	(v) Renal tubule
(c) Micturition	(iv) Urinary bladder
(d) Uricotelism	(i) Birds
(d) ADH	(ii) Water reabsorption

8. What is meant by the term osmoregulation?

Solution:

Osmoregulation is the process of regulating the osmotic concentration in the cells of the body by checking the quantity of water and salts.

9. Terrestrial animals are generally either ureotelic or uricotelic, not ammonotelic. Why?

Solution:

Ammonia is a nitrogenous waste that is exceedingly poisonous. A significant amount of water is required to lessen the toxicity of ammonia in the body. The bodies of terrestrial animals do not contain enough water to dilute ammonia. This extra ammonia may become exceedingly toxic to terrestrial animals if it is stored in their bodies. As a result, ammonia in these animals is always transformed into less harmful urea and uric acid. Terrestrial animals are typically either ureotelic or uricotelic for this reason.

10. What is the significance of the juxtaglomerular apparatus (JGA) in kidney function?

Solution:

The juxtaglomerular apparatus is a specialised sensitive region that is formed by the cellular modifications in the distal convoluted tubule and the afferent arteriole at the location of their contact.

Significance

- Its mechanism is via the renin-angiotensin-aldosterone system (RAAS).
- When the glomerular filtration rate dips, the juxtaglomerular apparatus stimulates, causing the secretion of renin.
- This renin converts a protein into a peptide, i.e., angiotensinogen, to angiotensin.
- Angiotensin is a hormone that elevates the GFR and the flow of blood in these three ways:
    1. Narrowing the efferent arterioles causes an increase in glomerular pressure.
    2. Triggering the walls of the PCT in order to reabsorb more water and NaCl.
    3. Triggers the adrenal gland to secrete aldosterone that facilitates reabsorption of water and NaCl in the DCT.
- The volume of blood and blood pressure thereby increases. The hypertonic urine and urine volume decreases.

11. Name the following.

(a) A chordate animal having flame cells as excretory structures.

(b) Cortical portions projecting between the medullary pyramids in the human kidney.

(c) A loop of capillary running parallel to Henle's loop.

Solution:

(a) A chordate animal having flame cells as excretory structures. – Amphioxus

Flame cells or protonephridia are the excretory structures found in some animals.

(b) Cortical portions projecting between the medullary pyramids in the human kidney. – Columns of

Bertini

The medulla is divided into several conical masses (medulla pyramids) that project into the calyces. The cortex extends in between the medullary pyramids as renal columns known as Columns of Bertini.

(c) A loop of capillary running parallel to Henle's loop. – Vasa recta

A minute vessel of the network that runs parallel to the Henle's loop forms a 'U' shaped vasa recta. Vasa recta are highly reduced in the cortical nephrons.

12. Fill in the gaps.

(a) Ascending limb of Henle's loop is _____ to water, whereas the descending limb is _____ to it.

(b) Reabsorption of water from distal parts of the tubules is facilitated by hormone _____.

(c) Dialysis fluid contain all the constituents as in plasma except _____.

(d) A healthy adult human excretes (on an average) _____ gm of urea/day

Solution:

1. Impermeable, permeable
2. Vasopressin (anti-diuretic hormone)
3. Nitrogenous waste
4. 25-30

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