Urinogenital Systems in vertebrates

Urinary systems of vertebrates includes Kidneys and their ducts, while reproductive system includes male and female gonads and their ducts.

Kidneys excrete harmful metabolic nitrogenous wastes and regulate the composition of body fluids while reproductive organs help in perpetuating the species. The two systems are intimately related in vertebrates, so these two systems are described together as urinogenital system.

Vertebrate Kidneys and ducts —

Basic Structure and origin — Vertebrate Kidneys are a pair of compact organs, lying dorsal to coelom in trunk region, one on either side of dorsal aorta. They are built in accordance with basic pattern. Each Kidney is made up of large number of units called uriniferous tubules or nephrons. These no, complexity and arrangement differ in different classes of vertebrates.

Kidney tubules arises in embryo in a linear series from a special part of mesoderm called mesomere or nephrotome. It is a ribbon like intermediate mesoderm running between segmental mesoderm (epimere) and lateral plate mesoderm (hypomere) on either side along the entire trunk from heart to cloaca. An uriniferous tubule is divided into three parts

① Peritoneal funnel ② tubule and 3 Malphigian body.

1. Peritoneal funnel — It is a funnel like ciliated structure near the free end of

of ~~uni~~ uriniferous tubule. It opens into coelom by a wide aperture, the coelomostome or nephrostome, for draining wastes from coelomic fluid.

(2) Malphigian body – A tubule begins as a blind, V cup like, hollow, double walled Bowman's Capsule, enclosing a tuft of blood capillaries called glomerules. which is together called Malphigian body.

(3) Tubule – Malphigian body filters water salts and other substances from blood. During passage through tubules more substances are secreted into filterate while some are reabsorbed.

Archinephros – Archinephros is the name given to the hypothetical primitive Kidney of ancestral vertebrates considered as complete Kidney or holonephros extending to the entire length of coelom. Each tubule is segmentally arranged and drained by a common longitudinal wolffian or archinephric duct opening behind the cloaca. Such a hypothetical archinephros is found in some larvae of cyclostomes but not in any adult vertebrate.

Modern vertebrates exhibit 3 types of Kidneys

(1) Pronephros
(2) Mesonephros and
(3) Metanephros.

Pronephros – In all vertebrate embryos, the first Kidney tubules appear dorsal to the anterior end to coelom on either called pronephros. The pronephros is also termed as head Kidney due to its anterior position immediately behind the head. It consists of 3 to 15 tubules segmentally arranged, one opposite each of the mesodermal somites. There are only 3 pronephric tubules in frog embryo, 7 in human embryo and about a dozen in chick embryo. Each tubule opens into coelom by a funnel or nephrostome. Also projecting into coelom by a funnel or nephrostome. Also projecting into coelom ~~by a funnel or nephrostome~~ near each tubule, and not connected with it is an external or naked glomerulus without capsule. In some cases glomeruli unite to form a single compound glomerulus called glomus. Glomus and tubules become surrounded by a large pronephric chamber derived from pericardial or pleuroperitoneal cavity. originally each tubule has its individual external aperture, but Secondarily all tubules of a pronephros open into a common pronephric duct leading posteriorly into the embryonic cloaca.

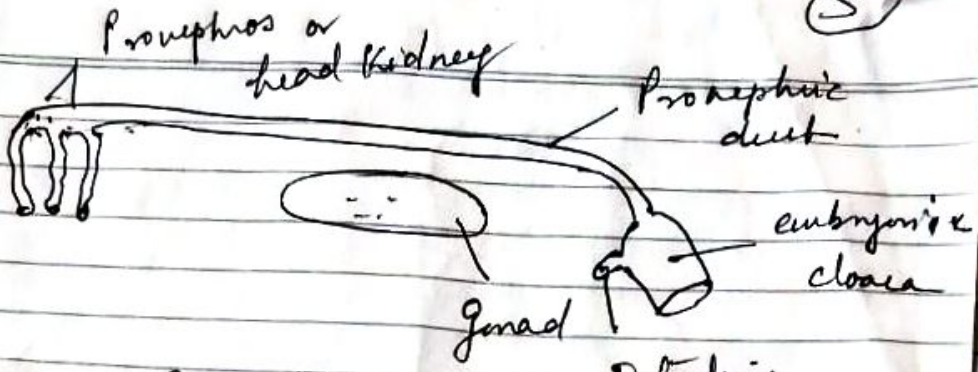
Pronephros is functional only in embryonic or larval stage, it is soon replaced by the next stage or mesonephros. Pronephros is retained throughout the life in adult cyclostomes and a few fishes, but it is non urinary and mostly lymphoidal in function.

Mesonephros — Mesonephros develops from the middle part of intermediate mesoderm, posterior to each pronephros soon after its degeneration. mesonephros is functionally better than pronephros due to its more no of tubules, more longer and develops internal glomeruli enclosed in capsules forming malphigian bodies. Thus they remove liquid wastes directly from glomerular blood than indirectly from coelomic fluid. The mesonephros is also termed as wolffian body, or because pronephros the old pronephric duct becomes the wolffian or mesonephric duct.

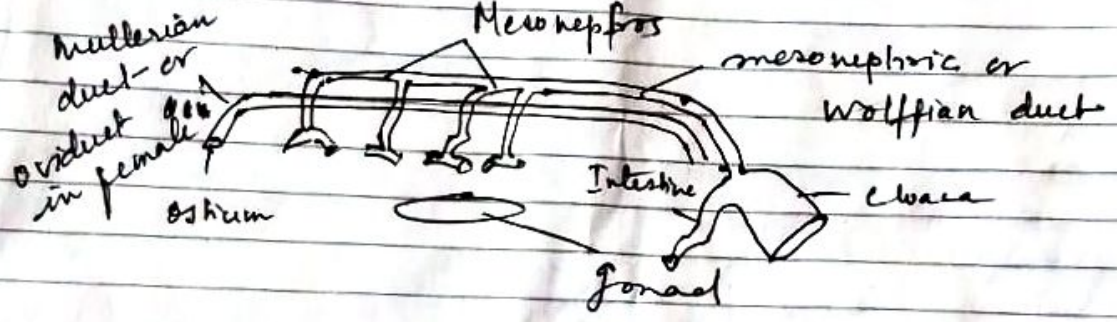
In amniotes (reptiles, birds and mammals) mesonephros is functional only in the embryo replaced by metanephros in the adults.

Metanephros — The functional Kidney of higher vertebrates or amniotes is a metanephros. The adult Kidney of amniotes differs from that of amniotes in following ways.

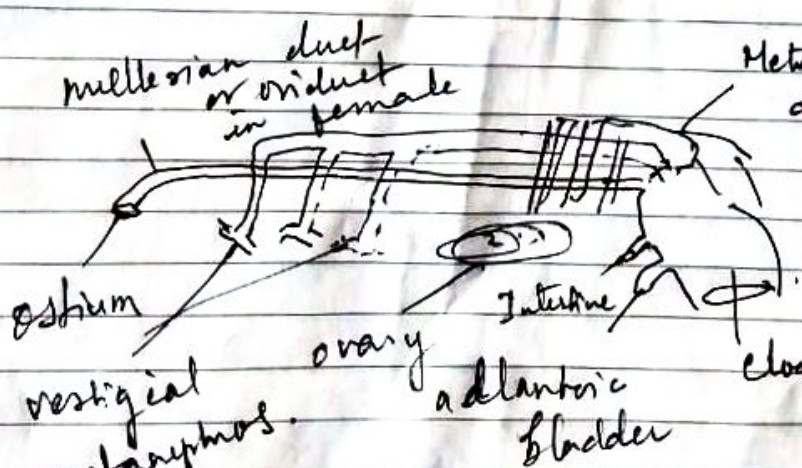
1) It originates from the caudal end of nephrogenic mesoderm.
2) They have a greater multiplication and posterior concentration of nephros or tubules. Each Kidney of man contains about 1 million nephrons.
3) The urinary duct buds off from metanephric duct
4) The mammalian metanephros shows greatest organization of all with several features such as a thin U shaped loop of Henle forms between proximal and distal convolutions of a metanephric tubule. Such loops are absent in reptiles and birds. Kidney shows outer cortex with concentration of renal capsules and inner medulla having collecting tubules and loop of Henle, which make pyramids tapering to pelvis.



Pronephros



mesonephros



Metanephros.

Evolution of Kidney in vertebrate.

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