Past Papers "physiology"❗

1) Which molecule has a time-dependent reabsorption in proximal tubules & T-max of transportation in distal tubule?

a) Glucose

b) Amino acids

c) Na+

Ans: C

2) Substance (x) plasma concentration was 2 mg/ml, and glomerular filtration rate was 100 mg/ml. If its urine concentration was 600 and urine flow= 1 mg/ml. The substance is probably:

a) Reabsorbed

b) Secreted

Ans: B. **1#**Clearance = $(U_x \times V) / P_x$

Clearance = (600 × 1) / 2 = 600 / 2 = 300 ml/min

2#نقارن مع GFR GFR = 100 ml/min، Clearance = 300 ml/min

بما أن C> GFR، فهذا يعني إفراز نشط من الأنابيب للبول

3) A person has a partial obstruction in his right kidney by a stone, after testing, doctors found that his capsular hydrostatic pressure = 20 mmHlg, his glomerular hydrostatic pressure= 50, and blood colloid pressure was 30 mmHlg. His net filtration pressure is:

a)0

b) 70

c) 150

Ans: A. Net Filtration Pressure: 50 - (20 + 30) = 50 - 50 = 0 mmHg

4) A patient is treated by diuretics i.e furosemide, after 4 weeks we will have:

a) Hypokalemia

b) Increased extracellular volume

c) Increased Na* reabsorption (hypernatrmeia)

Ans: A

5) Why diabetes patients have frequent urinations?

Ans: Osmotic effect of the unreabsorbed glucose.

6) What can increase GFR & reabsorption by decreasing renal blood flow & peritubular capillaries hydrostatic pressure?

a) Catecholamine

b) ANP

c) Angiotensin

Ans: C

7) A hypertensive patient took Renin & Angiotensin blockers, what will happen after 4 weeks:

Ans: Impaired GFR autoregulation.

8) Which of the following decreases renal blood flow & GFR?

a) Decrease afferent resistance to half.

b) Increase resistance of efferent vessels more than 3 times.

Ans: B

9) If GFR has decreased by 50%, and creatinine kept being produced by muscles. When GFR comes back to normal levels, what happens

to creatinine?

a) Increase excretion by double.

b) Unchanged excretion rate of creatinine.

Ans: B

10) If the maximum urine osmolarity = 200 mOsm/L, to maintain electrolyte balance what will be the obligatory urine volume if 600 mOsm of solute must be excreted each day?

a) 3L

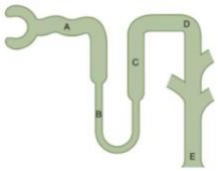
b) 0.337L

c) 4 L

d 0

Ans: A Obligatory urine volume = 600 / 200 = 3 L/day

11) In a patient with severe central diabetes insipidus caused by a lack of ADH secretion, which part of the tubule would have the lowest tubular fluid osmolarity?



a) A

b) B

c) C

d) D

e) E

Ans: E

12) Same picture and case as the previous, where is the highest

osmolarity?

Ans: C

13) Giving the following values, what is the reabsorption rate?

GFR = 100 ml/min. Glucose plasma concentration = 160mg/100ml.

No glucose molecules were found in urine. Transport maximum = 200.

a) 16

b) 160

c) 0

d) Secretion no absorption happened.

Ans: B) Filtered load = (GFR × [Glucose] >> 160 اعادت امتصاصه كامل

Filtered load = 160 mg/min ,Tm (Transport Maximum) = 200 mg/min

بما أن 160 < 200، فهذا يعني أن الكلى تستطيع إعادة امتصاص كل الجلوكوز، ولن يظهر أي منه في البول، كما في السؤال.

1. What is the net reabsorption rate (in mmol/min) in the renal tubules?

A) 0.08

B) 0.8

C) 8

D) 80

Answer: A) 0.08

2. What is the typical renal plasma flow rate?

A) 40 ml/min

B) 100 ml/min

C) 400 ml/min

D) 1000 ml/min

Answer: C) 400 ml/min ~ 600

3. The time gradient in the nephron primarily affects the reabsorption of which ion?

A) Potassium

B) Sodium

C) Calcium

D) Chloride

Answer: B) Sodium

إذا مرّ السائل بسرعة أقل، يُعاد امتصاص كمية أكبر من Na+

4. Inhibition of the renin-angiotensin system primarily impairs:

A) Sodium reabsorption

B) Water reabsorption

C) Glomerular filtration rate (GFR) only

D) Creatinine excretion

Answer: C) Glomerular filtration rate (GFR) only تثبيطه يؤدي لانخفاض ضغط الدم وانخفاض الترشيح

6. Which hormone is responsible for increasing sodium excretion and reducing blood pressure?

A) ADH

B) Aldosterone

C) ANP

D) Renin

Answer: C) ANP

7. During changes in renal function, what happens to creatinine excretion?

A) Increases

B) Decreases

C) Remains the same

D) Fluctuates randomly

Answer: C) Remains the same

معدل إخراج الكرياتينين غالبًا ما يبقى ثابتًا لأنه يعتمد على الإنتاج العضلي. لذلك يُستخدم لتقدير GFR

8. In a diabetic patient with hypokalemia, which of the following is most likely increased?

A) Glucagon

B) Insulin

C) Aldosterone

D) ADH

Answer: B) Insulin

الأنسولين يزيد من دخول البوتاسيوم إلى الخلايا، مما يؤدي إلى نقص بوتاسيوم الدم (hypokalemia)

9. Which of the following is NOT a function of the vasa recta?

A) Countercurrent multiplier

B) Countercurrent exchanger

C) Oxygen supply to medulla

D) Removal of reabsorbed water

Answer: A) Countercurrent multiplier -> Henle loop

11. What is the effect of increased resistance in the efferent arterioles?

A) Decreased GFR

B) Increased GFR

C) No change in GFR

D) Decreased renal blood flow only

Answer: B) Increased GFR فترة زمنية ثم ينخفض

12. Which hormone increases water reabsorption in the collecting ducts?

A) Aldosterone

B) ANP

C) ADH

D) Renin

Answer: C) ADH

Physiology 1

1. Which of the following is NOT a function of the kidneys?

A) Regulation of blood pressure

B) Production of bile

C) Excretion of metabolic waste

D) Regulation of blood pH

Answer: B) Production of bile

2. What is the correct sequence of blood flow through the kidney's vascular system?

A) Renal artery → interlobar artery → arcuate artery → afferent arteriole → glomerulus

B) Renal vein → arcuate artery → afferent arteriole → glomerulus

C) Renal artery → glomerulus → arcuate artery → afferent arteriole

D) Renal artery → efferent arteriole → glomerulus → interlobar artery

Answer: A) Renal artery → interlobar artery → arcuate artery → afferent arteriole → glomerulus

3. The functional unit of the kidney is the:

A) Nephron

B) Glomerulus

C) Renal corpuscle

D) Collecting duct

Answer: A) Nephron

4. Which part of the nephron is primarily responsible for filtration of blood?

A) Proximal convoluted tubule

B) Loop of Henle

C) Distal convoluted tubule

D) Glomerulus

Answer: D) Glomerulus

5. Which type of nephron has a long loop of Henle and is essential for urine concentration?

A) Cortical nephron

B) Juxtamedullary nephron

C) Renal corpuscle

D) Intercalated nephron

Answer: B) Juxtamedullary nephron

6. The hormone erythropoietin, produced by the kidneys, stimulates:

A) Sodium reabsorption

B) Red blood cell production

C) Bile secretion

D) Glucose reabsorption

Answer: B) Red blood cell production

7. The process of moving substances from the blood into the renal tubule for elimination is called:

A) Filtration

B) Reabsorption

C) Secretion

D) Excretion

Answer: C) Secretion

8. The tip of the renal pyramid that drains urine into the minor calyx is called the:

A) Renal cortex

B) Renal papilla

C) Renal capsule

D) Renal hilum

Answer: B) Renal papilla

9. Which of the following statements about nephron loss is TRUE?

A) Lost nephrons can be regenerated

B) Nephron loss is irreversible

C) Nephron loss does not affect kidney function

D) All nephrons are lost by age 40

Answer: B) Nephron loss is irreversible

10. The vasa recta are associated with which type of nephron?

A) Cortical nephrons

B) Juxtamedullary nephrons

C) Renal corpuscles

D) Collecting ducts

Answer: B) Juxtamedullary nephrons

Physiology 2

1. Which of the following is NOT a function of the kidneys?

A) Filtration of blood

B) Production of erythropoietin

C) Regulation of acid-base balance

D) Production of insulin

Answer: D) Production of insulin

Explanation: The kidneys do not produce insulin; this is a function of the pancreas.

2. The equation for urinary excretion is:

A) Excretion = Filtration + Reabsorption - Secretion

B) Excretion = Filtration - Reabsorption + Secretion

C) Excretion = Filtration × Reabsorption × Secretion

D) Excretion = Filtration - Secretion + Reabsorption

Answer: B) Excretion = Filtration - Reabsorption + Secretion

Explanation: This is the standard equation summarizing the three basic renal processes.

3. Which of the following substances is almost completely reabsorbed by the kidneys under normal conditions?

A) Urea

B) Glucose

C) Creatinine

D) Para-aminobenzoic acid

Answer: B) Glucose

Explanation: Glucose is completely reabsorbed unless plasma levels are abnormally high (e.g., diabetes).

4. What is the main structural feature of the glomerular capillaries that facilitates filtration?

A) Tight junctions

B) Fenestrations (pores)

C) Microvilli

D) Cilia

Answer: B) Fenestrations (pores)

Explanation: The glomerular capillaries have fenestrations to facilitate filtration.

5. Which of the following is NOT a barrier in the glomerular filtration membrane?

A) Fenestrated endothelium

B) Basal lamina

C) Podocyte pedicels

D) Juxtaglomerular cells

Answer: D) Juxtaglomerular cells

Explanation: Juxtaglomerular cells are involved in renin secretion, not filtration.

6. Which of the following best describes the renal handling of creatinine?

A) Filtration only

B) Filtration and partial reabsorption

C) Filtration and complete reabsorption

D) Filtration and secretion

Answer: A) Filtration only

Explanation: Creatinine is filtered and not reabsorbed, with a small amount secreted.

7. What happens to sodium excretion when sodium intake is increased tenfold?

A) It increases immediately to match intake

B) It remains unchanged

C) It increases gradually due to hormonal regulation

D) It decreases

Answer: C) It increases gradually due to hormonal regulation

Explanation: The kidney needs time to adjust sodium excretion through hormonal mechanisms.

8. Which factor does NOT affect the filterability of a molecule through the glomerular membrane?

A) Size

B) Electrical charge

C) Shape

D) Concentration in plasma

Answer: D) Concentration in plasma

Explanation: Size and charge are the main determinants; concentration does not affect filterability.

9. In minimal change disease, what is the main cause of albuminuria?

A) Structural damage to the glomerulus

B) Loss of negative charge on the filtration barrier

C) Increased blood pressure

D) Increased glucose levels

Answer: B) Loss of negative charge on the filtration barrier

Explanation: Minimal change disease is characterized by loss of negative charge, not structure.

10. Which of the following substances is handled by the kidney through filtration and secretion?

A) Glucose

B) Creatinine

C) Para-aminobenzoic acid

D) Water

Answer: C) Para-aminobenzoic acid

Explanation: This substance is filtered and secreted

11. Which of the following is a consequence of increased permeability of glomerular capillaries to proteins?

A) Increased blood colloid osmotic pressure

B) Edema

C) Decreased filtration

D) Increased glucose reabsorption

Answer: B) Edema

Explanation: Loss of proteins in urine lowers blood oncotic pressure, leading to edema.

12. Which of the following is filtered 60 times daily by the kidneys?

A) Sodium

B) Water

C) Glucose

D) Creatinine

Answer: B) Water

Explanation: 180 L of water is filtered daily, with a plasma volume of about 3 L.

13. Which layer of the filtration barrier is composed of negatively charged proteoglycans?

A) Fenestrated endothelium

B) Basal lamina

C) Podocyte pedicels

D) Bowman's capsule parietal layer

Answer: B) Basal lamina

Explanation: The basal lamina is rich in negatively charged proteoglycans.

14. Which of the following is a correct match between substance and renal handling?

A) Glucose – filtration and secretion

B) Water – filtration and complete reabsorption

C) Creatinine – filtration only

D) Na+ – filtration and secretion only

Answer: C) Creatinine – filtration only

Explanation: Creatinine is filtered and not reabsorbed; a small amount is secreted.

15. What is the main reason proteins are not filtered in the glomerulus?

A) They are too small

B) They are positively charged

C) They are large and negatively charged

D) They are actively reabsorbed

Answer: C) They are large and negatively charged

Explanation: Both size and negative charge prevent protein filtration.

Physiology 3

1. Which of the following is an early sign of glomerular disease, especially in diabetic and hypertensive patients?

A) Hematuria

B) Microalbuminuria

C) Glycosuria

D) Hyperkalemia

Answer: B) Microalbuminuria

2. What is the normal value for the glomerular filtration rate (GFR) in adults?

A) 60 L/day

B) 120 L/day

C) 180 L/day

D) 250 L/day

Answer: C) 180 L/day

3. The filtration fraction (FF) is defined as:

A) RBF / GFR

B) GFR / RPF

C) GFR / CO

D) RPF / GFR

Answer: B) GFR / RPF

4. Which of the following pressures directly opposes glomerular filtration?

A) Glomerular hydrostatic pressure

B) Bowman’s capsule oncotic pressure

C) Bowman’s capsule hydrostatic pressure

D) Renal plasma flow

Answer: C) Bowman’s capsule hydrostatic pressure

5. What is the main physiological regulator of GFR?

A) Filtration coefficient (Kf)

B) Glomerular hydrostatic pressure (PG)

C) Bowman’s capsule hydrostatic pressure

D) Glomerular capillary oncotic pressure

Answer: B) Glomerular hydrostatic pressure (PG)

6. Which of the following statements about the filtration coefficient (Kf) is correct?

A) It is physiologically regulated to control GFR

B) It is higher in the kidney than in other tissues

C) It is increased in diabetes and hypertension

D) It is lower in the kidney than in other tissues

Answer: B) It is higher in the kidney than in other tissues

7. In which of the following pathological conditions would Bowman’s capsule hydrostatic pressure increase and decrease GFR?

A) Renal artery stenosis

B) Obstruction by kidney stones or tumors

C) Dehydration

D) Hypertension

Answer: B) Obstruction by kidney stones or tumors

8. Which pressure increases as blood moves from the afferent to the efferent end of the glomerular capillary?

A) Glomerular hydrostatic pressure

B) Oncotic (colloid) pressure

C) Bowman’s capsule hydrostatic pressure

D) Renal arterial pressure

Answer: B) Oncotic (colloid) pressure

9. What happens to GFR if the resistance of the afferent arteriole increases?

A) GFR increases

B) GFR decreases

C) GFR remains unchanged

D) GFR first increases then decreases

Answer: B) GFR decreases

10. Which of the following statements is TRUE regarding renal autoregulation?

A) It maintains constant urine output between 60–140 mmHg

B) It maintains constant GFR and RBF between 60–140 mmHg

C) It is absent in healthy individuals

D) It regulates blood glucose levels

Answer: B) It maintains constant GFR and RBF between 60–140 mmHg

11. Which of the following is NOT a physiological regulator of GFR?

A) Glomerular hydrostatic pressure

B) Bowman's capsule hydrostatic pressure

C) Arteriolar resistance

D) Net filtration pressure

Answer: B) Bowman's capsule hydrostatic pressure

12. If the filtration fraction increases, what happens to the glomerular capillary oncotic pressure?

A) It decreases

B) It increases

C) It remains unchanged

D) It fluctuates randomly

Answer: B) It increases

13. What percentage of cardiac output is received by the kidneys?

A) 5%

B) 10%

C) 20%

D) 50%

Answer: C) 20%

14. Which of the following is the main plasma protein responsible for oncotic pressure in the glomerulus?

A) Fibrinogen

B) Albumin

C) Globulin

D) Hemoglobin

Answer: B) Albumin

15. In pathological conditions like diabetes and hypertension, what happens to the filtration coefficient (Kf)?

A) It increases

B) It decreases

C) It remains unchanged

D) It fluctuates randomly

Answer: B) It decreases

Physiology 4

1. What is the effect of afferent arteriole constriction on glomerular filtration rate (GFR)?

a) Increases GFR

b) Decreases GFR

c) No change in GFR

d) Initially increases then decreases GFR

Answer: b) Decreases GFR

2. Constriction of the efferent arteriole causes:

a) A linear decrease in GFR

b) An initial increase in GFR followed by a decrease if constriction is severe

c) No change in GFR

d) A decrease in renal plasma flow but no effect on GFR

Answer: b) An initial increase in GFR followed by a decrease if constriction is severe

3. Which of the following factors preferentially constricts the efferent arteriole to maintain GFR during low renal perfusion?

a) Prostaglandins

b) Angiotensin II

c) Nitric oxide

d) Endothelin

Answer: b) Angiotensin II

4. Prostaglandins in the kidney primarily cause:

a) Vasoconstriction of afferent arteriole

b) Vasodilation of afferent arteriole

c) Vasoconstriction of efferent arteriole

d) No effect on renal blood flow

Answer: b) Vasodilation of afferent arteriole

5. The myogenic mechanism of renal autoregulation involves:

a) Macula densa sensing NaCl concentration

b) Smooth muscle contraction of afferent arteriole in response to increased pressure

c) Release of renin from juxtaglomerular cells

d) Vasodilation of efferent arteriole

Answer: b) Smooth muscle contraction of afferent arteriole in response to increased pressure

6. Tubuloglomerular feedback is initiated by:

a) Changes in afferent arteriole pressure

b) Macula densa sensing NaCl concentration in distal tubule

c) Sympathetic nerve stimulation

d) Release of endothelin

Answer: b) Macula densa sensing NaCl concentration in distal tubule

7. Which hormone causes vasodilation of the afferent arteriole and increases GFR?

a) Endothelin

b) Angiotensin II

c) Nitric oxide (EDRF)

d) Sympathetic norepinephrine

Answer: c) Nitric oxide (EDRF)

8. Sympathetic nervous system activation during severe hemorrhage causes:

a) Equal constriction of afferent and efferent arterioles with no change in GFR

b) Greater constriction of afferent arteriole than efferent, decreasing GFR and RBF

c) Dilation of afferent arteriole

d) Increase in GFR due to increased cardiac output

Answer: b) Greater constriction of afferent arteriole than efferent, decreasing GFR and RBF

9. Which of the following statements about renal autoregulation is TRUE?

a) It maintains constant GFR only when blood pressure is below 50 mmHg

b) It involves the macula densa sensing changes in NaCl concentration

c) It depends solely on neurohumoral factors

d) It cannot compensate for changes in systemic blood pressure

Answer: b) It involves the macula densa sensing changes in NaCl concentration

10. Renin secretion is stimulated by all of the following EXCEPT:

a) Low afferent arteriole pressure

b) Increased NaCl delivery to macula densa

c) Sympathetic nervous system activation

d) Decreased NaCl delivery to macula densa

Answer: b) Increased NaCl delivery to macula densa

Physiology 5

1. Which of the following drugs impairs the kidney's ability to autoregulate glomerular filtration rate (GFR)?
A) Diuretics
B) ARBs (Angiotensin Receptor Blockers)
C) Beta-blockers
D) Calcium channel blockers
Answer: B) ARBs (Angiotensin Receptor Blockers)

2. What is the main function of the macula densa in the nephron?
A) Reabsorption of glucose
B) Regulation of GFR via tubuloglomerular feedback
C) Secretion of potassium
D) Filtration of proteins
Answer: B) Regulation of GFR via tubuloglomerular feedback
3. What happens to GFR when a person ingests a high-protein meal?
A) GFR decreases
B) GFR remains unchanged
C) GFR increases
D) GFR drops to zero
Answer: C) GFR increases

4. Which of the following factors decreases GFR by about 10% per decade after age 40?
A) Fever
B) High protein diet
C) Aging
D) Glucocorticoids
Answer: C) Aging

5. What is the formula for urinary excretion?
A) Excretion = Filtration + Reabsorption - Secretion
B) Excretion = Filtration - Reabsorption + Secretion
C) Excretion = Filtration x Reabsorption x Secretion
D) Excretion = Filtration - Secretion + Reabsorption
Answer: B) Excretion = Filtration - Reabsorption + Secretion

6. What is the approximate volume of fluid filtered by the kidneys per day?
A) 1-2 L
B) 10-20 L
C) 180 L
D) 500 L
Answer: C) 180 L

7. What is the primary mechanism for sodium reabsorption in the proximal tubule?
A) Passive diffusion
B) Na+/K+ ATPase pump (active transport)
C) Simple osmosis
D) Endocytosis
Answer: B) Na+/K+ ATPase pump (active transport)

8. Which of the following best describes “solvent drag”?
A) Active transport of glucose
B) Water reabsorption dragging cations paracellularly
C) Secretion of hydrogen ions
D) Filtration of proteins
Answer: B) Water reabsorption dragging cations paracellularly

9. In the context of renal autoregulation, what would happen if GFR regulation was poor and tubular reabsorption did not adapt?
A) Urine output would decrease to dangerous levels
B) Urine output would increase drastically, risking dehydration
C) GFR would remain constant
D) No effect on urine output
Answer: B) Urine output would increase drastically, risking dehydration

10. Which segment of the nephron is described as having a brush border and being the main site for reabsorption of sodium and water?
A) Loop of Henle
B) Distal convoluted tubule
C) Proximal convoluted tubule
D) Collecting duct
Answer: C) Proximal convoluted tubule

11. Which of the following substances is reabsorbed in the proximal tubule along with sodium via cotransport?
A) Urea
B) Amino acids
C) Creatinine
D) Uric acid
Answer: B) Amino acids

12. Which process is responsible for eliminating harmful substances faster than filtration alone?
A) Filtration
B) Reabsorption
C) Secretion
D) Diffusion
Answer: C) Secretion

13. What is the effect of hyperglycemia on GFR?
A) Decreases GFR
B) Increases GFR
C) No effect on GFR
D) Causes GFR to fluctuate randomly
Answer: B) Increases GFR

14. What is the main driving force for water reabsorption in the nephron?
A) Protein concentration
B) Glucose concentration
C) Osmolarity difference created by solute reabsorption
D) Blood pressure only
Answer: C) Osmolarity difference created by solute reabsorption

15. What is the analogy used in the slides to describe sodium's role in solute transport?
A) Sodium is a filter
B) Sodium is a train, and the ATPase pump is the engine
C) Sodium is a gatekeeper
D) Sodium is a pump
Answer: B) Sodium is a train, and the ATPase pump is the engine

1. What percentage of filtered sodium and water is reabsorbed in the proximal convoluted tubules?

A) 30%

B) 50%

C) 70%

D) 90%

Answer: C) 70%

2. Which process describes water dragging along other cations like potassium and calcium during reabsorption?

A) Active transport

B) Solvent drag

C) Facilitated diffusion

D) Secondary active transport

Answer: B) Solvent drag

3. Where does most glucose reabsorption occur in the proximal tubule?

A) Early proximal tubule (90%)

B) Late proximal tubule (90%)

C) Loop of Henle

D) Distal convoluted tubule

Answer: A) Early proximal tubule (90%)

4. What is the primary energy source driving glucose reabsorption in the proximal tubule?

A) ATP hydrolysis by sodium-glucose transporter (SGLT)

B) Sodium gradient created by sodium-potassium ATPase

C) Passive diffusion

D) Hydrogen ion gradient

Answer: B) Sodium gradient created by sodium-potassium ATPase

5. How does glucose exit the proximal tubule epithelial cells into the interstitium?

A) Sodium-glucose co-transport

B) Facilitated diffusion via GLUT transporters

C) Active transport using ATP

D) Paracellular diffusion

Answer: B) Facilitated diffusion via GLUT transporters

6. Why must glucose be reabsorbed against its concentration gradient?

A) Because glucose concentration in tubular fluid is lower than plasma

B) Because glucose is actively secreted into the tubule

C) Because filtered glucose concentration equals plasma concentration, requiring energy to move glucose back to plasma

D) Because glucose is not filtered by the glomerulus

Answer: C) Because filtered glucose concentration equals plasma concentration, requiring energy to move glucose back to plasma

7. What happens when plasma glucose concentration exceeds the transport maximum of glucose reabsorption?

A) All glucose is reabsorbed

B) Glucose appears in the urine

C) Sodium reabsorption increases

D) Hydrogen ion secretion stops

Answer: B) Glucose appears in the urine

8. What is the approximate plasma glucose concentration threshold at which glucose starts to appear in urine?

A) 100-120 mg/dL

B) 150-160 mg/dL

C) 170-180 mg/dL

D) 200-220 mg/dL

Answer: C) 170-180 mg/dL

9. Which transporter is responsible for hydrogen ion secretion in the proximal tubule?

A) Sodium-glucose transporter (SGLT)

B) Sodium-potassium ATPase

C) Sodium-hydrogen exchanger (NHE)

D) GLUT transporter

Answer: C) Sodium-hydrogen exchanger (NHE)

10. Why does chloride passively reabsorb in the proximal tubule?

A) It is actively transported by ATPase pumps

B) It follows the positive potential created by sodium reabsorption

C) It follows the negative potential created by sodium reabsorption via paracellular route

D) It is co-transported with glucose

Answer: C) It follows the negative potential created by sodium reabsorption via paracellular route

11. Which of the following substances does NOT have a transport maximum in the proximal tubule?

A) Glucose

B) Amino acids

C) Sodium

D) Phosphate

Answer: C) Sodium

12. What factor affects sodium reabsorption efficiency in the proximal tubule?

A) Number of glucose transporters

B) Time fluid spends in the tubule and concentration gradient

C) Number of hydrogen ion exchangers

D) Plasma potassium concentration

Answer: B) Time fluid spends in the tubule and concentration gradient

13. What causes urea to be passively reabsorbed in the proximal tubule?

A) Active transport by ATPase pumps

B) High concentration of urea in tubular fluid due to water reabsorption

C) Co-transport with sodium

D) Facilitated diffusion via GLUT transporters

Answer: B) High concentration of urea in tubular fluid due to water reabsorption

Physiology 6

1. In the proximal tubule, a substance with a tubular fluid/plasma concentration ratio equal to 1 is:

A) Reabsorbed more rapidly than water

B) Reabsorbed at the same rate as water

C) Not reabsorbed at all

D) Secreted into the tubule

Answer: B) Reabsorbed at the same rate as water

2. Which of the following substances is not reabsorbed in the proximal tubule, causing its concentration to increase along the tubule?

A) Sodium

B) Glucose

C) Creatinine

D) Bicarbonate

Answer: C) Creatinine

3. The thin descending limb of the loop of Henle is:

A) Permeable to water but not solutes

B) Permeable to solutes but not water

C) Impermeable to both water and solutes

D) Actively reabsorbs sodium

Answer: A) Permeable to water but not solutes

4. The thick ascending limb of the loop of Henle is called the “diluting segment” because:

A) It is highly permeable to water

B) It actively reabsorbs NaCl but is impermeable to water

C) It secretes large amounts of potassium

D) It is the main site of glucose reabsorption

Answer: B) It actively reabsorbs NaCl but is impermeable to water

5. Which transporter is blocked by furosemide (Lasix) in the thick ascending limb?

A) Na^+/Cl^- cotransporter

B) $Na^+/K^+/Cl^-$ cotransporter (NKCC2)

C) ENaC

D) H^+/K^+-ATPase

Answer: B) $Na^+/K^+/Cl^-$ cotransporter (NKCC2)

6. The early distal tubule is functionally similar to the:

A) Proximal tubule

B) Thin descending limb

C) Thick ascending limb of Henle

D) Collecting duct

Answer: C) Thick ascending limb of Henle

7. Which diuretic inhibits the Na^+/Cl^- cotransporter in the early distal tubule?

A) Furosemide

B) Thiazide

C) Spironolactone

D) Amiloride

Answer: B) Thiazide

8. Principal cells in the late distal tubule and collecting duct are primarily responsible for:

A) Acid-base balance

B) Na^+ reabsorption and K^+ secretion

C) Glucose reabsorption

D) Urea secretion

Answer: B) Na^+ reabsorption and K^+ secretion

9. Aldosterone increases:

A) Na^+ reabsorption and K^+ secretion

B) Na^+ secretion and K^+ reabsorption

C) Water excretion

D) Urea reabsorption

Answer: A) Na^+ reabsorption and K^+ secretion

10. Aldosterone antagonists (e.g., spironolactone) are classified as:

A) Loop diuretics

B) Thiazide diuretics

C) Potassium-sparing diuretics

D) Osmotic diuretics

Answer: C) Potassium-sparing diuretics

11. Amiloride acts by:

A) Blocking the $Na^+/K^+/Cl^-$ cotransporter

B) Inhibiting carbonic anhydrase

C) Blocking ENaC channels

D) Stimulating aldosterone release

Answer: C) Blocking ENaC channels

12. Type A intercalated cells in the collecting duct:

A) Secrete H^+ and reabsorb HCO_3^-

B) Secrete HCO_3^- and reabsorb H^+

C) Secrete K^+ and reabsorb Na^+

D) Secrete glucose

Answer: A) Secrete H^+ and reabsorb HCO_3^-

13. The permeability to water in the late distal tubule and collecting duct is mainly regulated by:

A) Aldosterone

B) ADH (antidiuretic hormone)

C) Parathyroid hormone

D) Insulin

Answer: B) ADH (antidiuretic hormone)

14. In the presence of ADH, the collecting duct becomes:

A) Impermeable to water

B) Permeable to water

C) Permeable to glucose

D) Permeable to proteins

Answer: B) Permeable to water

15. Type B intercalated cells are important during:

A) Acidosis

B) Alkalosis

C) Hypokalemia

D) Hypernatremia

Answer: B) Alkalosis

16. The medullary collecting duct becomes permeable to urea in the presence of:

A) Aldosterone

B) ADH

C) Thiazide diuretics

D) Furosemide

Answer: B) ADH

17. Voltage drag in the thick ascending limb facilitates the paracellular reabsorption of:

A) Glucose

B) Proteins

C) Cations (Mg^{2+}, Ca^{2+}, Na^{+}, K^{+})

D) Anions (Cl^{-}, HCO_3^{-})

Answer: C) Cations (Mg^{2+}, Ca^{2+}, Na^{+}, K^{+})

18. Which of the following is not a function of the early distal tubule?

A) Active reabsorption of Na^{+} and Cl^{-}

B) High water permeability

C) Contains the macula densa

D) Diluting the tubular fluid

Answer: B) High water permeability

19. ENaC blockers (e.g., amiloride) are called potassium-sparing diuretics because they:

A) Increase K^+ secretion

B) Decrease K^+ secretion

C) Increase Na^+ reabsorption

D) Increase water reabsorption

Answer: B) Decrease K^+ secretion

20. In the absence of ADH, the late distal tubule and collecting duct are:

A) Highly permeable to water

B) Impermeable to water

C) Permeable to urea

D) Permeable to glucose

Answer: B) Impermeable to water

Physiology 7

1. Which of the following best describes the main driving force for reabsorption into the peritubular capillaries?

A) High hydrostatic pressure in the peritubular capillaries

B) Net positive reabsorptive pressure due to hydrostatic and oncotic forces

C) Active transport of sodium

D) Filtration pressure in the glomerulus

Answer: B) Net positive reabsorptive pressure due to hydrostatic and oncotic forces

2. What is the approximate net reabsorptive pressure that favors reabsorption into the peritubular capillaries?

A) -10 mmHg

B) 0 mmHg

C) +10 mmHg

D) +32 mmHg

Answer: C) +10 mmHg

3. Which formula correctly calculates the filtered load of a substance?

A) Urine concentration × Urine flow rate

B) GFR × Plasma concentration of the substance

C) GFR × Urine concentration

D) Plasma concentration × Urine flow rate

Answer: B) GFR × Plasma concentration of the substance

4. If the excreted amount of a substance is greater than its filtered load, what does this indicate?

A) Net reabsorption

B) Net secretion

C) No movement

D) Filtration only

Answer: B) Net secretion

5. In the example where GFR = 100 ml/min, plasma Na^+ = 140 mEq/L, urine flow = 1 ml/min, and urine Na^+ = 100 mEq/L, what is the rate of Na^+ reabsorption?

A) 0.1 mEq/min

B) 13.9 mEq/min

C) 14 mEq/min

D) 100 mEq/min

Answer: B) 13.9 mEq/min

6. Which statement about transport maximum (Tm) is correct?

A) Tm is the same for all nephrons

B) Tm is the point where all nephrons are saturated and excess is excreted

C) Tm applies only to sodium

D) Tm is unrelated to carrier saturation

Answer: B) Tm is the point where all nephrons are saturated and excess is excreted

7. Which of the following substances exhibits a transport maximum in the kidney?

A) Sodium in the proximal tubule

B) Glucose

C) Urea

D) Water

Answer: B) Glucose

8. In which nephron segment does sodium not have a transport maximum?

A) Proximal tubule

B) Distal convoluted tubule

C) Collecting duct

D) Medullary collecting duct

Answer: A) Proximal tubule

9. A patient with a GFR of 90 ml/min and plasma glucose of 2 mg/ml has a glucose Tm of 150 mg/min. What is the rate of glucose excretion?

A) 0 mg/min

B) 30 mg/min

C) 90 mg/min

D) 120 mg/min

Answer: B) 30 mg/min

(Filtered load = 90 × 2 = 180 mg/min; Excreted = 180 – 150 = 30 mg/min)

10. Which factor will increase peritubular capillary reabsorption?

A) Increased peritubular capillary hydrostatic pressure

B) Increased peritubular capillary oncotic pressure

C) Decreased filtration fraction

D) Decreased plasma protein concentration

Answer: B) Increased peritubular capillary oncotic pressure

11. What is the effect of increasing afferent or efferent arteriolar resistance on peritubular capillary reabsorption?

A) Decreases reabsorption

B) Increases reabsorption

C) No effect

D) Only affects glomerular filtration

Answer: B) Increases reabsorption

12. Which hormone acts on principal cells of the collecting duct to increase sodium reabsorption and potassium secretion?

A) Antidiuretic hormone

B) Aldosterone

C) Parathyroid hormone

D) Atrial natriuretic peptide

Answer: B) Aldosterone

13. Which of the following is not a result of excess aldosterone (Conn's syndrome)?

A) Sodium retention

B) Hypokalemia

C) Hypotension

D) Metabolic alkalosis

Answer: C) Hypotension

14. What is the main stimulus for aldosterone secretion?

A) Low plasma calcium

B) Angiotensin II

C) High plasma sodium

D) Low plasma potassium

Answer: B) Angiotensin II

15. In Addison's disease (aldosterone deficiency), which of the following is expected?

A) Sodium retention and hypertension

B) Sodium wasting and hyperkalemia

C) Hypokalemia and alkalosis

D) Increased sodium reabsorption

Answer: B) Sodium wasting and hyperkalemia

1. Which of the following is a direct effect of ACE inhibitors on the kidney?

A) Increase aldosterone secretion

B) Constrict efferent arterioles

C) Decrease sodium and water reabsorption

D) Increase renin release

Answer: C) Decrease sodium and water reabsorption

2. What is the primary action of antidiuretic hormone (ADH) in the nephron?

A) Increase sodium reabsorption in the proximal tubule

B) Insert aquaporin-2 channels in the distal tubules and collecting ducts to increase water permeability

C) Inhibit renin secretion

D) Dilate afferent arterioles to increase GFR

Answer: B) Insert aquaporin-2 channels in the distal tubules and collecting ducts to increase water permeability

3. Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH) typically causes:

A) Hypernatremia and polyuria

B) Hyponatremia and water retention

C) Increased aldosterone secretion

D) Decreased extracellular fluid osmolarity due to sodium loss

Answer: B) Hyponatremia and water retention

4. Atrial natriuretic peptide (ANP) is released in response to:

A) Low blood volume

B) Increased blood volume and atrial stretch

C) High plasma osmolarity

D) Decreased renal perfusion pressure

Answer: B) Increased blood volume and atrial stretch

5. Which hormone increases calcium reabsorption in the kidneys and decreases phosphate reabsorption?

A) Aldosterone

B) Parathyroid hormone (PTH)

C) ADH

D) Renin

Answer: B) Parathyroid hormone (PTH)

6. How does the sympathetic nervous system affect renal sodium reabsorption?

A) It decreases sodium reabsorption by inhibiting Na+/K+ ATPase

B) It stimulates sodium reabsorption via alpha-adrenergic receptors and increases renin release

C) It dilates afferent arterioles to increase GFR

D) It inhibits aldosterone secretion

Answer: B) It stimulates sodium reabsorption via alpha-adrenergic receptors and increases renin release

7. What is the mechanism behind pressure natriuresis?

A) Increased renin and aldosterone secretion

B) Increased peritubular capillary hydrostatic pressure opposing sodium reabsorption

C) Decreased renal plasma flow

D) Increased sympathetic stimulation of the kidney

Answer: B) Increased peritubular capillary hydrostatic pressure opposing sodium reabsorption

8. Why does diabetes mellitus cause polyuria and excessive thirst?

A) Due to increased ADH secretion

B) Due to excess aldosterone causing sodium loss

C) Due to unreabsorbed glucose increasing tubular osmolarity, reducing water reabsorption

D) Due to increased ANP secretion

Answer: C) Due to unreabsorbed glucose increasing tubular osmolarity, reducing water reabsorption

9. Which of the following drugs is a direct renin inhibitor?

A) Losartan

B) Aliskiren

C) Captopril

D) Mannitol

Answer: B) Aliskiren

10. What effect does blocking angiotensin II have on the efferent arteriole?

A) Causes constriction, increasing glomerular pressure

B) Causes dilation, decreasing glomerular pressure

C) No effect on efferent arteriole

D) Causes constriction of afferent arteriole

Answer: B) Causes dilation, decreasing glomerular pressure

Physiology 8

1. If a substance is freely filtered at the glomerulus and is neither reabsorbed nor secreted, then:

A) Amount absorbed per minute = Amount excreted per minute

B) Amount absorbed per minute = Amount leaked out per minute

C) Amount filtered per minute = Amount excreted per minute

D) Amount filtered per minute = Amount reabsorbed per minute

E) Amount secreted per minute = Amount excreted per minute

Answer: C

2. Renal clearance of a substance depends primarily on:

A) Secretion

B) Filtration

C) Excretion

D) Plasma concentration

E) Urine concentration

Answer: C

3. Which of the following is NOT a criterion for a substance used to measure GFR?

A) Should not be secreted by tubular cells

B) Should not be reabsorbed by tubular cells

C) Should not be toxic

D) Should be metabolized

E) Should be easily measurable

Answer: D

4. To measure renal plasma flow (RPF), do we need to measure renal blood flow first?

A) True

B) False

Answer: B

5. When plasma glucose concentration exceeds about 200 mg/100 ml, what happens?

A) All nephrons reach maximal glucose reabsorption

B) Small amount of glucose appears in urine

C) Not all nephrons have the same transport maximum

D) Filtered glucose is completely reabsorbed

E) None of the above

Answer: B

6. What is the maximum clearance rate possible for a substance completely cleared from plasma?

A) GFR

B) Filtered load of the substance

C) Urinary excretion rate

D) Renal plasma flow

E) Filtration fraction

Answer: D

7. Which substance is used clinically to estimate GFR because it is freely filtered and not reabsorbed or secreted?

A) PAH

B) Creatinine

C) Inulin

D) Urea

E) Glucose

Answer: C

8. If GFR decreases by 50%, what happens to plasma creatinine concentration?

A) Decreases by 50%

B) Remains the same

C) Doubles

D) Triples

E) Becomes zero

Answer: C

9. The clearance of para-aminohippuric acid (PAH) approximates:

A) GFR

B) Renal plasma flow

C) Tubular reabsorption rate

D) Plasma creatinine concentration

E) Urine flow rate

Answer: B

10. Which of the following substances normally has zero clearance because it is completely reabsorbed?

A) Glucose

B) Urea

C) Creatinine

D) PAH

E) Inulin

Answer: A

Physiology 9 p1

1. Which hormone primarily regulates extracellular fluid osmolarity by increasing water reabsorption in the kidney?

a) Aldosterone

b) Antidiuretic hormone (ADH)

c) Renin

d) Atrial natriuretic peptide (ANP)

Answer: b) Antidiuretic hormone (ADH)

2. What is the maximum osmolarity of concentrated urine that the human kidney can produce?

a) 300 mOsm/L

b) 600 mOsm/L

c) 1200-1400 mOsm/L

d) 50-70 mOsm/L

Answer: c) 1200-1400 mOsm/L

3. Which segment of the nephron is impermeable to water but actively reabsorbs Na+, K+, and Cl-?

a) Descending limb of loop of Henle

b) Thick ascending limb of loop of Henle

c) Proximal convoluted tubule

d) Collecting duct without ADH

Answer: b) Thick ascending limb of loop of Henle

4. What effect does ADH have on the collecting ducts?

a) Decreases water permeability

b) Increases water permeability via aquaporins

c) Increases sodium reabsorption only

d) Decreases urea reabsorption

Answer: b) Increases water permeability via aquaporins

5. Obligatory urine volume is defined as:

a) The minimum urine volume needed to excrete solutes at maximal concentration

b) The maximum urine volume the kidney can produce

c) The urine volume during water deprivation

d) The volume of urine produced in 24 hours regardless of solute load

Answer: a) The minimum urine volume needed to excrete solutes at maximal concentration

6. Which part of the nephron contributes most to the medullary osmotic gradient?

a) Proximal tubule

b) Loop of Henle (especially thick ascending limb)

c) Distal convoluted tubule

d) Glomerulus

Answer: b) Loop of Henle (especially thick ascending limb)

7. Urea recycling in the kidney is important because:

a) It dilutes the medullary interstitium

b) It helps maintain a high osmolarity in the medullary interstitium

c) It decreases urine concentration

d) It inhibits ADH secretion

Answer: b) It helps maintain a high osmolarity in the medullary interstitium

8. During water diuresis (excess water intake), urine osmolarity:

a) Increases to above plasma osmolarity

b) Decreases below plasma osmolarity

c) Remains equal to plasma osmolarity

d) Does not change

Answer: b) Decreases below plasma osmolarity

9. Which of the following is NOT part of the countercurrent system in the kidney?

a) Loop of Henle

b) Vasa recta

c) Proximal convoluted tubule

d) Medullary collecting ducts

Answer: c) Proximal convoluted tubule

10. The specific gravity of urine increases by approximately 0.001 for every:

a) 10 mOsm/kg increase in osmolarity

b) 20 mOsm/kg increase in osmolarity

c) 35-40 mOsm/kg increase in osmolarity

d) 50 mOsm/kg increase in osmolarity

Answer: c) 35-40 mOsm/kg increase in osmolarity

1. What is the primary reason low protein intake reduces the kidney's ability to concentrate urine?

A) Decreased sodium reabsorption

B) Decreased urea production

C) Increased water intake

D) Increased urea excretion

Answer: B) Decreased urea production

2. After filtration, what percentage of urea is initially present in the urine?

A) 0%

B) 50%

C) 100%

D) 80%

Answer: C) 100%

3. In which part of the nephron is about 50% of filtered urea passively reabsorbed?

A) Proximal tubule

B) Descending loop of Henle

C) Thick ascending limb

D) Collecting duct

Answer: A) Proximal tubule

4. Why does urea concentration return to near 100% in the descending limb of Henle?

A) Active transport of urea into the tubule

B) High urea concentration in the surrounding medullary interstitium causes diffusion back into urine

C) Urea is secreted by tubular cells

D) Urea is impermeable in this segment

Answer: B) High urea concentration in the surrounding medullary interstitium causes diffusion back into urine

5. Which nephron segments are impermeable to urea, thus conserving urea concentration in the urine?

A) Descending thin limb and proximal tubule

B) Thick ascending limb and distal tubule

C) Medullary collecting duct

D) Loop of Henle

Answer: B) Thick ascending limb and distal tubule

6. What percentage of urea is reabsorbed in the medullary collecting duct under the influence of ADH?

A) 20%

B) 50%

C) 80%

D) 100%

Answer: C) 80%

7. How does ADH affect urea permeability in the medullary collecting duct?

A) Decreases permeability by closing urea channels

B) Increases permeability by activating urea transporters (UT-1)

C) Has no effect on urea permeability

D) Causes urea secretion into the tubule

Answer: B) Increases permeability by activating urea transporters (UT-1)

8. What is the main physiological purpose of urea recirculation in the kidney?

A) To increase sodium excretion

B) To lower obligatory urine volume by increasing medullary osmolarity

C) To decrease water reabsorption

D) To increase potassium secretion

Answer: B) To lower obligatory urine volume by increasing medullary osmolarity

9. Which of the following best describes the role of urea in the kidney's concentrating mechanism?

A) Urea is actively secreted to dilute urine

B) Urea contributes to the hyperosmotic medullary interstitium, facilitating water reabsorption

C) Urea is completely excreted in urine without reabsorption

D) Urea blocks water channels in the collecting duct

Answer: B) Urea contributes to the hyperosmotic medullary interstitium, facilitating water reabsorption

10. What happens to urea reabsorption when ADH levels are low?

A) Urea reabsorption increases

B) Urea reabsorption decreases

C) Urea secretion increases

D) Urea permeability remains unchanged

Answer: B) Urea reabsorption decreases

Physiology 9 p2

1. Which of the following is the MOST important factor contributing to the kidney's ability to concentrate urine?

A) High urea concentration in plasma

B) High ADH levels

C) Increased GFR

D) High blood pressure

Answer: B) High ADH levels

2. What is the main function of the vasa recta in the renal medulla?

A) Generation of the medullary osmotic gradient

B) Preservation of the medullary osmotic gradient

C) Active reabsorption of sodium

D) Secretion of urea

Answer: B) Preservation of the medullary osmotic gradient

3. Which segment of the nephron is impermeable to urea?

A) Thin descending limb of loop of Henle

B) Proximal convoluted tubule

C) Thick ascending limb of loop of Henle

D) Inner medullary collecting duct

Answer: C) Thick ascending limb of loop of Henle

4. In the presence of high ADH, which nephron segment becomes highly permeable to urea?

A) Proximal convoluted tubule

B) Early distal convoluted tubule

C) Inner medullary collecting duct

D) Thick ascending limb of loop of Henle

Answer: C) Inner medullary collecting duct

5. Which of the following best describes the effect of ADH on urine?

A) Increases urine volume and decreases osmolarity

B) Decreases urine volume and increases osmolarity

C) No effect on urine volume or osmolarity

D) Increases both urine volume and osmolarity

Answer: B) Decreases urine volume and increases osmolarity

6. Urea recycling is important because:

A) It increases obligatory urine output

B) It helps maintain the hyperosmolarity of the medullary interstitium

C) It decreases water reabsorption

D) It reduces sodium reabsorption

Answer: B) It helps maintain the hyperosmolarity of the medullary interstitium

7. Which of the following is TRUE regarding free water clearance (CH_2O)?

A) Positive CH_2O means concentrated urine is being excreted

B) Negative CH_2O means dilute urine is being excreted

C) Positive CH_2O means dilute urine is being excreted

D) CH_2O is always negative

Answer: C) Positive CH_2O means dilute urine is being excreted

8. Which of the following conditions is characterized by a failure to produce ADH?

A) Nephrogenic diabetes insipidus

B) Central diabetes insipidus

C) Chronic renal failure

D) Pyelonephritis

Answer: B) Central diabetes insipidus

9. What is the effect of low or no protein intake on the kidney's concentrating ability?

A) Increases urea concentration and concentrating ability

B) Decreases urea concentration and concentrating ability

C) No effect

D) Increases sodium reabsorption

Answer: B) Decreases urea concentration and concentrating ability

10. Which of the following is NOT a stimulus for ADH secretion?

A) Increased plasma osmolarity

B) Decreased blood volume

C) Alcohol consumption

D) Angiotensin II

Answer: C) Alcohol consumption

11. Which part of the nephron reabsorbs the highest percentage of filtered water under normal conditions?

A) Proximal convoluted tubule

B) Thick ascending limb of loop of Henle

C) Early distal convoluted tubule

D) Collecting duct

Answer: A) Proximal convoluted tubule

12. Which of the following is a consequence of chronic renal failure with significant nephron loss?

A) Increased maximal urine osmolarity

B) Isosthenuria (urine osmolarity equals plasma osmolarity)

C) Increased ability to concentrate urine

D) Decreased urine volume

Answer: B) Isosthenuria (urine osmolarity equals plasma osmolarity)

13. What is the maximal rate of water excretion in adults to avoid water intoxication?

A) 100–200 mL/hr

B) 400–600 mL/hr

C) 800–1,000 mL/hr

D) 2,000–3,000 mL/hr

Answer: C) 800–1,000 mL/hr

14. Which of the following factors decreases thirst sensation?

A) Increased osmolarity

B) Decreased blood volume

C) Gastric distention

D) Increased angiotensin II

Answer: C) Gastric distention

15. Which of the following is most sensitive in stimulating ADH secretion?

A) 2% decrease in blood volume

B) 5% increase in plasma osmolarity

C) 10% increase in blood pressure

D) 15% decrease in blood pressure

Answer: B) 5% increase in plasma osmolarity

By: Ayah Freihat