



Dr. Bbosa Science

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Based on, best for sciences

O level Biology

Excretion

This is the removal of metabolic waste products from the body

Example of excretory product

1. Carbon dioxide
2. Ammonium excretory product (ammonia, urea and uric acid)

What determines the ammonium product to excrete?

Generally, the amount of water required to excrete uric acid is lower than that required for urea than for ammonia. Actually, uric acid is excreted in semi solid form.

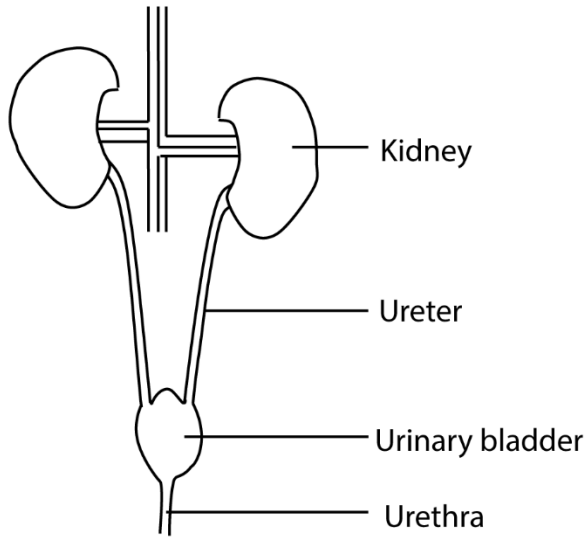
Nature through natural selection has made it that

- (i) animals (e.g. frog) living in places with abundant water such as fresh water lakes and rivers, excrete ammonia,
- (ii) Animals that with limited access to water such as arthropods and birds excrete uric acid.
- (iii) Animals that live in not so dry land such man excrete urea. Other organisms excrete varying amounts of ammonia, urea and uric acid depending on the metabolic capacity of their body to do so.

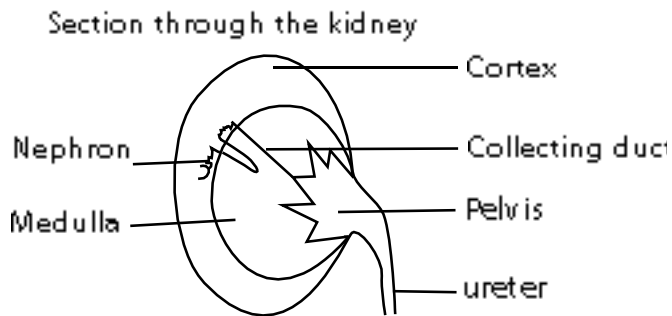
Table of excretory organs and their excretory product

Excretory organ	Products of excretion
Lungs	Carbon dioxide
Skin	Urea, ammonia
Kidney	Urea ammonia and uric acid

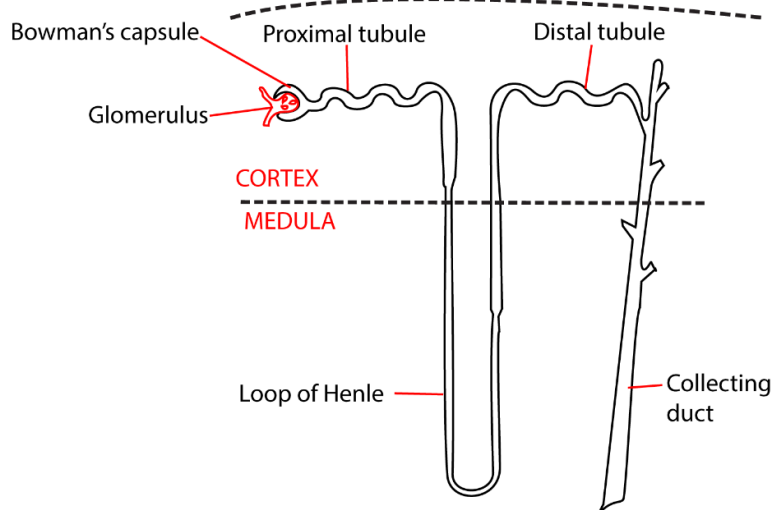
The kidney
The urinary system



Section of kidney



The functional unit of the kidney is the nephron



Urine production involves three processes

1. Filtration:

This occurs in glomerulus into the Bowman's capsule. The filtration pressure is due to the fact that **afferent** blood vessel is bigger than the efferent blood vessel.

Small molecules like glucose, amino acids, ammonia are filtered through the pores of capillary vessels.

Big molecules like proteins and blood cell are not filtered because they cannot pass through the pores of the glomerular membrane

2. Reabsorption

Useful molecules like glucose, amino acids and water are reabsorbed from the filtrate in proximal convoluted tubules while unwanted molecules like urea are not reabsorbed. More water is reabsorbed from the loop of Henle.

3. Secretion

Urea and ammonia which remained in blood is removed by active transport and secreted into the filtrate.

The remaining material including urea and ammonia pass through the collecting duct to the bladder as urine

Adjustment of pH

The pH of the body is kept at 7.4 to avoid undesirable effects on the enzymes. In addition to phosphate and hydrogen carbonate buffers that maintain this pH, excessive change in pH of the body is counteracted by the kidney at the distal convoluted tubule: This excretes hydrogen ions and retains hydrogen carbonates ions if the pH falls, and excretes hydrogen carbonate ions and retains hydrogen ions if the pH rises. A fall in pH also stimulates the kidney cells to produce ammonia (NH₃) which combine with the acids brought to the kidney and is then excreted as ammonium salt (NH₄⁺)

2. Regulation of water in the body

Body fluids are mainly water and electrolytes, and the three main organs that regulate fluid balance are the brain, the adrenal glands and the kidneys

Role of the brain

The osmoreceptors in the hypothalamus detects the osmotic level of blood, determines the body water need and directs the kidney and adrenal gland to respond accordingly.

Role of the kidney

When a person loses a lot of water or takes excess salt, osmotic pressure of blood rises and detected by osmoreceptors of the hypothalamus. This causes Antidiuretic hormone (ADH) to be

released. **ADH** causes reabsorption of water from distal convoluted tubule thus diluting blood. When the required dilution is not achieved, drinking of water is initiated by osmoreceptors in the hypothalamus.

Drinking, particularly if excessive, results in the osmotic pressure of the blood to fall below normal value. The osmoreceptors are less stimulated leading to less ADH being produced. Less water is thus reabsorbed from the tubule leading to copious dilute urine (diuresis).

Inability of a person to produce insufficient amounts ADH causes diuresis; the disease condition is called **diabetes insipidus**.

Role of adrenal gland

When blood volume falls due to blood loss or low sodium levels in blood, adrenal gland produces a hormone aldosterone. This hormone causes absorption of sodium and water at the distal convoluted tubule in conjunctions with ADH to increase blood volume.

Revision question

1. Which one of the following organs is responsible for removing excess amino acids from blood
 - A. Gall bladder
 - B. Kidney
 - C. Liver
 - D. spleen
2. In which part of the kidney nephron does reabsorption of glucose occurs?
 - A. Proximal convoluted tubule
 - B. Distal convoluted tubule
 - C. Descending loop of Henle
 - D. Ascending loop of Henle
3. The reason why urine of a healthy person does not contain glucose is that
 - A. The glomerulus is impermeable to glucose
 - B. Glucose is used for respiration before reaching the collecting duct
 - C. Glucose passes back into the blood stream
 - D. The kidney converts glucose to urea
4. Which one of the following would contain the highest concentration of proteins?
 - A. Blood plasma
 - B. glomerular filtrate
 - C. urine
 - D. serum
5. Which one of the following statements best explains why urine does not normally contain glucose?
 - A. Glucose molecules are too large to pass through the capillaries of the glomerulus
 - B. Glucose present in the renal tubule is changed to carbon dioxide and water
 - C. All the glucose filtered is reabsorbed back into the blood in renal tubule

- D. The bladder reabsorbs all glucose filtered.
6. Which of the diseases listed below is a result of lack of the anti-diuretic hormone (ADH) in body?
- A. Diabetes mellitus
 - B. Anemia
 - C. goiter
 - D. diabetes insipid
7. The following are physiological processes that occur in the body of a mammal
- (i) Elimination of urea
 - (ii) Regulation of salts in the body
 - (iii) Regulation of water in the body
 - (iv) Deamination of excess amino acid

Which of them are carried out by the kidney?

- A. (i), (ii) and (iv)
- B. (ii), (iii) and (iv)
- C. (i), (ii) and (iii)
- D. (ii) and (iii) only

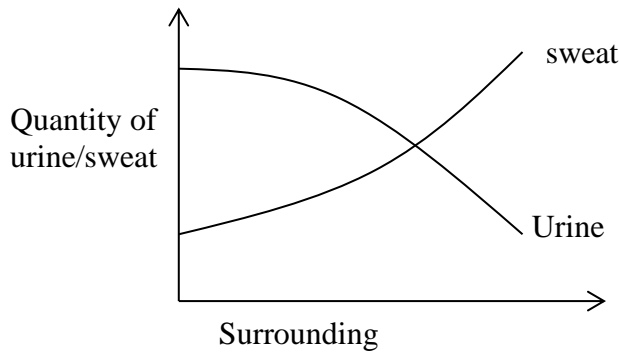
8. A man's urine gave a positive test with Benedict's solution. What is the best deduction about this man?
- A. He had been eating a lot of sugar
 - B. There was too much insulin in blood
 - C. There was too much insulin in his blood
 - D. He was suffering from diabetes
9. Urine is formed by
- A. Ultra-filtration and selective reabsorption
 - B. Selective reabsorption in the proximal tubules
 - C. Selective reabsorption at the loop of Henle
 - D. Ultra-filtration in the Bowman's capsule
10. A sample of urine from a woman was boiled with Benedict's solution and the mixture turned orange in color. Which of the following is the best deduction about the condition of the person?
- A. She has a deficiency of insulin in his blood
 - B. There is a lot of glycogen in his blood
 - C. Her diet has a lot of sugar
 - D. Her kidneys were damaged
11. Which of the following substances are secreted in mammalian sweat?
- A. Urea, ammonia, water
 - B. Urea, carbon dioxide,
 - C. Uric acid, water
 - D. Uric acid, urea
12. Which one of the following happens when the osmotic pressure of blood is higher than normal?
- A. Less ADH is secreted and more water is reabsorbed

- B. Less ADH is secreted and less water is reabsorbed
 - C. More ADH is secreted and more water is reabsorbed
 - D. More ADH is secreted and less water is reabsorbed
13. Which one of the following is completely reabsorbed from the kidney tubules during urine formation?
- A. Water
 - B. Glucose
 - C. Urea
 - D. Plasma proteins
14. Which of the following does not occur when Antidiuretic hormone is released in blood?
- A. Reabsorption of more water from the kidney tubule
 - B. Production of little urine
 - C. Production of concentrated urine
 - D. Production of dilute urine
15. An individual deficient in antidiuretic hormone is likely to produce?
- A. Vast quantity of dilute urine
 - B. Urine containing glucose
 - C. Little concentrated urine
 - D. Urine containing proteins
16. Which of the following constituent of blood is not found in glomerular filtrate?
- A. Urea
 - B. Proteins
 - C. Water
 - D. Glucose
17. Which one of the following occurs to urine as it leaves the kidney to the bladder?
- A. Glucose is removed
 - B. Urea is added
 - C. Its composition remains unchanged
 - D. Water is removed.
18. A reason for simpler excretory organ in plants as compared to those of animals is that plants
- A. Do not excrete solid wastes
 - B. Have lower metabolic rate
 - C. Do not use proteins
 - D. Are primary producers
19. Which one of the following substances is not contained in glomerular filtrate in mammalian kidney?
- A. Urea
 - B. Plasma proteins
 - C. Glucose
 - D. Mineral salts
20. The group organs performing excretory functions is

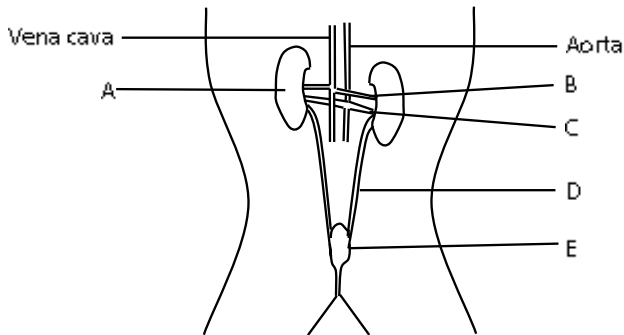
- A. Kidneys, lungs, skin
- B. Liver, kidney, and pancreas
- C. Skin, kidney, pancreas
- D. Lungs, spleen and gall bladder

Structured questions

1. (a) Why do flowering plants possess simpler excretory organ than those found in mammals?
 (b) describe how mammalian urine is formed
 (c) What part is played by the mammalian skin in excretion.
2. The graph shows the variation in the amount of sweat and urine with temperature in humans



- (a) How does the increase in temperature affect
 - (i) Urine production
 - (ii) Sweat production
 - (b) Explain your answer in (a)(i) and (a)(ii) above
 - (i) Explanation for (a)(i)
 - (ii) Explanation for (a)(ii)
 - (c) State three conditions under which human pass out concentrated urine
 - (d) A part from sweating, state three other response by mammal to over heating
3. Figure 4, below shows a mammalian urinary system



- (a) Name parts A-F
 A.

- B.
- C.
- D.
- E.

(b) Briefly explain why the concentration of urea in B is less than that in C.

.....

(c) What is the function of E?

.....

(d) A sample of urine was found to contain sugar

(i) Suggest the type of sugar likely to be in urine sample:

.....

(ii) What hormone is likely to be deficit in a person from whom the urine sample was taken:

.....

(iii) Name the disease that the person is likely to be suffering from:

.....

(e) Another individual was passing out a lot of urine but without sugar and complaining of thirst most of the time.

(i) Suggest a hormone that is deficient in this individual:

.....

(ii) Name the organ which produces the hormone referred to in (e)(i) above.

.....

.....

Essay type questions

1. (a) What is excretion?
(b) With the aid of diagram describe the functioning of the kidney in excretion?
2. Describe how the amount of water is regulated in the body

Answers

1.	C	6.	D	11	A	16	B		
2.	A	7.	C	12	C	17	C		
3.	C	8.	D	13	B	18	B		
4.	D	9.	A	14	D	19	B		
5.	C	10.	A	15	A	20	A		

Structured questions

1 (a)

- Most of plant wastes are gaseous (oxygen from photosynthesis and carbon dioxide from respiration) and are lost by diffusion through stomata.
- There is very little accumulation of toxic wastes e.g. nitrogenous wastes because plants are inactive
- Excess water passes to the exterior via similar routes and is eliminated by processes of guttation (droplet exudation) and transpiration (evaporation of water from plant surfaces).
- Plants use waste plants (oxygen for respiration and carbon dioxide for photosynthesis)
- The plant wastes are stored in cellular vacuoles, and lost in leaves that fall off. Some other waste products are stored in the xylem, like resins and gums.

(b) Urine production involves three processes

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(iii) Secretion

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The remaining material including urea and ammonia pass through the collecting duct to the bladder as urine

(c) During sweating a person loses metabolic wastes like urea and ammonia

2. (a) (i) Increase in surrounding temperature lowers urine production

- (ii) Increase in surrounding temperature increases sweat production.
- (b) (i) Increase in temperature increases the amount of water lost in sweat leaving less water to be lost urine
- (ii) High temperature provided heat of vaporization that increases the amount of sweat produced.
- (c) - After excessive vomiting
 - When he takes in excessive amount of salt
 - After excessive diarrhea
 - After excessive sweating
- (d)
 - Lowering of hair
 - Superficial vasodilatation
 - Reduction of metabolic rate
- 3. (a)
 - A. Kidney
 - B. Renal vein
 - C. renal artery
 - D. ureter
 - E. bladder
 - F. urethra
- (b) because urea and other waste products are removed by the kidney
- (c) temporary storage of urine
- (d)(i) glucose
 - (ii) insulin
 - (iii) diabetes mellitus
- (e) (i) antidiuretic hormone (ADH)
 - (ii) Pituitary

Assay question

1. (a) Excretion is the removal of metabolic wastes from the body.
- (b) draw nephron and explain urine formation.

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