

Physiology of Excretion

B.Sc Second year Zoology (subsidiary) Paper - 2

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Lecture-2

Urine Formation

Urine formation, which is divided into three processes:

Glomerular Filtration

- Glomerular filtration occurs when whole blood enters the glomerulus by way of the afferent arteriole.
- Due to glomerular blood pressure, water and small molecules move from the glomerulus to the inside of the glomerular capsule.
- This is a filtration process because large molecules and formed

- elements are unable to pass through the capillary wall.
- In effect, then, blood in the glomerulus has two portions: the filterable components and the non-filterable components.
 - The non-filterable components leave the glomerulus by way of the efferent arteriole.
 - The glomerular filtrate inside the glomerular capsule now contains the filterable blood components in approximately the same concentration as plasma. If the composition of urine were the same as that of the glomerular filtrate, the body would continually lose water, salts, and nutrients.
 - Therefore, we can conclude that the composition of the filtrate must be altered as this fluid passes through the remainder of the tubule.

Tubular Reabsorption

- Tubular reabsorption occurs as molecules and ions are passively and actively reabsorbed from the nephron into the blood of the peritubular capillary network.

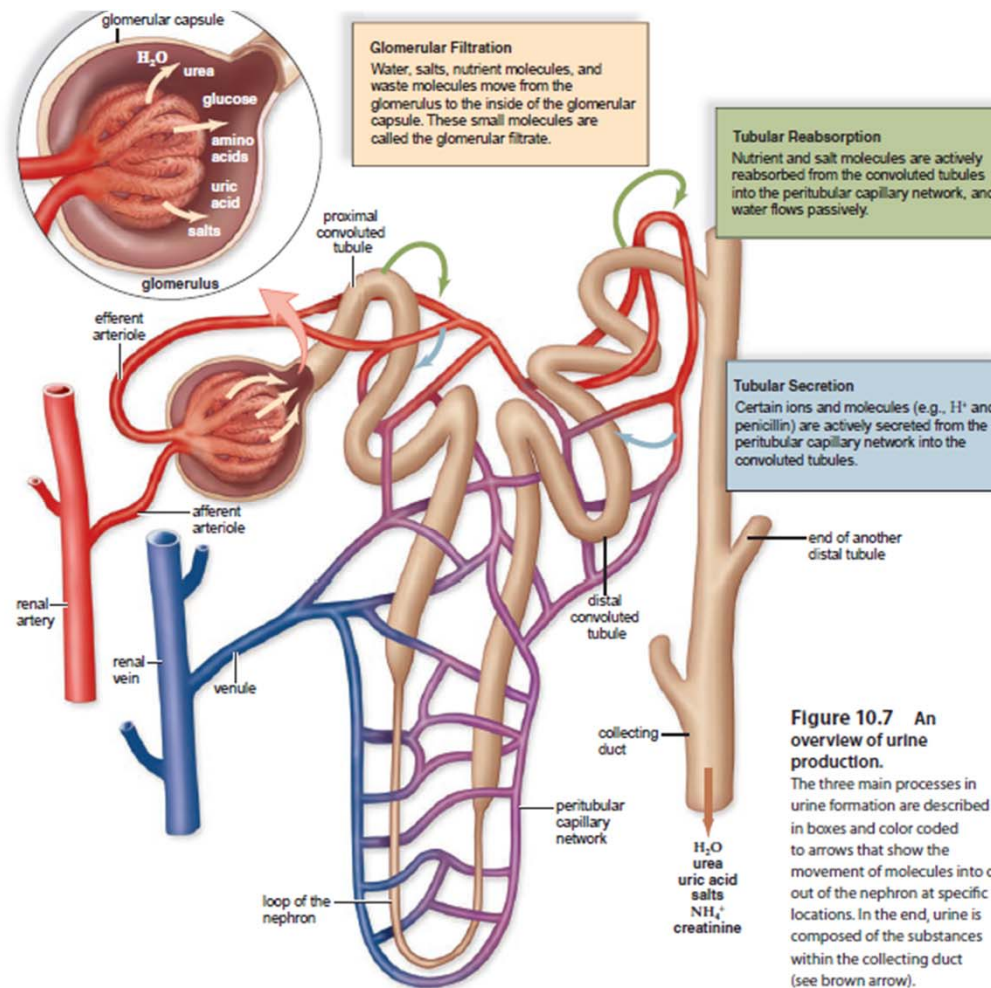


Figure 10.7 An overview of urine production.
 The three main processes in urine formation are described in boxes and color coded to arrows that show the movement of molecules into or out of the nephron at specific locations. In the end, urine is composed of the substances within the collecting duct (see brown arrow).

- The osmolarity of the blood is maintained by the presence of plasma proteins and salt.
- When sodium ions (Na^+) are actively reabsorbed, chloride ions (Cl^-) follow passively. The reabsorption of salt (NaCl) increases the osmolarity of the blood compared with the filtrate. Therefore, water moves passively from the tubule into the blood.
- About 65% of Na^+ is reabsorbed at the proximal convoluted tubule.
- Nutrients such as glucose and amino acids return to the peritubular capillaries almost exclusively at the proximal convoluted tubule. This is a selective process because only molecules recognized by carrier proteins are actively reabsorbed.
- We have seen that the filtrate that enters the proximal convoluted tubule is divided into two portions: components reabsorbed from the tubule into blood, and components not

reabsorbed that continue to pass through the nephron to be further processed into urine.

- The substances not reabsorbed become the tubular fluid, which enters the loop of the nephron.

Tubular Secretion

- Tubular secretion is a second way by which substances are removed from blood and added to the tubular fluid.
- Hydrogen ions (H^+), creatinine, and drugs such as penicillin are some of the substances moved by active transport from blood into the kidney tubule.
- In the end, urine contains substances that have undergone glomerular filtration but have not been reabsorbed and substances that have undergone tubular secretion.

Reabsorbed Filtrate Components	Nonreabsorbed Filtrate Components
Most water	Some water
Nutrients	Much nitrogenous waste
Required salts (ions)	Excess salts (ions)