False color scanning electron micrograph of a kidney stone.

Overview of the Urinary System

Center for
Educational Outreach

Baylor College of Medicine

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Overview of the Urinary System

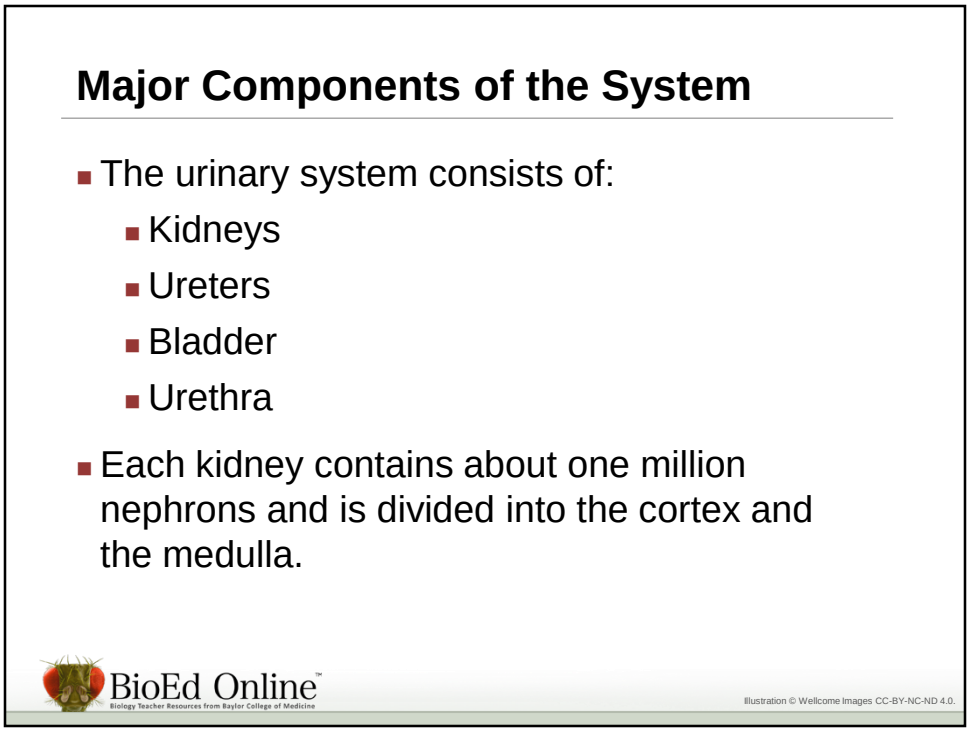
Kidney stones are hard cystaline structures formed in the urinary tract. These crystals are comprised of different combinations of chemicals, normally salts and minerals, which separate from urine and solidify. Kidney stones can vary in size and those less than 5mm are normally passed naturally by drinking lots of fluids. This image shows a 5mm stone formed from calcium oxalate crystals.

Image Reference

SEM B0007247 © Annie Cavanagh, Wellcome Images, CC-BY-NC-ND 4.0.
http://www.welcomeimages.org

Key Words

urethra, bladder, ureter, kidney, urinary system



Major Components of the System

The urinary system cleanses blood, rids the body of wastes, regulates blood pressure, and helps maintain homeostasis in the body. It is controlled by the nervous system.

The human urinary system consists of a pair of kidneys, each connected to a ureter, a urinary bladder and a urethra. Each kidney is divided into a cortex and medulla, and contains about one million functional units, called nephrons. Nephron tubules receive a blood filtrate and modify it to produce urine, which is expelled from the kidney through the ureter.

References

1.Raven, P.H. (2005). *Biology, 7th Edition.* New York, NY: McGraw-Hill.

2.Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition.* San Francisco, CA: Pearson Benjamin Cummings.

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3ef2482e3e22@7.1@7.1

Key Words
urethra, bladder, ureter, kidney, urine, urinary system

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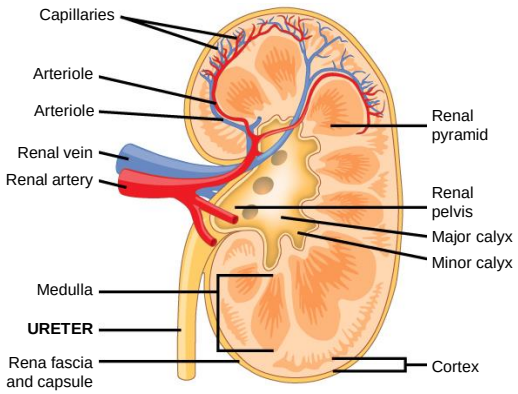
Kidneys

- Among their key functions, kidneys filter and remove wastes from the blood, and transfer them to the urinary bladder.
- The kidney can be divided into two major components, the cortex and the medulla.



LEFT KIDNEY

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Kidneys

Kidneys are fist-sized organs about 10cm long, located in the lower back. Each kidney receives blood from a renal artery, and this blood is used to produce urine. Each kidney also drained by a renal vein.

Renal tissue is divided into an outer renal cortex and inner renal medulla. Together, these structures perform filtration, reabsorption, secretion and excretion. The renal cortex contains renal corpuscles and renal tubules, with the exception of certain parts of the renal tubule, which descend into the renal medulla. The renal medulla can be further subdivided into renal pyramids, which are formed by segments of nephrons. Urine flows from from the renal pyramid and converges at the renal pelvis, which funnels urine into the ureter.

References

1.Raven, P.H. (2005). *Biology, 7th Edition.* New York, NY: McGraw-Hill.

2.Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition.* San Francisco, CA: Pearson Benjamin Cummings.

Image Reference

OpenStax College. The Kidneys and Osmoregulatory Organs, OpenStax-CNX CC-BY-3.0. February 24, 2014. http://cnx.org/content/m44809/1.8/

Key Words

kidney, urinary system, bladder, renal

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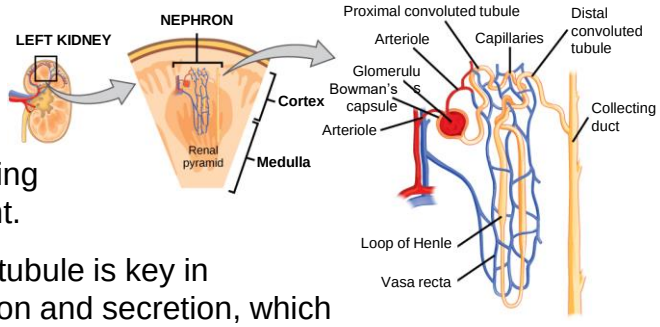
Nephron Structure

- Nephrons can be either cortical (corpuscle in cortex) or juxtamedullary (corpuscle near the medulla).
- The renal corpuscle is the nephron's initial filtering component.
- The renal tubule is key in reabsorption and secretion, which occur at specialized regions of the tubule.



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Nephron Structure

•There are two different types of nephrons in the kidney. Juxtamedullary nephrons have long loops that dig deep into the medulla; cortical nephrons have short loops.

•Each nephron consists of a long tubule and associated small blood vessels. Blood enters the glomerulus, a ball of capillaries in the renal cortex, through an afferent arteriole. The blood is filtered and the filtrate immediately enters the first region of the nephron tubules, called the bowman's capsule.

•The filtrate enters the proximal convoluted tubule, located in the cortex, and moves on to the loop of Henle. Fluid is then delivered to the distal convoluted tubule in the cortex that drains into a collecting duct.

•The collecting duct again descends into the medulla, merging with other collecting ducts to empty urine into the renal pelvis.

References

1.Raven, P.H. (2005). *Biology, 7th Edition.* New York, NY: McGraw-Hill.

2.Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition.* San Francisco, CA: Pearson Benjamin Cummings.

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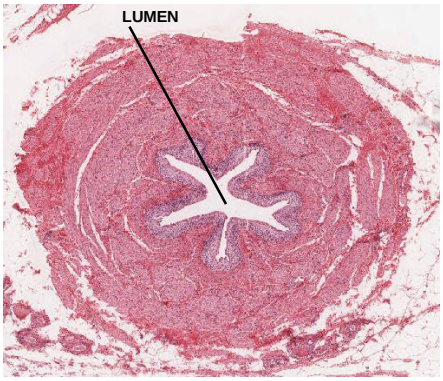
Key Words

kidney, urinary system, nephron, renal, urine

Ureters

- Ureters are muscular tubes which direct urine from the kidneys toward the bladder.
- The site at which the ureters connect to the kidneys is a common location for the lodging of kidney stones (hardened material made of crystalized minerals, such as calcium).



Urine moves through the lumen by way of peristaltic waves, and by fluid pressure and gravity (128x).

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Ureters

Urine drains from each kidney through a ureter, which propels the urine toward the urinary bladder. The ureters arise from the renal pelvis of the kidneys and enter at the back of the bladder. Several valves, known as uterovesical calves, prevent the backflow of urine up the ureter.

To explore tissue samples in greater detail or to view histology images of the Urinary System, or find histology images of other body tissues, visit the University of Michigan's WebScope site at http://141.214.65.171/Histology/view.apml?/.

References

1.Raven, P.H. (2005). *Biology, 7th Edition.* New York, NY: McGraw-Hill.

2.Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition.* San Francisco, CA: Pearson Benjamin Cummings.

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Key Words

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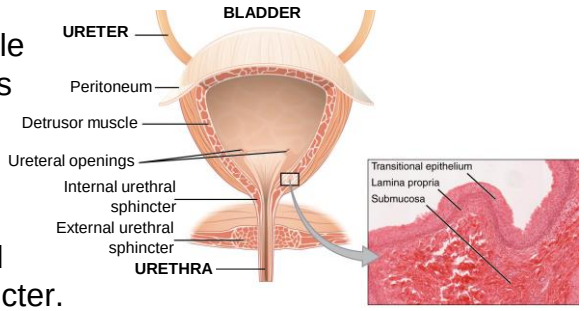
Bladder and Urethra

- Urine collects in the distensible organ known as the bladder.
- The bladder has both an involuntary and voluntary sphincter.
- Urine exits the bladder, and the human body, through the urethra.



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Bladder and Urethra

Urine collects in the hollow organ known as the bladder. The bladder contains an involuntary and voluntary sphincter, and both must be opened for urine to exit the bladder. Urine leaves the bladder through the urethra, a hollow tube that exits through the penis in males and above the vaginal opening in females.

References

1.Raven, P.H. (2005). *Biology, 7th Edition.* New York, NY: McGraw-Hill.

2.Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition.* San Francisco, CA: Pearson Benjamin Cummings.

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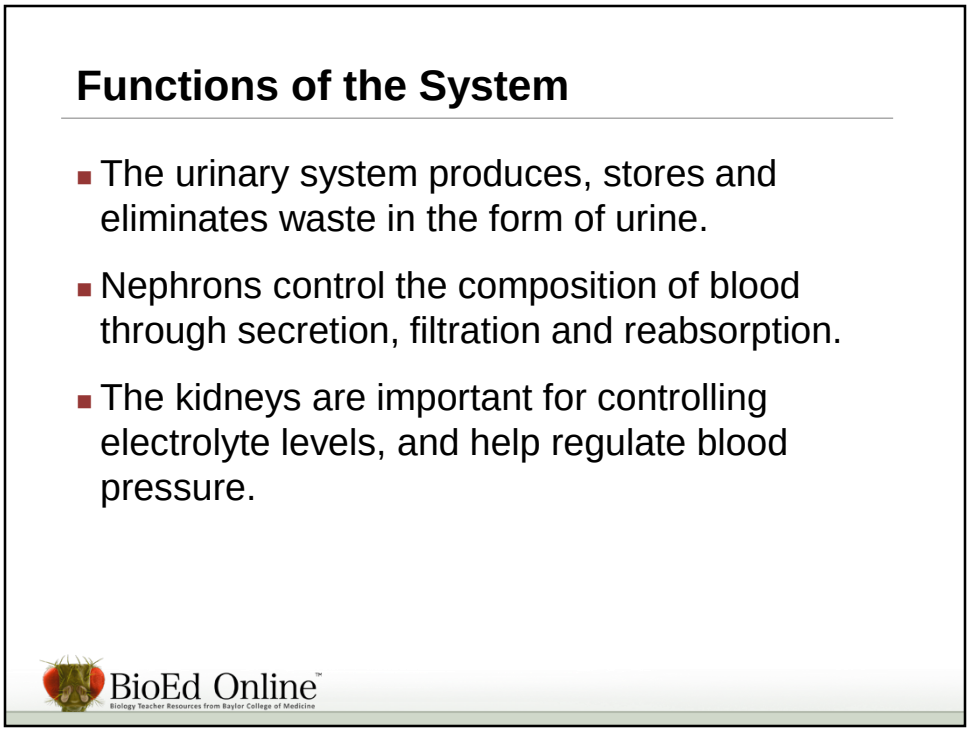

Functions of the System

Key functions of the urinary system include filtration and elimination of waste materials through urine. In addition, the kidneys also secrete hormones, such as erythropoietin, which stimulates red blood cell production; and renin, which leads to an increase in aldosterone secretion and blood pressure.

References

1.Raven, P.H. (2005). *Biology, 7th Edition.* New York, NY: McGraw-Hill.

2.Campbell, N.A., and Reece, J.B. (2008). *Biology, 8th Edition.* San Francisco, CA: Pearson Benjamin Cummings.

Key Words

kidney, urinary system, nephron, urine, filtration, blood