

- * **The genital segments** - The genital segments contain some of the most important characters in identifying insects - important to taxonomy.
- * **gonopod** - an appendage of a genital segment modified for copulation [Snodgrass says also for oviposition, but this term is usually reserved for males].
- * **gonopore** - in males it is the opening of the median ejaculatory duct which is usually an internal pouch; in the female it is the opening(s) of the lateral oviduct(s) (fusion of the paired oviducts is called the **oviductus communis**).
- * **gonapophysis** - valves of oviposition - appendages surrounding the gonopore.
- * **terebrea** - a modification of the ovipositor for boring or cutting (sawflies, Hymenoptera).

Female genitalia

- * In some insects the female has no special structures associated with egg-laying, but in others the posterior part of the abdomen or some posterior abdominal appendages are modified to form an ovipositor.
- * In the primitive condition there were a pair of openings of the lateral ducts of the female genital system that were located on the 7th abdominal segment. Today this is found only in the Ephemeroptera which have a pair of genital duct openings in the membrane just posterior to the 7th abdominal segment. In the Dermaptera the openings are still in the membrane behind the 7th abdominal segment, but now the pair of ducts have united for a short distance such that now there is only one genital duct opening. In the rest of the insects these openings (just a single opening per insect) have migrated posteriorly and are now located on the 8th or 9th segments. When the genital opening is associated with the 8th abdominal segment, there is usually associated with it an organ formed of appendicular parts of the 8th and 9th segments serving for the deposition of eggs called the **ovipositor**.
- * The 8th sternum frequently stretches beneath the remaining segments. In general the 8th segment is the last part of the abdomen that can be seen from ventral view. Sometimes the last ventral segment visible is the 7th segment.
- * **The ovipositor** - In the female most of the differentiation of the genital segments is due to the development of an ovipositor. The ovipositor is nearly always rudimentary or suppressed in those insects in which the genital openings are on the 9th segment, and often it is reduced or absent in those with the openings on the 8th segment.
- * **Possible evolution of the ovipositor** - Theoretical primitive leg appendage - basal coxite; exite and/or endite from next segment; telopodite. Abdominal appendages of the Thysanura - basal plate is the coxopodite; stylus is an exite and the vessicle is possibly the endite; telopodite is lost. Ovipositor of Thysanura - the sterna is lost; still have stylus, but gonapophysis may have arisen from the vessicle (from 8th and 9th segments).
- * Typically there are 3 **valves** of the ovipositor. [see Snodgrass p. 611, fig. 314].
 1. Coming off the venter of segment 8 is the first pair of valves - the basal portions are called the **valvifers 1** and coming off each basal valvifer is the **valvula 1**. The valvifers are usually basal lobes with the valvulae coming off of the valvifers.
 2. coming off the venter of segment 9 is the basal pair of **valvifers 2** and off each basal lobe are born the pair of **valvulae 2 and 3**. [In most of the Thysanura there are only 2 pairs of valvulae]. Valvulae 1 and 2 form the shaft down which the egg travels when it is oviposited. When the 3rd pair of valvulae are present it usually ensheaths or surrounds the other 2 pairs of valvulae. [**Note:** Above terminology is from Snodgrass; Comstock uses a completely different terminology: valvifer 1 =

gonocoxa 1, valvifer 2 = gonocoxa 2, valvula 1 = **gonapophysis** 1, valvula 2 = gonapophysis 2, and valvula 3 = the **gonoplac**]

1st VLF + 1st VL = Anterior Gonapophysis = ventral = 8th segment

2nd VLF + 2nd VL = Posterior Gonapophysis = dorsal = 9th segment

2nd VLF + 3rd VL = Lateral Gonapophysis = sheath = 9th segment

- * The lateral gonapophysis is not a true gonapophysis - it is an extension of the coxopodite. It used to be thought that it was a derivation of the stylus, but it is not; the stylus has been lost, but it is still called the lateral gonapophysis.
- * The principal muscles of the ovipositor are inserted on the valvifers. The dorsal muscles of the 1st valvifer take their origin on the tergum of the 8th abdominal segment, those of the 2nd valvifer on the tergum of the 9th abdominal segment. So the 1st valvifer is associated with the 8th abdominal segment and the 2nd valvifer is associated with the 9th abdominal segment.
- * There is often in the grasshoppers a median process of the subgenital plate behind the genital opening called the **egg guide** (the subgenital plate is usually the 8th sternum).
- * In most of the Heteroptera the ovipositor is reduced or absent, but it is usually well developed in the Homoptera. The 8th abdominal sternum is reduced or practically obliterated in all Hemiptera, and the subgenital plate is the 7th sternum.
- * In the Hymenoptera the first gonocoxae (valifers 1) are absent, although they may be present in a few species, and the second gonapophyses are united. In the Symphyta and the parasitic groups the ovipositor retains its original function, but in the Aculeata it forms the **sting**. But even here the structure of the sting is basically the same as the ovipositor. The genital opening is now at the base of the sting. In the honey bee, the 1st gonapophysis is known as the **lancet**, and the fused second gonapophyses as the **stylet**. This forms an inverted trough which is enlarged into a basal bulb into which the reservoir of the poison gland discharges. **See overhead - fig. 208B - stylet, poison canal between the lancets.**

Male genitalia - the external male genitalia is primarily concerned with coupling with the female genitalia and the intromission of the sperm.

- * **Development of the external male genitalia** - In the primitive form, the male also had paired openings which have in more advanced forms become a single opening. In the primitive form there was a **primary phallic lobe** at each opening. Once the internal ducts had fused and the opening became single then the primary phallic lobes were situated on each side of the opening. The primary phallic lobes then divided into 2 parts forming an inner pair of **mesomeres** and an outer pair of **parameres** (together they are called **phallomeres**). The mesomeres united to form the **aedeagus** or intromittent organ. The inner wall of the aedeagus, which has become a continuation of the ejaculatory duct is called the **endophallus**, and the opening of the duct at the tip of the aedeagus is the **phallostreme**. The true gonopore is at the junction of the ejaculatory duct and the endophallus and as such is internal. In some insects the endophallic duct is eversible so that the gonopore assumes a terminal position in copulation. The parameres have evolved into claspers which can be quite variable in form. The parameres may be mounted with the aedeagus on a common base which is then called the **phallobase**. In many insects these primary structures are accompanied by secondary structures from segments 8, 9, or 10. [Note - Snodgrass uses the term phallus for both the parameres and the aedeagus together, but many authors use phallus for the aedeagus alone; sometimes the term penis is used instead of phallus].
- * No intromittent organ is present in the Collembola or Diplura. Archaeognatha and Thysanura have some structures similar to the females, sperm is not directly introduced into the females.

*** Phallic organs**

1. **genital chamber** (pocket) - may conceal external genitalia - invagination in body wall where phallus can be protected - usually a ventral invagination between segments 9 and 10.
2. **phallus** (penis) - organ of male on which the male gonopore is located - terminal portion of the ejaculatory duct. (1)
3. **aedeagus** distal part of phallus (tip). (2)
4. **ectophallus** - outer wall of aedeagus. (3)
5. **endophallus** - inner wall of aedeagus. (4)
6. **gonopore** - opening of ejaculatory duct. (5)
7. **phallotreme** - opening of aedeagus. (6)
8. **subgenital plate** (hypandrium) - protective covering which extends beneath genital chamber. In the male the 9th abdominal sternum is usually visible which forms the **hypandrium** which often appears to be subdivided into 2 sclerites which form a lid-like structure to protect the male's membranous internal genitalia when it is retracted into the abdomen.
9. **phallomeres** - accessory lobes at side of gonopore - in some insects these actually form phallus.

*** Periphallic organs** - most are on the 9th segment, some are on the 7th and 8th segments. These are accessory structures which can be classified by whether they are movable or immovable. These are often called **claspers**, and they may be derived from parameres, cerci, or paraprocts.

1. **Movable - harpagones** - occur in Ephemeroptera, Lepidoptera, Diptera, Hemiptera, and a few others (in most holometabolous insects). They are movable clasping hooks. They are called a number of different names depending upon what insect they are present in - eg. hamulus, parameres, etc.
2. **Immovable** - different accessory processes (a number of them) which are immovable extensions of the tergum and/or sternum.

*** Several insect orders still have primitively paired gonopores in the male - Protura, Ephemeroptera, and some Dermaptera:**

1. Protura - openings are between the 11th and 12th segments, and they have no accessory copulatory structures.
2. Ephemeroptera - openings are at base of 10th segment [remember that there are paired gonopores in the females also]
3. Dermaptera - gonopores are either single or paired, if single then are usually paired down to the between 9th and 10th sterna and then becomes single [remember female has single opening].

Other special cases

*** Some Diptera and others have the terminal end of the abdomen rotated through 180 degrees and some even are rotated through 360 degrees. [see overhead].**

*** Odonata** - males have secondary penis on second abdominal segment. Male transfers sperm from true genital area at posterior end to the secondary penis on the 2nd abdominal segment. He then catches the female by back of head with his posterior end and then moves female abdomen to secondary penis to transfer the sperm.