

# **URINOGENITAL SYSTEM**

## **part-2**

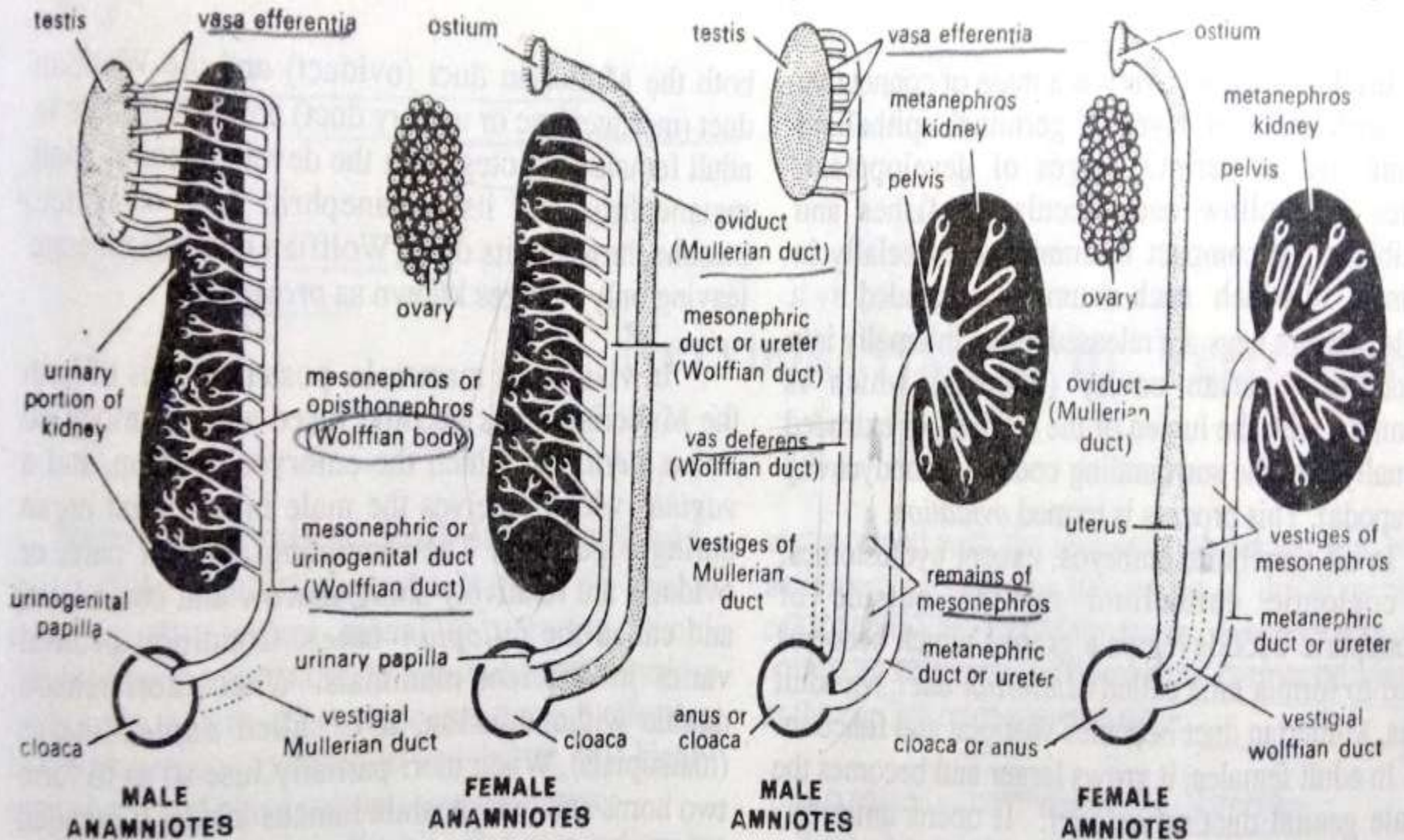
# **EVOLUTION OF UROGENITAL DUCTS**

Course: B.Sc.(H) Zoology IV semester

Paper: Comparative Anatomy

Faculty: Dr. Priya Goel

# EVOLUTION OF UROGENITAL DUCTS



# MALE URINOGENITAL DUCTS

## CYCLOSTOMES:

- No genital ducts present. Sperm are shed into the coelom and exit via abdominal pore.
- The archinephric ducts drain the kidneys exclusively.

## Anamniotes

- The opisthonephros (or mesonephros) is differentiated into **Anterior GENITAL** and **Posterior RENAL** portions.
- In the anterior genital portion in males, some uriniferous tubules lose excretory function, form slender **Vasa efferentia**, and become continuous with **seminiferous tubules** of the adjacent testis. They serve to convey sperm of testis to the mesonephric duct of kidney.
- Thus, in male anamniotes, *mesonephric or wolffian duct forms a urinogenital duct, serving both as a vas deferens for sperm as well as a ureter for urine.*
- However, in many elasmobranchs (e.g. dogfish), accessory urinary ducts drain urine from kidney to cloaca so that the mesonephric duct serves entirely or mainly as a vas deferens.
- The **anterior genital** part of kidney along with the part of mesonephric duct forms an **epididymis**.
- In the embryos of **Anura**, each testis is made of two portions - *the anterior portion disappear and the posterior portion becomes the adult functional testis.*
  - In adult male toad, the anterior portion also persists as the **Bidder's organ**, containing large cells similar to immature ova.

## **AMNIOTES:**

A metanephros develops as the adult functional kidney with its own urinary duct or ureter to transport urine.

*Thus, mesonephric or Wolffian duct becomes solely a genital duct or vas deferens.*

The remnants of embryonic mesonephros and a coiled portion of mesonephric duct become the epididymis of the adult kidney.

From each testis sperms pass first through epididymis, then through vas deferens to reach urethra.

# FEMALE OVIDUCTS

- ***Branchiostoma***: No genital ducts.
- **Cyclostomes**: No genital ducts.
- In all vertebrate embryos, except cyclostomes, the coelomic epithelium on the outside of mesonephric duct develops a groove which becomes closed to form a tube called **Mullerian duct**.
- In adult males, Mullerian duct becomes vestigial and functionless.
- In adult females, the Mullerian duct grows larger and becomes the female genital duct or **oviduct**.
- It opens anteriorly into coelom, in the region of degenerating pronephros, by a **coelomic funnel** or **ostium**, and terminates posteriorly into **cloaca**.

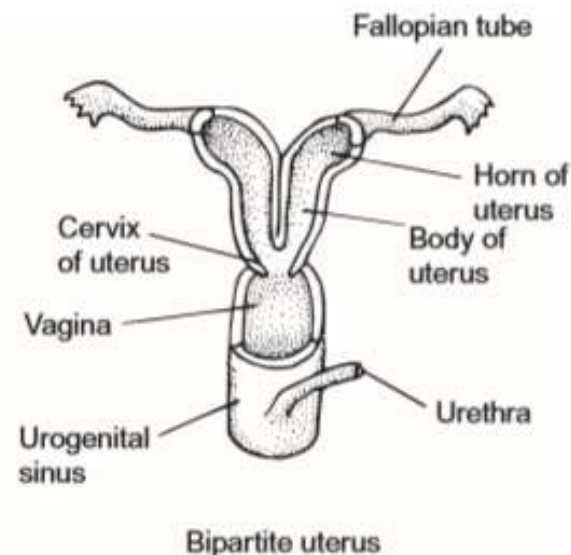
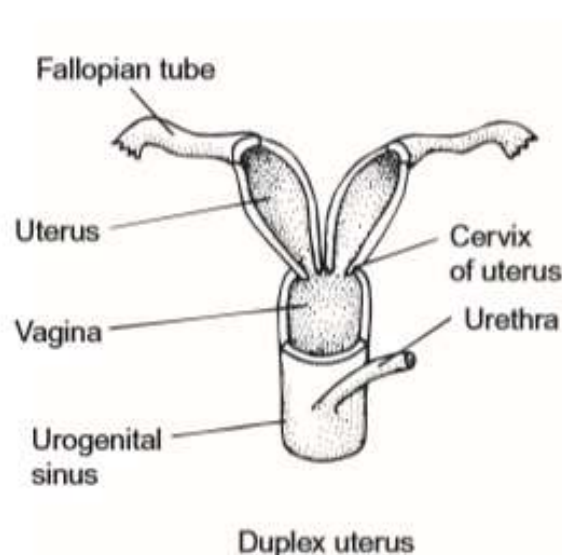
- **Fishes:**
  - In **Elasmobranchs** and **lungfishes**, the Mullerian duct is formed differently by the longitudinal splitting of the pronephric duct. It differentiates into four regions: **funnel**, **shell gland**, **isthmus**, and **uterus**. **Funnel** receives the ova from ovary, **shell gland** secretes albumen and mucus or egg shell around it. The **isthmus** connects the shell gland to the uterus. The uterus nutritionally supports embryos if they are held in the oviduct for an extended period. Oviducts may join before they enter the **cloaca**, or they may enter separately.
  - **Teleost fishes** have a short oviduct that starts directly from the ovaries. They are not mullerian ducts and are often called **Egg Ducts**. There is no cloaca in teleosts.
- **Amphibians:** **Mullerian** ducts function as oviducts. They are long and convoluted. Posteriorly each oviduct dilates to form **uterus/ovisac** that open independently into cloaca.
- **Amniotes:** Remnants of the **mesonephros** may persist in larval stages as **PROVARIUM**, but adults have **metanephric** kidneys drained exclusively by new paired ducts, the **ureters** (**metanephric ducts**).
- The oviducts (**Müllerian** ducts) persist in their roles of transporting ova from the ovaries and supporting the embryo while it is in transit.

- **Reptiles:** The **oviducts** are long and open into the coelom by large, slit-like **ostia**. The right oviduct is shorter than the left in snakes. Posteriorly, the oviducts dilate to form the **shell gland** or **ovisac**, and open independently into the cloaca. Upper parts of oviduct have **glandular lining** in crocodilians, chelonians and *Sphenodon* that secrete albumen over the egg. Many reptiles have **cloacal glands** also, which release a secretion with nauseating odour and a defensive role.
- **Aves:** Both the oviducts (**Mullerian ducts**) appear in the embryo but only the left grows and becomes functional in the adult. A vestige of the right persists attached to the cloaca. The left oviduct is a long, muscular, convoluted tubule.
  - The anterior end widens to form the **oviducal funnel/infundibulum** that serves to receive the ova released from the ovary.
  - Next is the glandular part **Magnum**, where albumen is laid down around the egg.
  - Then comes the **isthmus** which secretes the shell membranes around the egg.
  - The terminal part is known as **vagina**, it secretes mucus to facilitate laying of eggs. Both oviducts are functional in certain birds of prey.
- **Mammals:** mammals have paired oviducts (Mullerian ducts). Each oviduct consists of anterior narrow **Fallopian tube** and a posterior wide **uterus**. The former opens into coelom by an **Ostium** bordered by fringed margins called **fimbria/ fallopian funnel/ infundibulum**. The uteri terminate in vagina through cervix. However in monotremes, only the left oviduct is functional.

# TYPES OF UTERI IN MAMMALS

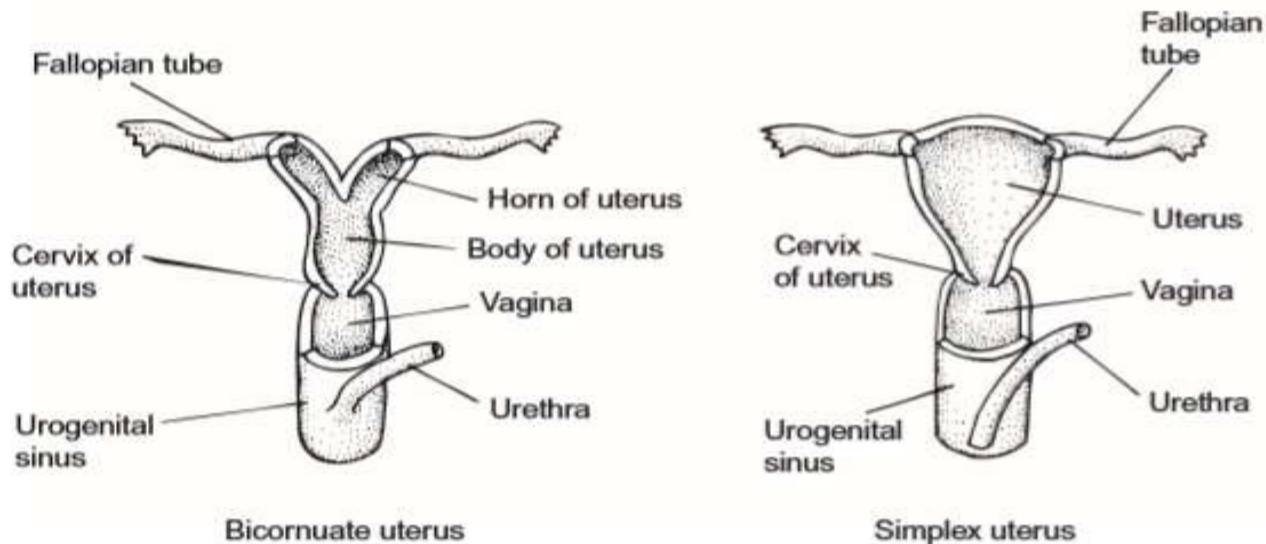
Eutherian mammals possess one of the four types of uterus on the basis of degree of fusion of uterus with vagina at the distal end:

1. **Duplex uterus:** uteri distinct and open separately into the vagina (elephants, many rodents and some bats. There may even be two separate vaginas for each uterus that
2. **Bipartite uterus:** uteri partly fused and open by a single aperture into the vagina (most carnivores, pigs, cattle, some rodents, few bats)





3. **Bicornuate uterus:** uteri over half fused (rabbit, whales, sheep, insectivores, most bats, some carnivores, hoofed mammals). The uterus has two horns/cornua in which the young develop. A uterus with two horns may have two totally separate passageways within the body of the uterus, although this is not discernible from the external view. One horn may be larger and longer than the other, the blastocysts implant in that horn, even though both ovaries produce viable eggs.
4. **Simplex uterus:** uteri completely fused (Armadillo, Apes, Humans). Fusion commences at the ends of short oviducts and there are no uterine horns. Blastocysts implant in the body of the uterus and there is only one foetus per pregnancy. Armadillos are exceptional: they give birth to identical quadruplets.



# Points to remember:

- The **pronephric** duct usually persists and is renamed the **mesonephric (Wolffian)** duct or the **opisthonephric** duct (if it extends till the caudal end of coelom), respectively.
- In males, this duct transports sperm and is then called the **Vas deferens**.
- In females, it is known embryologically as the Wolffian duct.
- The **metanephric duct** is commonly renamed as the **ureter**.
- In females, the **archinephric (mesonephric)** ducts tend to function only within the urinary system. The Müllerian duct arises embryologically next to the archinephric (wolffian) duct.
- In males, the Müllerian duct regresses, but in females, the Müllerian ducts become the oviducts of the reproductive system.

Duct	Fate/other name
Archinephric duct → Pronephric duct → Mesonephric duct (Wolffian duct)	Vas deferens in male genital system
Mullerian duct	Oviduct in female genital system
Metanephric duct	Ureter (urinary duct)