

**nephron.** The glandular epithelial lining of distal convoluted tubule absorbs the nitrogenous waste products from the surrounding capillaries and secretes into the tubule. This secretion being against the concentration gradients, is called active transport. Thus, the metabolic wastes escaped in the ultra-filtration are put back into the filtrate due to the process of tubular secretion. The resulting fluid is now called urine, which contains hydrogen ions, ammonia, potassium, urea, creatinine and water. Urine is hypotonic to blood. The chief excretory material being urea the frog is called *ureotelic animal*.

Thus, the final urine excreted is the result of three basic processes *filtration, reabsorption and secretion*. The method adopted by the kidneys for clearing the blood is comparable to clearing a working table, by first removing everything lying over it, and then replacing whatever is needed on the table.

## F REPRODUCTIVE SYSTEM

Reproduction in frog and higher animals is a complicated process involving the existence of two sexes both of which play their role in the formation new individual.

Frog is unisexual and shows sexual dimorphism (as discussed in earlier chapter.) The male is distinguished from the female in having pair of *vocal sacs* and the *nuptial pads*. The excretory system and reproductive system in frog are closely associated and therefore, usually they are considered as *urinogenital systems*.

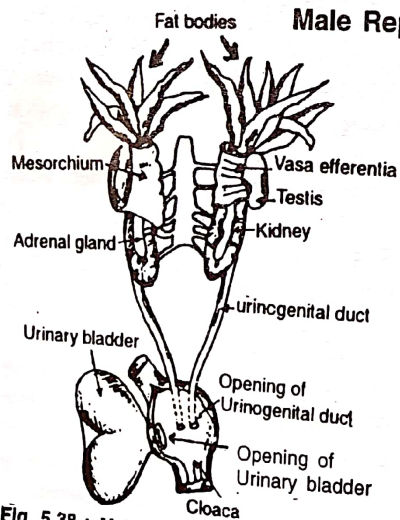


Fig. 5.38 : Male urinogenital system of frog

### Male Reproductive System

The male reproductive system of frog cannot be separated from the excretory system for they have common urinogenital duct and therefore, the system is known as *Urino-genital system*.

The system includes :

- (i) Pair of testes, (ii) Vasa efferentia (8 to 10 pairs),
- (iii) Pair of urinogenital duct,
- (iv) Cloaca, (v) Fat bodies.

(i) **The Testis** : Testes are two glandular organs, capsule like in shape, suspended by a double fold of peritoneum

called *mesorchium*. Each testis is creamish - yellow or orange coloured attached to anterior and ventral surface of kidney by mesorchium. In fact the size and colour of testis varies in different frogs according to the season.

Internally the testis shows number of seminiferous tubules surrounded by connective tissue, blood vessels, interstitial cells etc. The internal lining of seminiferous tubule undergoes spermatogenesis to produce sperms, the male gametes. The interstitial cells secrete male hormone testosterone which is responsible for male secondary sexual characters.

**Seminiferous Tubules** : These are microscopic convoluted tubules lined internally by germinal epithelium which produce sperms by spermatogenesis. There are different developing stages of sperms observed in the tubule, like spermatogonia, primary, secondary spermatocytes and spermatids. The larger cells in the tubule are called *Sertoli cells*. These are nurse cells in which the heads of developing sperms are embedded. They are most helpful in supporting sperms, nourishing sperms and providing site of attachment to developing sperms.

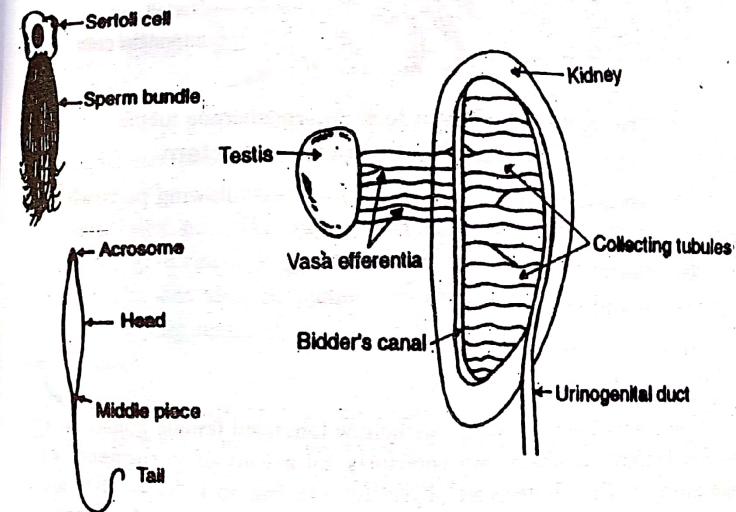


Fig. 5.39 : V. S. of kidney and testis

(ii) **Vasa Efferentia** : There are about eight to ten tubules arising from testis and passing through mesorchium to open into *Bidder's canal* of kidney. Bidder's canal is a longitudinal canal running along the inner margin of kidney internally and connected to urinogenital duct by number of transversely placed collecting tubules. The main function of vasa efferentia is to carry the sperms from testis to Bidder's canal. The sperms from the Bidder's canal are then passed to the urinogenital duct through the transverse collecting tubules.

(iii) **Urinogenital Ducts** : These are also known as *Wolffian ducts*. The pair of urinogenital ducts are thin transparent ducts running along the outer margin of kidney posteriorly upto cloaca. In cloaca they open dorsally by separate openings. At the time of *amplexus* or sexual embrace the sperms that are discharged from testis pass through the vasa efferentia, Bidder's canal, collecting tubule and ultimately enter urinogenital ducts. From the cloacal aperture. Thus, the urinogenital ducts are the common ducts to carry urine as well as sperms. (never together.) Usually they carry urine but only during *amplexus* they carry the sperms.

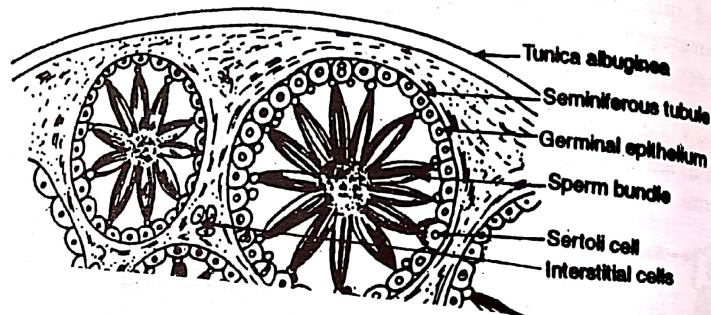


Fig. 5.40 : T.S. of Testis to show seminiferous tubule

### Female Reproductive System

The female reproductive system of frog has following parts which are mainly adapted to produce and pass ova or eggs.

- (i) Pair of ovaries
- (ii) Pair of oviducts
- (iii) Single cloaca
- (iv) Fat bodies.

(i) **Ovary** : Pair of ovaries are hollow lobulated female gonads attached to the kidneys ventrally and anteriorly by a fold of peritoneum called *mesovarium*. Though, they are physically attached to kidneys, they are not internally connected to them. Each ovary is a hollow lobulated structure practically occupying the major body cavity containing thousands of ova in a matured frog. The immature ovaries are small, yellow and semi-transparent but the mature ovaries are quite big and occupy major portion of body cavity. They are opaque and blackish in colour. The mature ova are released in the body cavity by rupturing the wall of the ovary and the process is called *ovulation*.

The T. S. of ovary shows internal hollow lymph filled cavity divided by septa into many compartments. The wall of ovary is made up of *outer theca*

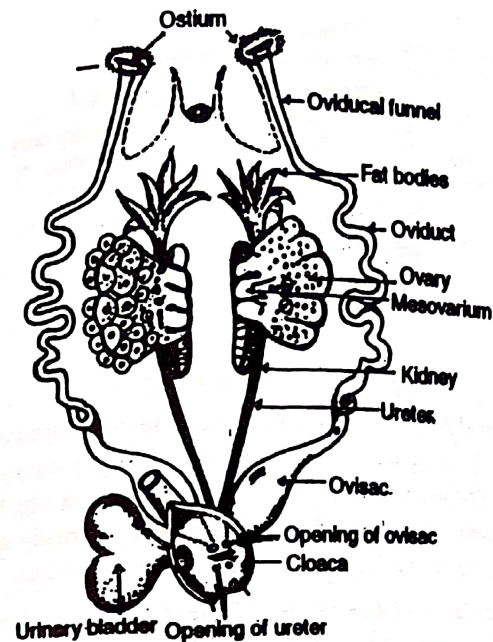


Fig. 5.41 : Female urinogenital system of frog

*externa* and *inner theca interna*. The area in between these two layers is called *stroma*. The stroma consists of group of germ cells, nerve fibres, blood capillaries etc. The germ cells of germinal epithelium divide meiotically to give rise to ova. The process is called *oogenesis*. Number of ovarian follicles are seen projecting from inner wall of ovary. There are different developing stages of ova like primary oocyte, secondary oocyte and mature ovum.

The follicular cells provide nourishment to developing ova and also secrete female sex hormone. The mature ovum is released by rupturing the *theca externa* and the process is called *ovulation*:

(ii) **Oviducts** : On outer side of each ovary there is a highly convoluted tube called *oviduct* or *female gonoduct*. It is yellow or cream coloured tube extending from the base of lung to the cloaca. Each oviduct is distinguished into three regions.

- (a) Anterior oviducal funnel
- (b) Middle glandular and convoluted part
- (c) Posterior ovisac.

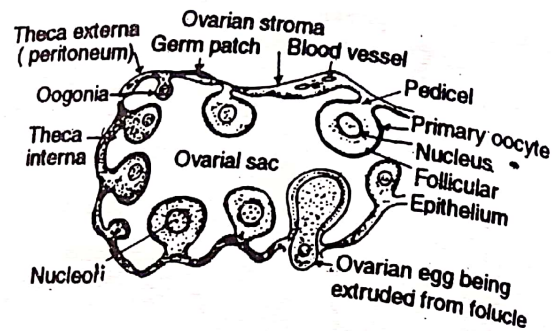


Fig. 5.42 : T. S. of ovary of frog

(a) **Oviducal Funnel** : This is the anterior funnel shaped end of oviduct situated at the base of lung and opened into the body cavity by a mouth called *ostium*. The *ostium* is ciliated and receives the ova which are released in the body cavity. The oviducal funnel is ciliated internally and continued behind as the long convoluted tube called glandular oviduct.

(b) **Glandular and Convoluted Oviduct** : It is the longest part of oviduct and much convoluted. Internally, it is lined by glandular epithelial lining. The glandular cells secrete the albuminous coating over the passing ova.

(c) **Ovisac** : It is the distal dilated part of oviduct which is bag like, thin walled, semitransparent, opening into cloaca dorsally. Right and left ovisacs open separately in the cloaca just in front of the openings of ureters but on a raised genital papilla. The two ovisacs store the ova for a short period till they are discharged in water during amplexus.

(iii) **Cloaca** : It is a common chamber serving as a passage for ova (during spawning) and also for urine and faecal matter. The ova are discharged into water by opening the cloacal aperture during amplexus.

(iv) **Fat Bodies** : These are attached to the ovaries and kidneys anteriorly. They are meant for providing nourishment to developing ova during hibernation.

**Breeding** : The breeding season of frog is mainly the rainy season (from June to September). They use to go to water for breeding and hence, the rainy season is most suitable. Breeding habit in frog is special and called *amplexus*.

*Amplexus* is an instinctive behaviour of frogs. It is a *sexual embrace* of

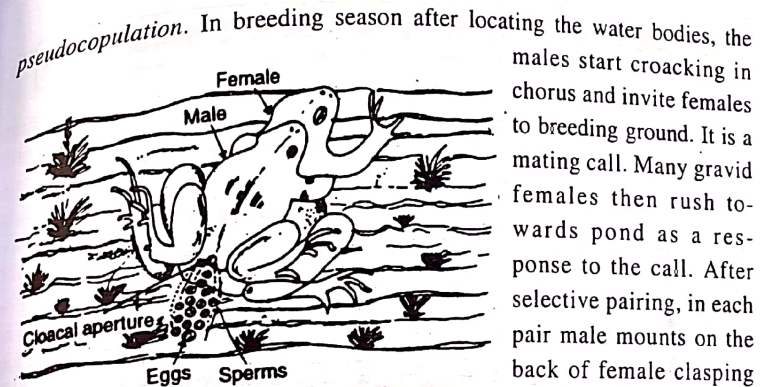


Fig. 5.43 : Amplexus in frog

**Spawning** : Spawning is the process of laying eggs in the water during amplexus. The eggs are laid in bunches called *spawn*. The spawn is one

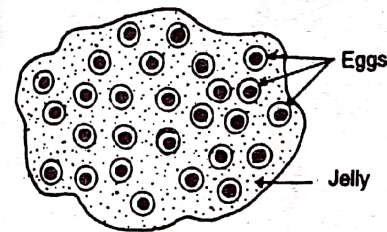


Fig. 5.44 : Spawn of frog

large gelatinous mass floating on the surface of water usually in heavy aquatic vegetation. When the eggs come in contact with water their jelly covering swells and binds the eggs together forming a large mass of spawn. The spawn is transparent and can be recognised on the surface of water observing the black dots in frothy mass. The pigmented animal pole of egg is being light, it is directing upward while yolky portion lies below. The pigmented area absorbs heat from atmosphere and makes the eggs warm. The jelly layer protects the eggs from cold and also from the attack of insects, microorganisms. The jelly coatings makes the spawn non-edible for fish and birds.