

Embryology of the Kidney

The kidneys are paired organs located retroperitoneally. Their vascular supply comes from the renal arteries, and they drain into the renal veins. Each kidney excretes into a ureter, which will in turn empty into the urinary bladder. Its functional unit is the nephron.

During the development of the kidney, there are 3 main structures initially, which derive from intermediate mesoderm. These structures are **pronephros, mesonephros and metanephros**.

Pronephros

Forms most caudally of all three. It starts to develop during the fourth embryonic week and regresses in the same week. It appears at 7-10 cell groups which constitute a nephrotome. By the time of birth, all signs of the pronephros have disappeared.

Mesonephros

The mesonephros begins to develop as the pronephros is regressing (fourth week). It starts as a series of S-shaped tubules which will acquire capillaries to become a glomerulus. The tubules around the glomerulus will form a Bowman's capsule. Together this will lead to the formation of a renal corpuscle. Laterally, the tubule enters the mesonephric collecting duct (wolffian duct).

Metanephros

This final urinary organ appears during the fifth week. For the development of this organ, it is important to distinguish between the development of its collecting system and its excretory system. The collecting system develops from the ureteric bud, which in turn is an outgrowth of the mesonephric duct. The bud penetrates the metanephric tissue. The bud then dilates, forming a renal pelvis. The renal pelvis will differentiate into the major calyces, which will do the same for 12 or more generations to become the minor calyces. By the fifth generation, the renal pyramids are formed. The excretory system is formed because a metanephric tissue cap is induced by the collecting tubules to form renal vesicles. From here, the process is very similar to the formation of the metanephros; the vesicles form an s-shaped tubules which is covered in capillaries, giving rise to glomeruli. The tubules and the glomeruli form the nephron. Continues expansion of the tubules will form the convoluted tubules of the kidney and the loop of Henle.