

Prof ANIL KUMAR Associate Professor Zoology

Topic Describe the evolution and fate of kidney  
Part II Paper IV

**Q. 5. Describe the evolution and fate of kidney.**

**Ans.** The end product of metabolism are waste substances they are carbon dioxide, ammonia, urea, uric acid, pigments, creatinine and some inorganic salts. Carbon dioxide is removed through the skin and gills or lungs, but the others are excreted through the kidney, though in

some fishes gills also excrete some waste substances. Most excretory substances are in solution in water and any excess of water is also eliminated by kidney. The excretory and reproductive systems are closely associated structurally, particularly in the males, hence it is customary to consider the two systems together as urogenital or urinogenital system.

**Evolution of Kidney :** The kidneys of vertebrates are fundamentally alike in structure and development but may appear different because of their position in relation to the body cavity. Recent writers tend to emphasise the vertebrates kidney calling it a Holonephrons and minimize the distinctions made between both evolutionary and developmental stage under the name of pro, meso and metanephros. In addition to this primitive archinephros type is also found in larval forms of myxine and others.

In the embryonic story we find that the presence of the mesoderm on either hand of a band of kidney forming tissue lying between somite and the lateral plate and frequently showing segmental division into a series of small mesomeres (nephrostomes). Probably in the ancestral vertebrate each mesomere gave rise to a single renal tubule.

### **Fate of kidney in vertebrates :**

#### **1. Pisces :**

- (a) Actinopterygians and (b) Teleost.

#### **(a) Kidney Bolonephros :**

(i) In teleosts the pronephros is developed much like posterior. In some teleosts the adult kidney is opisthonephros. The nephric ducts join above the area of anus as middle sinus has a longer bladder.

(ii) **Polypterus :** Kidney opisthonephros type. Long, thin are on either side but not jointed posteriorly. The nephric duct is distinct from the genital duct in both male and female.

#### **(b) Chondrichthys :**

Opisthonephros kidney. In the sexually matured male the anterior part is converted into an epididymis. The nephric duct becomes hypertrophied and coiled, acting as a ductus deferens. Posterior to epididymis part of kidney is modified into Leydig's gland.

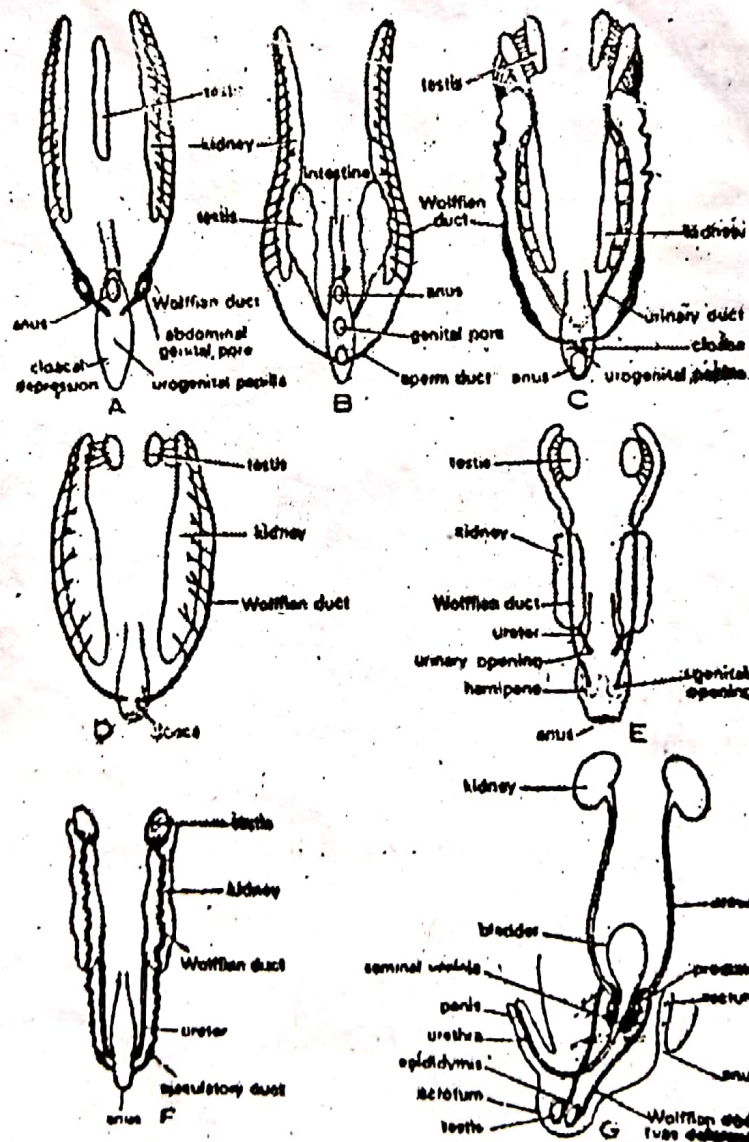


### (c) Choanate Fishes :

(i) **Actinistian** : Short, thick medical mass lying in the post cloacal part of the abdominal cavity; not against the roof but rather on floor.

(ii) **Diploan** : Opisthonephros kidney. Bank like on either side and fused posteriorly except bepdosivren. The nephirc duct of both side unit posteriorly and formed urinary sinus which opens into the cloaca along with the mullerian ducts and the gut.

**2. Amphibia** : Archinephric kidney in larval caecilians, opisthonephros in adult. In urodela opisthonephros kidney made up of two regions an anterior portion which is concerned more with genital than urinary functions in male and posterior expanded region, Anurans kidney show posterior connection of tubus through out life.



**3. Reptiles** : Metanephric kidney which is restricted to the posterior half of the abdominal cavity and usually continued to the pelvic region. In lizards kidney tubules vary from 3,000 to 30,000.

**4. Aves :** Kidney are of metanephric type. Typical, lobulated and contains a much larger number of tubules 200000 in a fowl presumably correlated with the greater metabolic activity of birds and a consequence in need for waste disposal.

**5. Mammals :** In mammals there is a pair of bean shaped metanephric kidney lying asymmetrically against the dorsal body wall, the right kidney being anterior to the left. On the innerside each kidney has a notch or hilus. Uriniferous tubules converge to open near the hilus into a wide chamber or pelvis which is continued into a metanephric duct or true ureter. In mammals the tube count is high. A mouse appears to have about 20,000 and in such large mammals as a man and cow. The number may run into the millions.