Functional Anatomy of the Urinary System

Gross Anatomy of the Human Urinary System

1. What is the function of the fat cushion that surrounds the kidneys in life? **Holds the kidneys in place in the retroperitoneal cavity**

2. Complete the labeling of the diagram to correctly identify the urinary system organs. Then respond to the questions that follow.

Which of the structures identified above is applicable to the following statements?

- **Kidney**: 1. maintains water and electrolyte balance of the blood
- **Urinary Bladder**: 2. serves as a storage area for urine
- **Urethra**: 3. transports urine to the body exterior
- **Renal Artery**: 4. transports arterial blood to the kidney
- **Kidney**: 5. produces urine
- **Ureter**: 6. transports urine to the urinary bladder
- **Urethra**: 7. is shorter in women than in men
Gross Internal Anatomy of the Pig or Sheep Kidney

3. Match the appropriate structure in column B to its description in column A. (Some responses may be used more than once.)

Column A

1. smooth membrane clinging tightly to the kidney surface
2. portion of the kidney containing mostly collecting ducts
3. portion of the kidney containing the bulk of the nephron structures
4. superficial region of kidney tissue
5. basinlike area of the kidney, continuous with the ureter
6. an extension of the pelvis that encircles the apex of a pyramid
7. area of cortexlike tissue running between the medullary pyramids

Column B

cortex
medulla
calyx
renal column
fibrous capsule
renal pelvis

Functional Microscopic Anatomy of the Kidney

4. Match each of the lettered structures on the diagram of the nephron (and associated renal blood supply) on the left with the terms on the right:

1. collecting duct
2. glomerulus
3. peritubular capillaries
4. distal convoluted tubule
5. proximal convoluted tubule
6. interlobar artery
7. cortical radiate artery
8. arcuate artery
9. cortical radiate vein
10. efferent arteriole
11. arcuate vein
12. loop of Henle
13. afferent arteriole
14. interlobar vein
15. glomerular capsule
5. Using the terms provided in question 4, identify the following:

**Glomerulus**
1. site of filtrate formation

**Proximal convoluted tubule**
2. primary site of tubular reabsorption

**Collecting duct**
3. structure that conveys the processed filtrate (urine) to the renal pelvis

**Peritubular capillaries**
4. blood supply that directly receives substances from the tubular cells

**Glomerulus**
5. its inner (visceral) membrane forms part of the filtration membrane

6. Explain why the glomerulus is such a high-pressure capillary bed. **Because afferent arteriole feeding into it is greater diameter compared to the efferent arteriole.** How does the high pressure help the glomerulus form filtrate? **The high pressure helps to force fluid out of the glomerulus.**

7. What structural modification of certain tubule cells enhances their ability to reabsorb substances from the filtrate?

**Microvilli**

8. Trace a drop of blood from the time it enters the kidney in the renal artery until it leaves the kidney through the renal vein.

Renal artery → **Segmental artery - interlobar artery** → Arcuate artery → **Cortical radiate** → Afferent arteriole → **Glomerulus** → Efferent arteriole → Cortical radiate vein → Arcuate vein → Interlobar vein → Renal vein

9. Trace the anatomical pathway of a molecule of creatinine (metabolic waste) from the glomerular capsule to the urethra. Note each microscopic and/or gross structure it passes through in its travels, and include the names of the subdivisions of the renal tubule.

Glomerular capsule → **Proximal convoluted tubule** → Loop of Henle → Distal convoluted tubule → Collecting duct → Minor calyx → Major calyx → Renal pelvis → Ureter → Urinary bladder → Urethra

**Urinalysis: Characteristics of Urine**

10. What is the normal volume of urine excreted in a 24-hour period? **1.0 - 1.8 liters**

11. List three nitrogenous wastes that are routinely found in urine:

**Urea, Uric acid, Creatinine, Ammonium, Ammonium**

List three substances that are absent from the urine of healthy individuals:

**Glucose, Amino Acids, Blood Proteins**

List two substances that are routinely found in filtrate but not in the urine product:

**Glucose, Amino Acids**

12. Explain why urinalysis is a routine part of any good physical examination. **If there are abnormal substances in the urine, it can indicate disease issues in the body.**
13. What substance is responsible for the normal yellow color of urine? **UROCHROME**

14. Which has a greater specific gravity: 1 ml of urine or 1 ml of distilled water? **1 ML OF URINE**

Explain. **SPECIFIC GRAVITY IS RELATED TO THE AMOUNT OF SOLUTES IN A SOLUTION. URINE WILL ALWAYS HAVE MORE SOLUTES THAN DISTILLED WATER.**

15. Explain the relationship between the color, specific gravity, and volume of urine. **USUALLY THE GREATER THE VOLUME OF URINE THE LESS COLOR IT HAS AND THE LOWER THE AMOUNT OF SOLUTES IT THUS LOWER SPECIFIC GRAVITY.**

### Abnormal Urinary Constituents

16. How does a urinary tract infection influence urine pH? **IT INCREASES THE PH**

17. Several specific terms have been used to indicate the presence of abnormal urine constituents. Identify which urine abnormalities listed in column A might be caused by each of the conditions listed in column B.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEMATURIA</td>
<td>albuminuria</td>
</tr>
<tr>
<td>HEMOGLOBINURIA</td>
<td>glycosuria</td>
</tr>
<tr>
<td>GLYCOSEURIA</td>
<td>hematuria</td>
</tr>
<tr>
<td>ALBUMINURIA</td>
<td>hemoglobinuria</td>
</tr>
<tr>
<td>KETONURIA</td>
<td>ketonuria</td>
</tr>
<tr>
<td>PYURIA</td>
<td>pyuria</td>
</tr>
<tr>
<td>1. blood in the urine</td>
<td>2. hemolytic anemia</td>
</tr>
<tr>
<td>3. eating a 5-lb box of candy at one sitting</td>
<td>4. pregnancy</td>
</tr>
<tr>
<td>5. starvation</td>
<td>6. urinary tract infection</td>
</tr>
</tbody>
</table>

18. What are renal calculi, and what conditions favor their formation? **THEY ARE KIDNEY STONES. THEY COME FROM EXCESSIVELY CONCENTRATED URINE.**

19. What change would you expect to occur in a urine sample that has been stored at room temperature? **IT WILL GROW BACTERIA AND SMELL LIKE AMMONIA.**