# Loop of henle labeled

Nephronet is the smallest functional unit of the kidney. It seems to make sure that the urine you secrete leaves your body in the right volume and concentration. This is a complicated process, but once you master it, it is exciting to understand this important function of the human body! Here's a marked diagram of a nephron followed by a general overview of the process: image coming from KaplanStep 1: Bowman's Capsule Blood Pressure in small capillaries at one end of nephron (called glomerulus) shoots fluid into a sack called the Bowman capsule. Red blood cells and larger proteins are too large to pass from glomerulus in Bowman's capsule, but water, ions, and amino acids, are small enough to pass. This mixture of water, ions, amino acids, and other small molecules is called the filtrate. This filtrate is further modified as it travels through the rest of the nephron. Step 2: Proximal Intricate Tubule Filtrate travels from Bowman's capsule into the proximal intricate tubules. The goal of this step is to reabsorb (in other words, not secrete) essential nutrients including amino acids, glucose and vitamins that are still present in the filtrate. These are transported out of the nephron into the separate room and reabsorbed by capillaries running next to the proximal convoluted tube. In addition to saving essential nutrients by transporting them out of the filtrate (reabsorption), waste products including , ammonia and urea are transported into the filtrate for excretion. Step 3: Falling Limb of loop of Henle The falling limb is only permeable to water. As the Loop of Henle drops from the cortex into the medulla, concentration of salts in interstitium increases (you will learn why it happens in the next step). As a result, the medulla is hypernic for the filtrate, so water will spread out of the filtrate on the descending part of the loop, and the urine concentration will increase. Step 4: Ascending Limb of the Loop of Henle The rising limb is only permeable to salts, not water. In the ascending limb, salts (etc) leave the filtrate using both passive and active diffusion. This is what causes renal medulla to have a high salt concentration and therefore be hypertensive to the filtrate. The filtrate is diluted on the way up the ascending limb. On top of the ascending part, a thick section is called the dilution segment. This section is thick because it contains many mitochondria required to actively pump out salt from hypotonic filtrate to more hypertonic blood! Step 5: Distal Convoluted Tubule You can distinguish this from the proximal intricate tubule, which is closer to Bowman's Capsule, because distal agents farther away (think distance). Functionally it does many of the same things as the proximal convoluted tubule; waste products ammonia and urea are into the filtrate for excretion, while calcium and sodium continue to be reabsorbed (via active transport out of the nephron into the interstitium). Since water generally follows salt (through osmosis), water also leaves the nephron, which further dilutes the filtrate. Step 6: Collecting channels At the end of the distal intricate tube, the filtrate is emptied into collection channels, where it is combined with filtrate from other nephrons. Collect channels move back into the medulla, which is salty, so more water leaves through passive diffusion. The collection channel is important because it has variable permeability that is controlled in part by the hormones aldosterone (which increases the permeability of the canal to water by opening aquaporins) and antidiuretic hormone (which increases Na/K pump activity), both resulting in more concentrated filtrate. You may have noticed an organizing principle during this review; in general, the horizontal parts of the nephron function to hold what the body needs and eliminate what it does not need, while the vertical parts of the nephron function to control the amount and concentration of the filtrate, mostly by controlling the movement of water in and out of the filtrate. Good luck as you work to master this important content! Are you interested in connecting with Eden, or one of our other New York or Cambridge biology supervisors? Fancy more tips and tricks on biology from our blog? AP Bio Exam Question Breakdown : Biotechnology Tools Tips and Mnemonics for Memorizing Amino Acid Structures Question Breakdown: How to Solve a 6 Grid-In Case of AP Biology Exam Skill:• Annotation of diagrams of nephron Nephron is the functional unit of the kidney, with each nephron consisting of the following components:Bowman's capsule – the first part of the nephron where blood is initially filtered (to form filtrate)Proximal convoluted tubule – weight structure attached to Bowman's capsule where selective reabsorption occursLoop of Henle – a selectively permeable loop that descends into the the medulla and establishes a salt gradientSubtal convoluted tubule – a folded structure connected to the loop of Henle where further selective reabsorption occursThe blood to be filtered enters the Bowman capsule via an afferent arteriole and leaves the capsule via an efferent arterioleWithin the Bowmancapsule , the blood is filtered at a capillary tuft called glomerulusThe efferent arteriole forms a blood network called vasa recta as reabsorbs components of the filtrate from nefronetAnkakanen connect to a collecting channel (via the distal convoluted tubules), which is fed into the renal pelvisIt collects the channels shared by nephrons and thus is not technically considered part of a single nephronStructure of a Nephron ⇒ Click on the image to show color Nephron FunctionNephrons filter blood and then reabsorb usable materials from the filtrate before eliminating the residue as urineThis process occurs over three important steps:Ultrafiltration – Blood is filtered out from glomerulus at Bowman's capsule to form filtrateSelectiv reabsorption – Usable material is reabsorbed into intricate tubules (both proximal and distal)Osmoregulation – Eyelet of Henle establishes a salt gradient, that draws water from the collecting channelRelationship between nephron structure and function periodic acid-schiff staining (PAS). The thick falling limbs of the loop of Henle look like the proximal tubules, with apical brush boundaries. The thick ascending limbs consist of cubic cells, but unlike the proximal intricate tubule, they do not have apical brush edges. Collecting channels can also be seen in this picture. They can be easily distinguished by the presence of prominent lateral boundaries between adjacent cells. Ascending limb of loop of HenleScheme of renal tubule and its vascular delivery. (Marked in the center left.) Nephron Ion Flow ChartDetailsIdentifiersLatintubulus rectus distalis, pars recta tubuli distalisFMA1777Anatomical terminology[edit on Wikidata] Within the nephron of the kidney, the ascending part of the loop of Henle is a segment of the heterogeneous loop of Henle downstream of the falling limb, after the sharp bend of the loop. This part of renal tubules is divided into a thin and thick ascending limb; the thick part is also known as the distal straight tubules, in contrast with the distal intricate tububule downstream. Structure The ascending part of the henle loop is a direct continuation from the descending part of the Loop of Henle, and one of the structures of the nephron of the kidney. The ascending limb has a thin and a thick segment. The rising part drains urine into the distal convoluted tubules. The thin ascending limb is found in the medulla of the kidney, and the thick ascending limb can be divided into a part that is in renal medulla and a part that is in the kidney cortex. The ascending limb is much thicker than the descending limb. At the junction of the thick ascending part and the distal intricate tubules is a subset of 15-25 cells called macula densa which is part of renal autoregulation through the mechanism of tubuloglomerular feedback. Histology As in the falling limb, the epithelium is simple squamous epithelium. [1] Function Thin ascending limb The thin ascending limb is impermeable to water; but is permeable to ions allowing for some sodium reabsorption. Na/K-ATPase is expressed at very low levels in this segment and thus this reabsorption is likely by passive diffusion. [2] Salt migrations out of the tubuand into the interstitium due to osmotic pressure created by the countercurrent system. Thick rising limb Functionally, the of the ascending part of the medulla and cortex are very similar. [citation needed] The medullary ascending limb is largely impermeable to water. Sodium ($Na^+$), potassium ($K^+$) and chloride ions ($Cl^-$) are reabsorbed by active transport. The dominant mechanism for active transport in this segment is through $Na^+/K^+/Cl^-$ co-transports NKCC2 and sodium/hydrogen exchanger NHE3. [3] In total, this segment accounts for about 25-30% of the total $Na^+$ reabsorption along the nephron. This is of clinical importance since commonly occurring loop diuretics act by inhibiting NKCC2. [4] This active transport enables the kidney to establish an osmotic gradient that is essential for the kidneys' ability to concentrate urine earlier isotocity. $K^+$ is passively transported along its concentration gradient through a $K^+$ leak channel in the apical aspect of the cells, back into the lumen of the ascending limb. This $K^+$ leak generates a positive electrochemical potential difference in lumens. This drives more paracellular reabsorption of $Na^+$, as well as other cations such as magnesium ($Mg^{2+}$) and essential calcium $Ca^{2+}$ due to charging disgust. This is also the part of the tubules that generates Tamm-Horsfall protein. The function of this protein is not well understood, but is responsible for creating urine casts. Clinical significance The thick ascending limb symporter: Na-K-Cl cotransporter. See also Descending Limb of Loop by Henle References This article contains text in the public domain from page 1223 of the 20th edition of Gray's Anatomy (1918) ^ Pawlina, Wojciech and Ross, Michael. Histology: A text and Atlas. 5th ed. N.p:Clipping,2006. 663+. Print. ^ Sands JM, Layton HE (2013). The urea concentrate mechanism and the Urea transporters. In Alpern RJ, Moe OW, Caplan M (ed.). Seldin and Giebisch's Kidney. Elsevier. p. 1463-1510. doi:10.1016/b978-0-12-381462-3.00043-4. ISBN 9780123814623. ^ Mount DB (November 2014). Thick ascending limb of the loop of Henle. Clinical journal of the American society of nephrology. 9 (11): 1974–86. doi:10.2215/CJN.04480413. PMC 4220766. PMID 25318757. ^ Wile D (September 2012). Diuretics: a review. Annals of clinical biochemistry. 49 (Pt 5): 419-31. doi:10.1258/acb.2011.011281. PMID 22783025. External links Nosek, Thomas M. Section 7/7ch07/7ch07p11. Essentials of human physiology. Archived from the original on 2016-03-24. 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