Chapter 9-22: The Nephron

As you learned in the preceding plate, the two major organs involved in the process of excretion are the kidneys. In this plate, we will discuss the nephron, the independent unit inside the kidney that produces urine. There are approximately one million nephrons in each human kidney. Nephrons perform the functions of filtration, reabsorption, and secretion.

Looking over the plate, you will notice that it is composed of three diagrams: the entire kidney, nephrons in their environment, and a close up of a single nephron, the microscopic unit of the kidney. Color the structures as you encounter them.

In the first diagram, we see the **kidney (A)**, as it was shown in the previous plate. One section of the kidney is enlarged and shown in detail, and this area contains a **nephron (B)**. A pale shade is recommended to highlight it. The **renal artery (C)** delivers blood to the kidney, the **renal vein (D)** removes blood from it, and the **ureter (E)** is responsible for carrying urine away.

We now focus on the expanded view of a section of the kidney, in which we see eight nephrons. We will briefly study this perspective before going on to the detailed view of a single nephron.

The second diagram of the plate shows the **cortex (F)**, which is indicated by a bracket and should be colored in a bold color; its general area can be colored in a pale hue. This diagram also shows the **medulla (G)**.

Within the cortex and medulla we present the simplified views of eight nephrons. Each of the eight nephrons has a **renal corpuscle (H)**, and we have circled one of these. Nephrons are oriented so that they're perpendicular to the kidney's surface. There are **cortical nephrons (H_1)** and **juxtamedullary nephrons (H_2)**, both of which have capsules, proximal tubules, and distal tubules that are in the cortex, and long **loops of Henle (R)** that extend into the medulla. In this diagram, we recommend that you color in the cup-like renal corpuscles then the tubules that lead from the corpuscle as they extend toward a collecting duct. The **collecting duct (I)** receives urine from many nephrons.

Now we come to a single nephron and study its vascular and tubular components. We recommend variations of one color for all parts of the vascular system, and variations of a different color for parts of the tubular component. Continue reading below as you study the nephron, and color the structures as you come upon them.

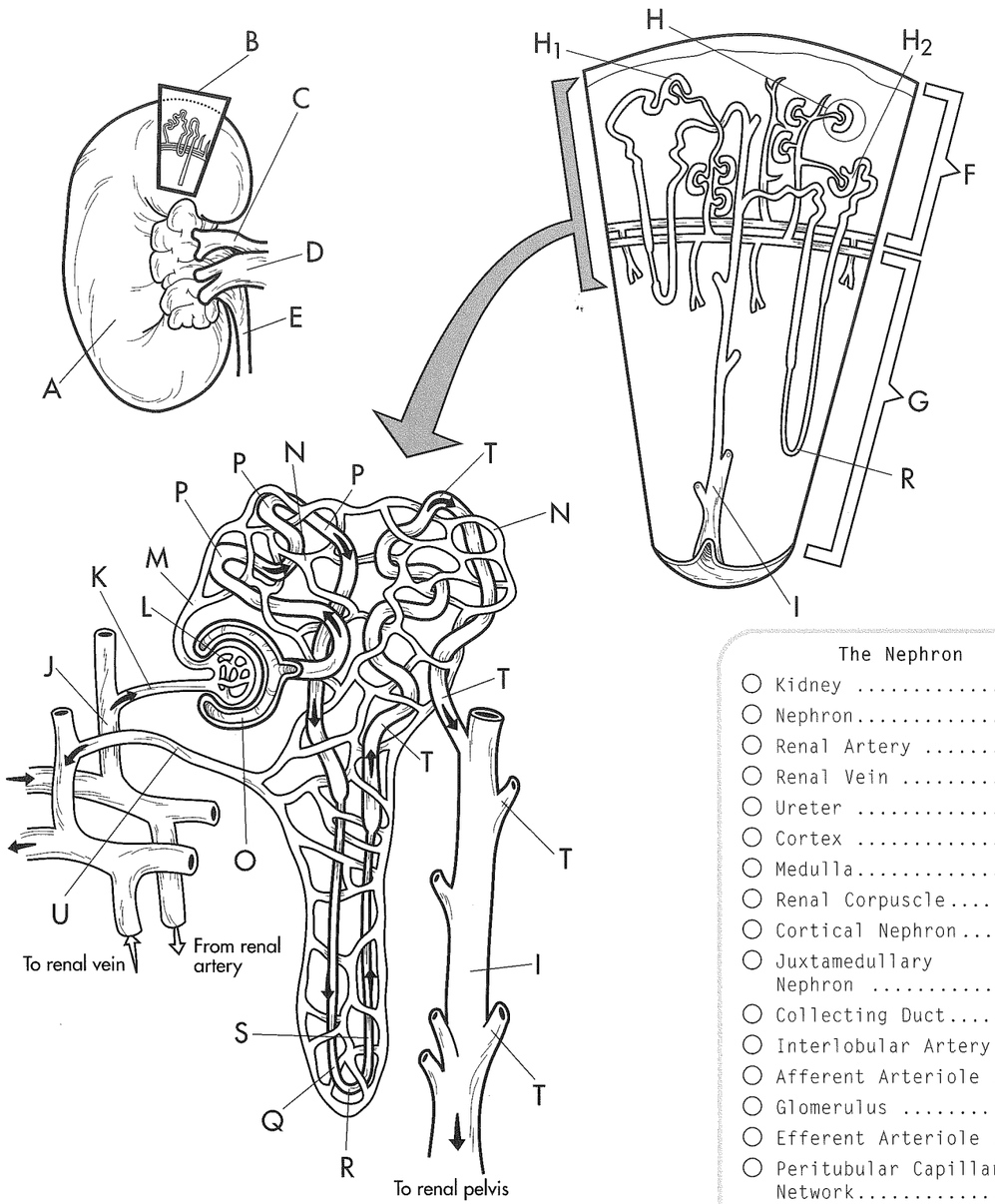
Blood travels from the heart through a series of arteries and finally reaches the **interlobular artery (J)**; one branch of this artery is the **afferent arteriole (K)**. Blood flows through this vessel into a small network of capillaries called the **glomerulus (L)**. Filtration takes place here (as we describe below), and then the blood enters a vessel called the **efferent arteriole (M)**. The efferent arteriole branches into a network of capillaries, called the **peritubular capillary network (N)**. You should use variations of a single color for these vascular tubules.

Filtration occurs when blood passes through the glomerulus. As blood passes through the glomerulus, normal blood pressure forces fluid across the wall of the nephron tubule, which is also known as **Bowman's Capsule (O)**. Together the glomerulus and Bowman's capsule are called the renal corpuscle. This fluid, or filtrate, contains water, salts, glucose, nitrogenous wastes, and other small molecules. The blood then continues to flow through the tubular component, first encountering the **proximal convoluted tubule (P)**. At several points along the nephron tubule, fluid is filtered out and reabsorbed back into blood that is traveling through the peritubular capillary network.

Now the proximal tubule descends toward the renal medulla. The descending tubule is called the **descending limb (Q)**. This tubule turns abruptly at the **loop of Henle (R)** and ascends as the **ascending limb (S)**. Variations of the color used for the proximal tubule should be used to color here. The peritubular capillaries surround the tubules as they dip into the medulla and water and salts are reabsorbed back into the blood.

As the tubule ascends, it forms the **distal convoluted tubule (T)**. Again, it intertwines with capillaries of the peritubular capillary network (N), and selective reabsorption takes place. This reabsorption is critical; without it the body would lose an excess of water, vitamins, and other important molecules and ions in the process of excretion. The capillary network then moves toward the renal corpuscle and forms the **interlobular vein (U)**. This vein ultimately leads to the renal vein, which removes the cleansed blood from the kidney.

Following the tubule once again, you will notice that the distal convoluted tubule (T) comes to the collecting duct (I). The fluid in the collecting tubule is urine, which is sent to the ureter for discharge.



The Nephron

- ○ Kidney .....A
- ○ Nephron.....B
- ○ Renal Artery C
- ○ Renal Vein .....D
- ○ Ureter .....E
- ○ Cortex .....F
- ○ Medulla.....G
- ○ Renal Corpuscle.....H
- ○ Cortical Nephron.....H_1
- ○ Juxtamedullary Nephron .....H_2
- ○ Collecting Duct.....I
- ○ Interlobular Artery....J
- ○ Afferent Arteriole ....K
- ○ Glomerulus L
- ○ Efferent Arteriole ....M
- ○ Peritubular Capillary Network.....N
- ○ Bowman's Capsule .....O
- ○ Proximal Convoluted Tubule .....P
- ○ Descending Limb.....Q
- ○ Loop of Henle.....R
- ○ Ascending Limb .....S
- ○ Distal Convoluted Tubule .....T
- ○ Interlobular Vein.....U