Excretory Product and their Elimination

CHAPTER 19

NCERT FOCUS

ANSWERS

Topic 1

1. Ammonotelic animals are aquatic animals that excrete ammonia which is highly soluble in water, thus large amount of water is also excreted. Terrestrial animals cannot afford to lose such large quantities of water from their bodies as they live in environment having water scarcity. They, therefore, excrete either urea (ureotelic) or uric acid (uricotelic) as these are less soluble in water.

2. (a) Cephalochordate – *Amphioxus*

(b) Columns of Bertini

(c) *Vasa recta*

3. The regulation of water and solute contents of the body fluids by the kidney is called osmoregulation.

Topic 2

1. (a) True (b) False (c) True (d) True (e) True

2. The amount of filtrate formed by the kidneys per minute is called glomerular filtration rate (GFR). It is approximately 125 mL/min in a healthy person.

3. The kidneys have built-in mechanisms for the regulation of glomerular filtration rate. One such efficient mechanism is carried out by juxtaglomerular apparatus (JGA). JGA is a special sensitive region formed by cellular modifications in the distal convoluted tubule and the afferent arteriole at the location of their contact. A fall in GFR can activate the JG cells to release renin which can stimulate the glomerular blood flow and thereby the GFR back to normal.

4. The kidneys have a special mechanism for concentrating the urine, it is called counter current mechanism. The mechanism is said to be a counter current mechanism because the out flow (in the ascending limb) of Henle's loop runs parallel to and in the opposite direction of the inflow (in the descending limb) and *vasa recta*. As the mechanism begins to function, the ascending limb of loop of Henle actively transports chloride and sodium ions out into the *vasa recta* from where it is secreted into the interstitial fluid. As a result, the interstitial fluid around the loop of Henle contains large quantities of NaCl. The filtrate passes from the ascending limb of loop of Henle and enters a collecting duct. The collecting duct passes adjacent to the loop of Henle where the interstitial fluid contains large amount of NaCl. The high osmotic pressure created by NaCl causes water to diffuse out of the collecting duct in the interstitial fluid and eventually to the blood of *vasa recta*. The filtrate becomes greatly concentrated and is now called urine. A similar counter current mechanism, operates between the interstitial fluid and blood passing through the *vasa recta*. As the blood capillary runs along the ascending limb of loop of Henle, NaCl diffuses out of the blood. The direction is reversed as the blood capillary passes along the descending limb of Henle. The blood flows in the *vasa recta* around the loop of Henle from ascending to the descending side while the fluid passing through the loop of Henle goes in the opposite direction. The arrangement helps to maintain the concentration gradient of NaCl.

The overall function of counter current mechanism is to concentrate sodium chloride in the interstitial fluid and thereby cause water to diffuse out of the collecting ducts and concentrate the urine.

5. The process of passing out urine from the urinary bladder is called micturition. Urine formed by the nephrons is ultimately carried to the urinary bladder where it is stored. This causes stretching of the wall of bladder that leads to the stimulation of stretch receptors on the walls of the bladder. This sends signal to the CNS. The CNS passes on motor messages to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sphincter causing the release of urine.

6. Juxtaglomerular apparatus (JGA) is a special sensitive region formed by cellular modifications in the distal convoluted tubule and the afferent arteriole at the location of their contact. The JGA plays a complex regulatory role. A fall in glomerular blood flow/glomerular blood pressure/GFR can activate the JG cells to release renin which converts angiotensinogen in blood to angiotensin I and further to angiotensin II. Angiotensin II, being a powerful vasoconstrictor, increases the glomerular blood pressure and thereby GFR. Angiotensin II also activates the adrenal cortex to release aldosterone. Aldosterone causes reabsorption of Na^+ and water from the distal parts of the tubule. This also leads to an increase in blood pressure and GFR.

Topic 3

1. Other than the kidneys, lungs, liver and skin also help in the elimination of excretory wastes. Lungs remove large amounts of CO_2 200 mL/minutes and also significant quantities of water every day. Liver secretes bile which contains substances like bilirubin, biliverdin, cholesterol, degraded steroid hormones, vitamins and drugs. Most of these substances ultimately pass out along with digestive wastes. The sweat and sebaceous glands in the skin can eliminate certain substances through their secretions. Sweat produced by the sweat glands is a watery fluid containing NaCl, small amounts of urea, lactic acid etc. Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum.

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