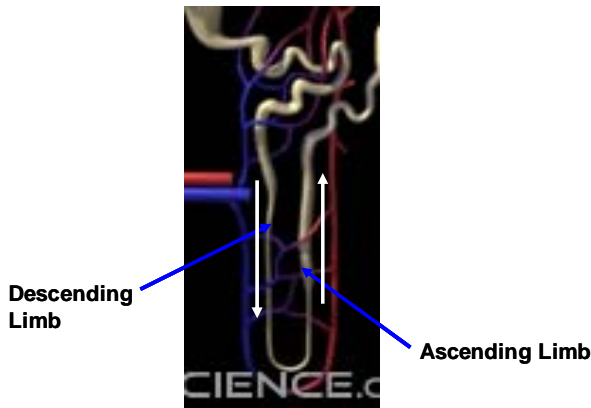


17: Kidney and Nephronal Physiology

Key Terms

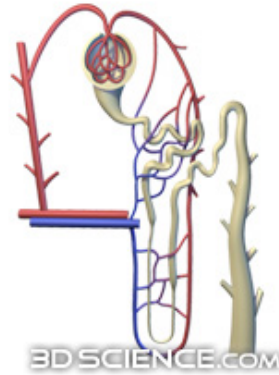
- **Ureter:** are hollow, muscular tubes. The filtrate fluid drains from the kidneys to the bladder.
- **Bladder:** functions by collecting and storing urine until it is eliminated from the body.
- **Urethra:** is a hollow tube leading from the bladder to the body surface, for the external elimination of urine.
- **Nephron:** There are over 1 million in each kidney. All the nephrons drain towards the center of the kidney into the collecting duct system. The nephron performs almost all of the kidney's functions, including reabsorption and secretion of certain solutes and ions.
- **Minor calyx:** receives drainage from nephron.
- **Renal pelvis:** gathers fluid from major calyx before draining into ureters.
- **Vasa recta:** blood vessels around Loop of Henle. These vessels function to maintain the gradients necessary for countercurrent exchange.
- **Loop of Henle:** The Loop of Henle can be divided into 2 functional regions: Descending Limb and the Ascending Limb. In the Descending Limb, fluid travels down the descending limb towards the medulla. In the Ascending Limb, fluid travels towards the cortex. In this region of the nephron, Na⁺ and Cl⁻ are actively transported out of the limb. This leads to dilute or hypo-osmotic fluid entering the collecting tubule.
- **Countercurrent mechanism:** establishes osmolarity gradient from cortex (300 mOsm) to medulla (1200 mOsm); enables urine to be concentrated.
- **Tubular Maximum:** maximal level of a substance to be transported by the nephrons.
- **Micturition Reflex:** emptying of the bladder, involves spinal cord reflex, as well as conscious control.
- **Diabetes:** In uncontrolled diabetes, higher than normal blood glucose levels occur. This leads to greater than normal glucose being filtered in the glomerulus. Therefore, glucose levels in the nephron exceed tubular maximum and this causes glucose to be excreted in the urine. The excreted glucose can be easily detected on urine test strips.
- **Glomerulus:** specialized capillary; filters blood into nephron; pore size determines what passes into nephron.
- **Bowman's Capsule:** membrane surrounding glomerulus; captures all filtrate, which then drains into the proximal tubule

Loop of Henle



- **Filtration:** movement of substances through the glomerular pores into the nephron

Nephron Anatomy and Function



- **Proximal tubule:** primary reabsorption area; has microvilli and protein transporters; 100% of glucose; 60-70% of water and sodium; calcium, magnesium, potassium.
- **Descending limb:** water is reabsorbed; fluid in nephron becomes hyperosmotic.
- **Ascending limb:** sodium and chloride transported from nephron; water can not follow; fluid in the nephron become dilute – can excrete dilute urine.
- **Distal tubule and Collecting ducts:** impermeable to water unless hormones are present.

Hormones and Urine Concentration

- **Anti-diuretic hormone:** inserts water channels in collecting duct; increases water reabsorption and decreases urine volume.
- **Aldosterone:** increases sodium and water reabsorption which increases blood volume and blood pressure.
- **Atrial natriuretic hormone:** released from atria of heart in response to high blood pressure; increases urine output to reduce blood volume and pressure.

Kidney Function Tests and Dialysis

- **Plasma Clearance:** assesses how quickly the kidneys are able to remove or clear a substance from the plasma.
- **Blood Urea Nitrogen (BUN):** measures urea levels in the blood which indicates how well the kidneys are ridding the body of waste products such as urea.
- **Glomerular Filtration Rate (GFR):** an assessment of quickly the blood is being filtered.
- **Urinalysis:** A urinalysis is a common test used in the doctor's office as part of yearly physicals or if a problem is suspected. A urinalysis tests for electrolyte levels and for the presence of proteins, glucose, blood cells, bacteria and immune cells. This test, along with others, can be used to assess overall kidney function.
- **Dialysis:** Dialysis is an artificial means of filtering the blood. Blood flows through specialized membranes, similar in principle to glomerular filtration. Waste products are filtered out and then the blood is returned into the patient's circulation.
- **Diabetes and Kidney:** increased glucose levels can result in glucose appearing in the urine.
- **Kidney Transplant:** only one kidney needed to maintain life; kidneys can be donated and transplanted; approximately 10,000 kidney transplants per year in U.S.

How to Use This Cheat Sheet: These are the keys related this topic. Try to read through it carefully twice then recite it out on a blank sheet of paper. Review it again before the exams.