INSECT MORPHOLOGY - MALE REPRODUCTIVE SYSTEM

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* The male reproductive organs typically consist of a pair of testes which connect with paired seminal vesicles and a median ejaculatory duct. In most insects there are also a number of accessory glands which open into the vasa deferentia or the ejaculatory duct.

TESTES

* The **testes** may lie below or above the gut in the abdomen and usually are near the midline of the body. Usually each testis consists of a number of **testis tubes** or **follicles**. The number of follicles can be quite variable (in some Coleoptera, there is a single follicle; in some lice, there are 2 follicles; and in some grasshoppers, there may be over 100). In some insects (some Lepidoptera), the follicles may be incompletely separated from one another, and in some Diptera the testes consist of simple, undivided sacs, although these may be regarded as single follicles. Sometimes the testes consist of a series of lobes each with several follicles.

* The walls of the follicles consist of a thin epithelium standing on a basement membrane and in some cases the epithelium consists of 2 layers of cells. The follicles are bound together by a peritoneal sheath, and sometimes the 2 testes themselves are bound together (some Hymenoptera and Lepidoptera), and in extreme cases the 2 testes may completely fuse together forming one median structure (some Lepidoptera).

VAS DEFERENS

* From each testis follicle a fine, and usually short, **vas efferens** connects with the **vas deferens**. The vas deferens is a tube with a fairly thick bounding epithelium, a basement membrane and a layer of circular muscle outside it. The vasa deferentia run backwards to lead into the distal end of the **ejaculatory duct** and often they are dilated to form the **seminal vesicles**. In other insects (some grasshoppers), the seminal vesicles are separate diverticula arising from the ejaculatory duct, while in some Diptera there is a common median seminal vesicle.

EJACULATORY DUCT

* The **ejaculatory duct** which leads to the **aedeagus** is ectodermal in origin and is lined with cuticle. The wall of the ejaculatory duct is at least partially muscular (the Hymenopteran genus *Apis* is an exception - has no musculature).

* When the insect is of the kind that produces a complex spermatophore, then the **ejaculatory duct** is also usually complex. For example in some Orthoptera, the ejaculatory duct consists of upper and lower ducts connected via a funnel-like constriction. The lumen of the upper part of the duct is a vertical slit bounded laterally by columnar epithelium. In the funnel the cuticle forms a series of, usually 9, ridges on either side. These curve upwards posteriorly as they run back to meet in the dorsal midline and they project so that they almost completely divide the lumen. The lumen of the lower duct is circular and leads to the **ejaculatory sac** and **spermatophore sac**. Scattered muscle fibers are present in the wall of the upper duct, but are absent elsewhere. The ejaculatory duct of some Heteroptera (genus *Oncopeltis*) is also very complex, being specialized for the erection of the **penis**.

* The Ephemeroptera (remember both sexes have paired gonopores) have no **ejaculatory duct**, and the **vasa deferentia** lead directly to the paired genital openings. Dermaptera (only males have paired genital openings) also have paired genital openings, but now the **ejaculatory ducts** lead to the genital openings, but in some species one of the ducts may be vestigial.

ACCESSORY GLANDS

* The male **accessory glands** open into the **vasa deferentia** or the distal end of the **ejaculatory duct**. They may be ectodermal in origin, in this case called **ectadenia** which open into the ejaculatory duct. In other insects, the accessory glands are mesodermal in origin, called **mesadenia**. And finally in some insects both ectadenia and mesadenia occur.

* The number of accessory glands is quite variable. Apterygota and some Diptera lack accessory glands all together. Some Orthoptera have a large number of accessory glands.

THE INSECT FOLLICLE AND SPERMATOGENESIS

* At the distal end of each follicle is the **germarium** in which the germ cells divide to produce **spermatogonia**. Often there is a large **apical cell** which may be important in obtaining nutriment for the developing sperm [SEE OVERHEAD]. The developing **spermatogonia** then become enclosed in a **cyst**. There may be more than one spermatogonia in each cyst and there are usually at least 2 cells forming the cyst around the spermatogonia. These are then pushed towards the base by newer less developed spermatogonia, thus forming a gradient of development from the younger less developed spermatogonia distally to the older more developed spermatogonia basally. This gradient is often broken into 3 different areas:

1. Zone I - growth. A zone of growth in which the primary spermatogonia, enclosed in cysts, divide and increase in size to form **spermatocytes**.
2. Zone II - maturation. A zone of maturation and reduction in which each spermatocyte undergoes 2 meiotic divisions to produce **spermatids**.
3. Zone III - transformation. A zone of transformation in which the spermatids develop into spermatozoa, a process known as **spermiogenesis**.