

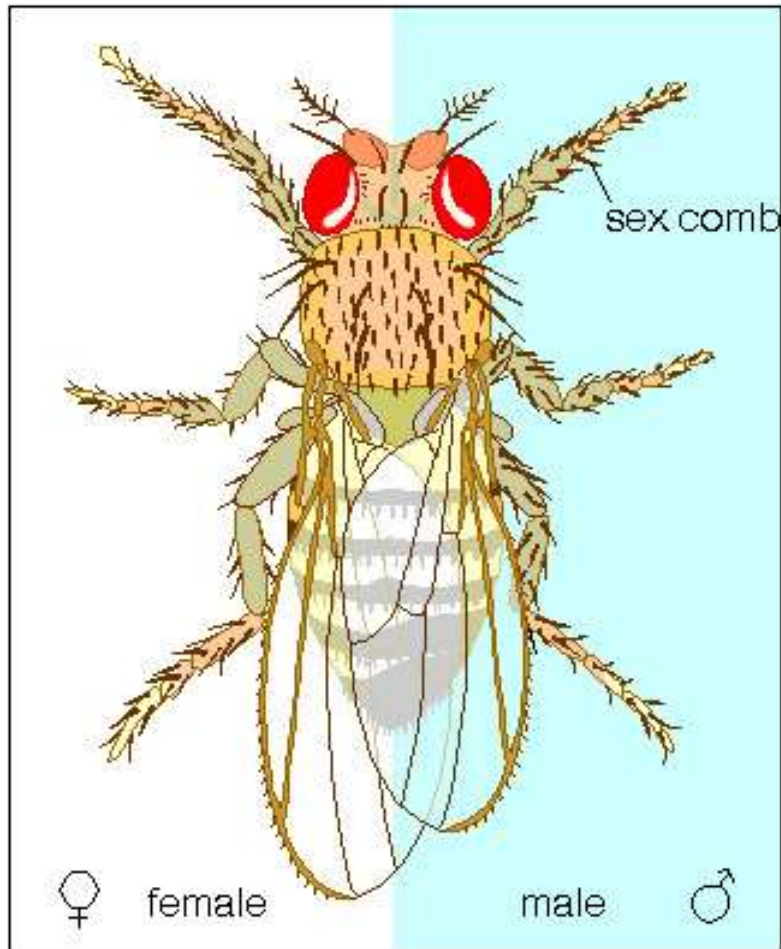


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ENTO 131 - Fundamentals of Entomology (3+1)

Reproductive system & Types of reproduction

Gynandromorph: (Sexual mosaic) Abnormal individual with secondary sexual characters of both male and female. e.g. mutant *Drosophila*.





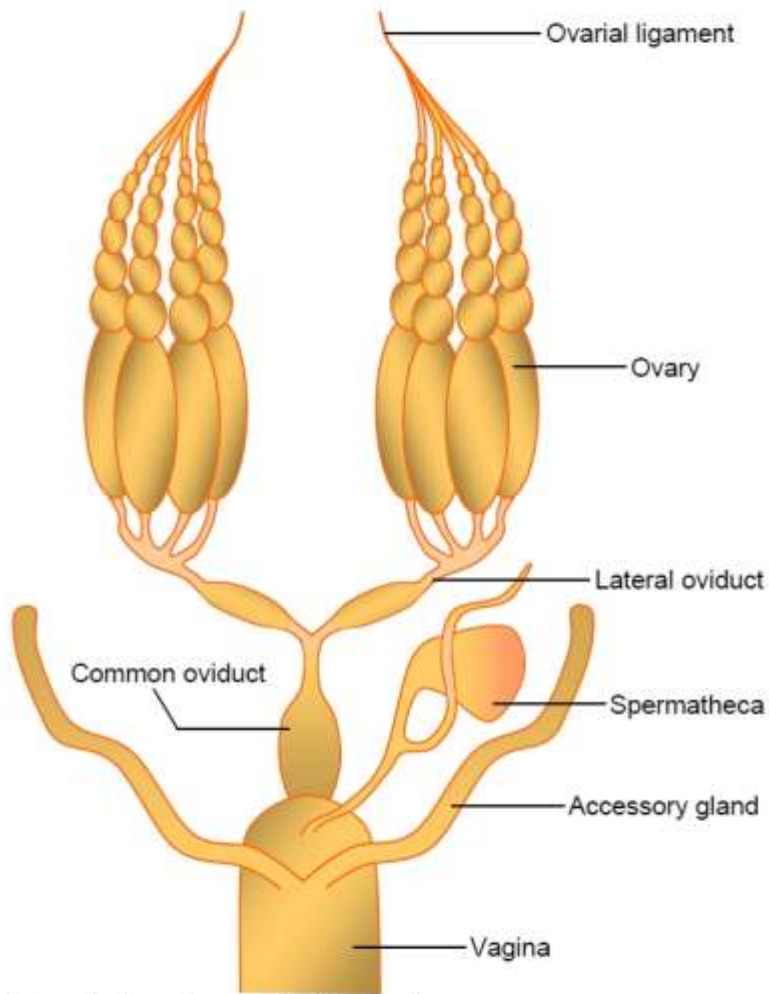


- **Hermaphrodite:** Male and female gonads are present in one organism. e.g. Cottony cushion scale.



Female reproductive system:

- The basic components of the female system are paired ovaries



Female insect reproductive system

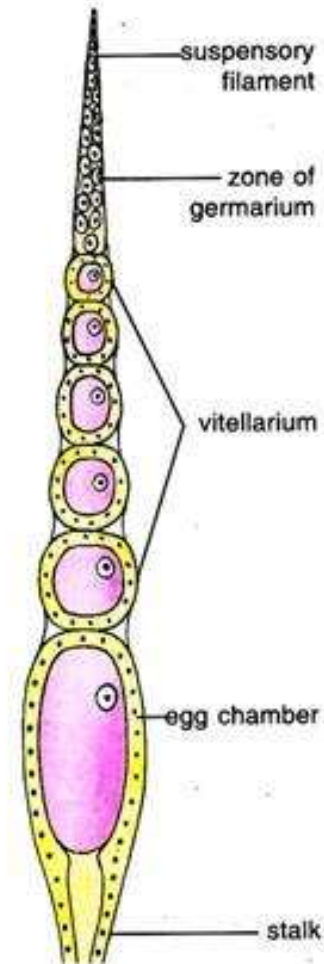
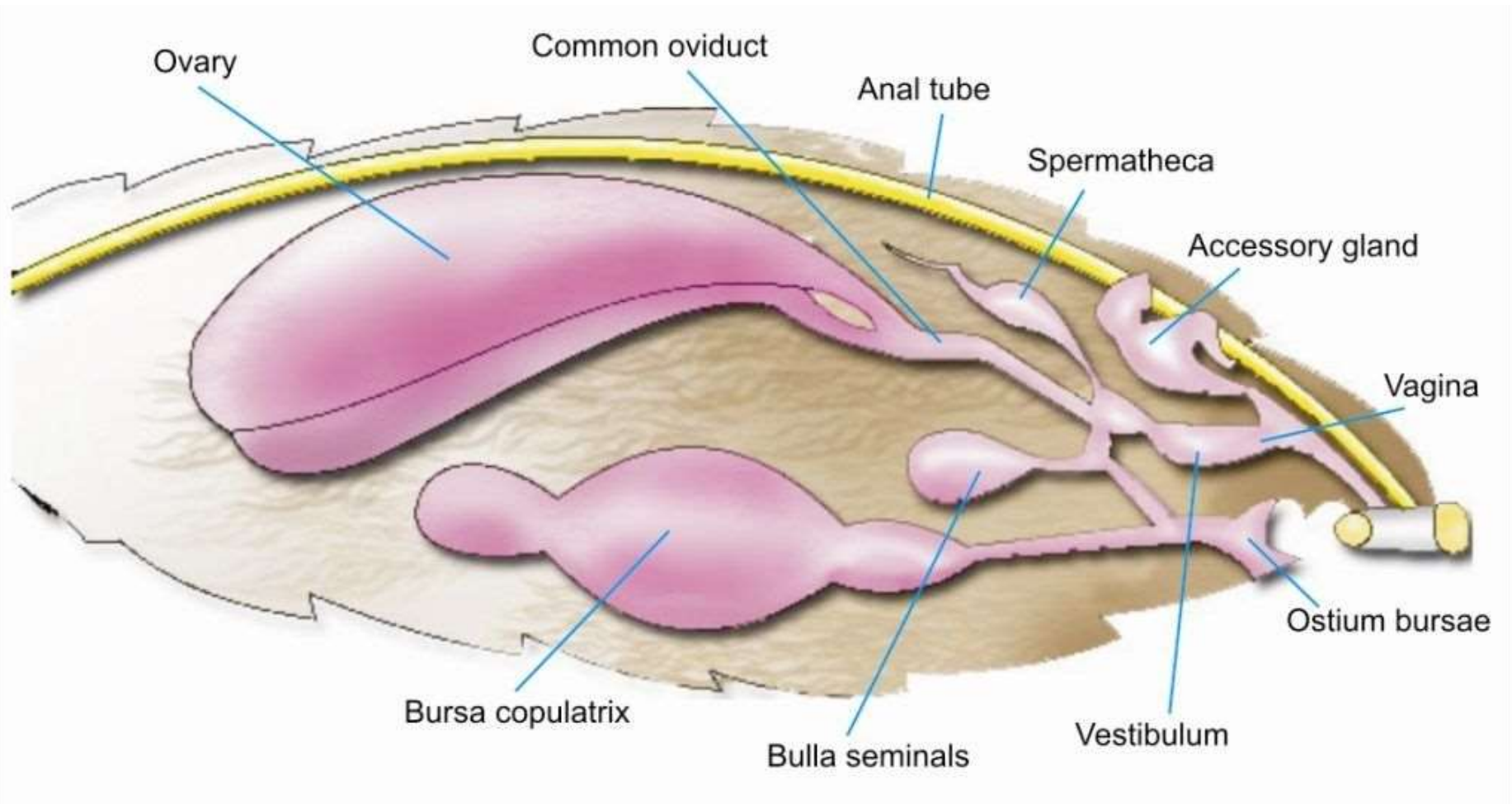


Fig. 73.36. *Periplaneta*. An ovariole in L.S.



- There are different types of ovarioles based on the presence or absence of specialized nutritive cells called trophocytes / nurse cells for nourishment of oocytes.

Paniostic ovariole: Lacks specialized nutritive cells so that it contains only a string of follicles, with the oocytes obtaining nutrients from the haemolymph via the follicular epithelium. e.g. Cockroach.

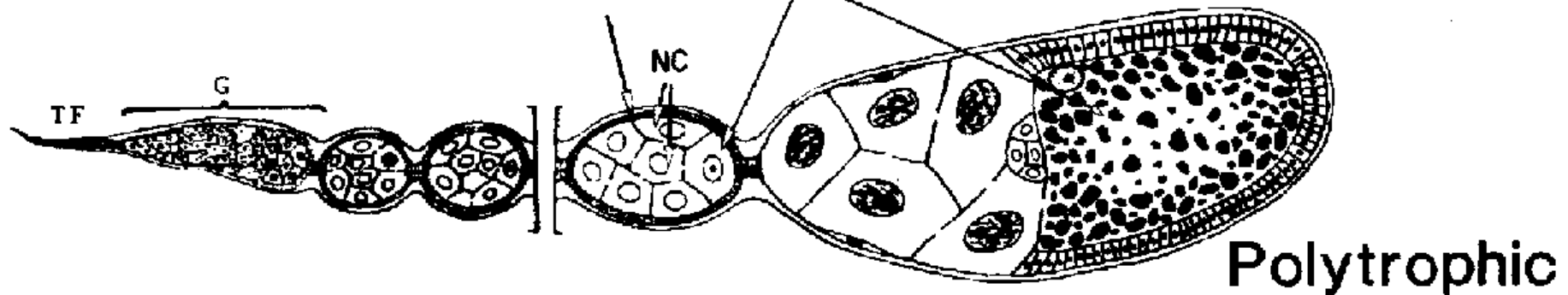
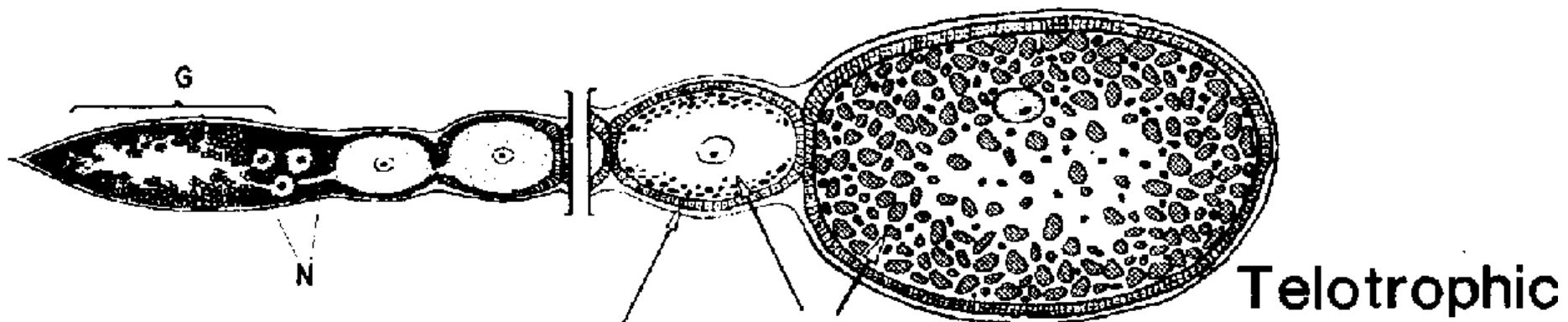
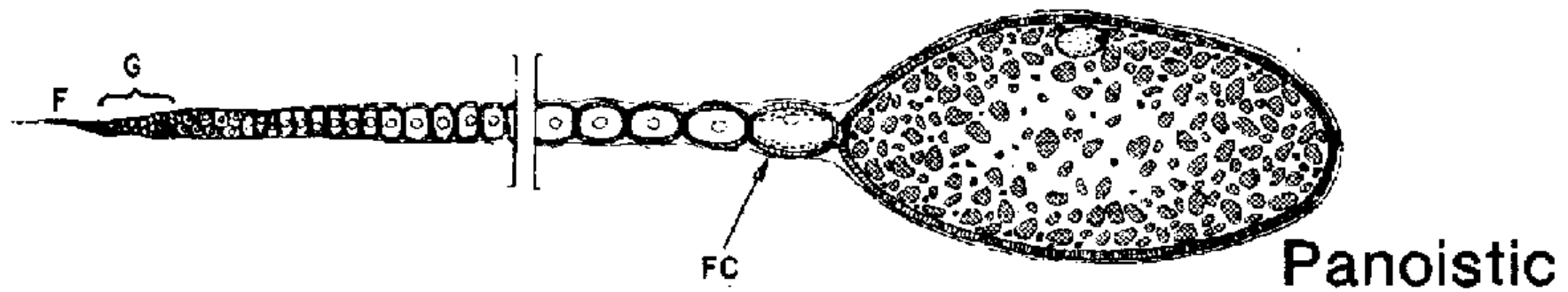
Telotrophic ovariole: (Acrotrophic) The trophocyte is present and its location is confined to the germarium and remain connected to the oocytes by cytoplasmic strands as the oocytes move down the ovariole. eg. bugs.

Polytrophic ovariole: A number of trophocytes are connected to each oocyte and trophocytes moves down along with the ovariole, providing nutrients until depleted. Thus individual oocytes are alternated with groups of smaller trophocytes in the ovarioles. e.g. moths and flies.

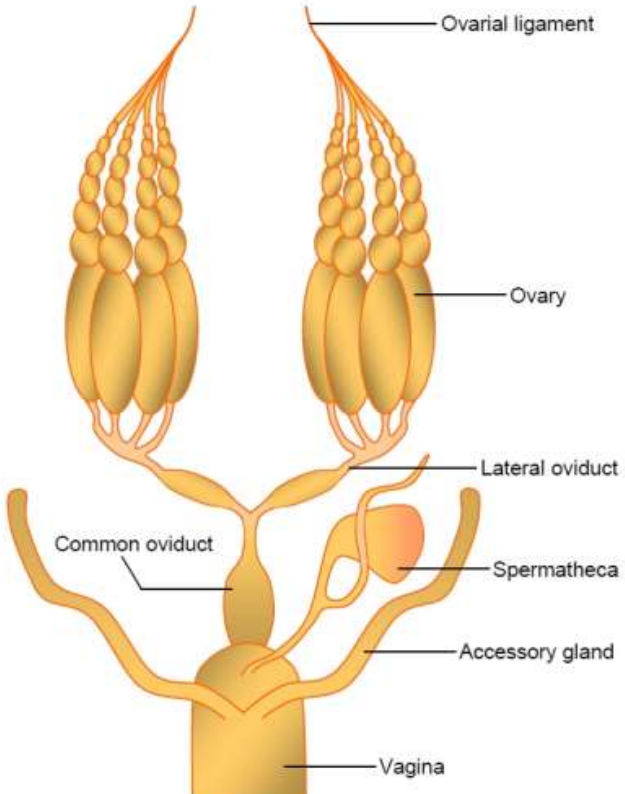
Maternal and Oocyte Polarity

Anterior ←

→ Posterior



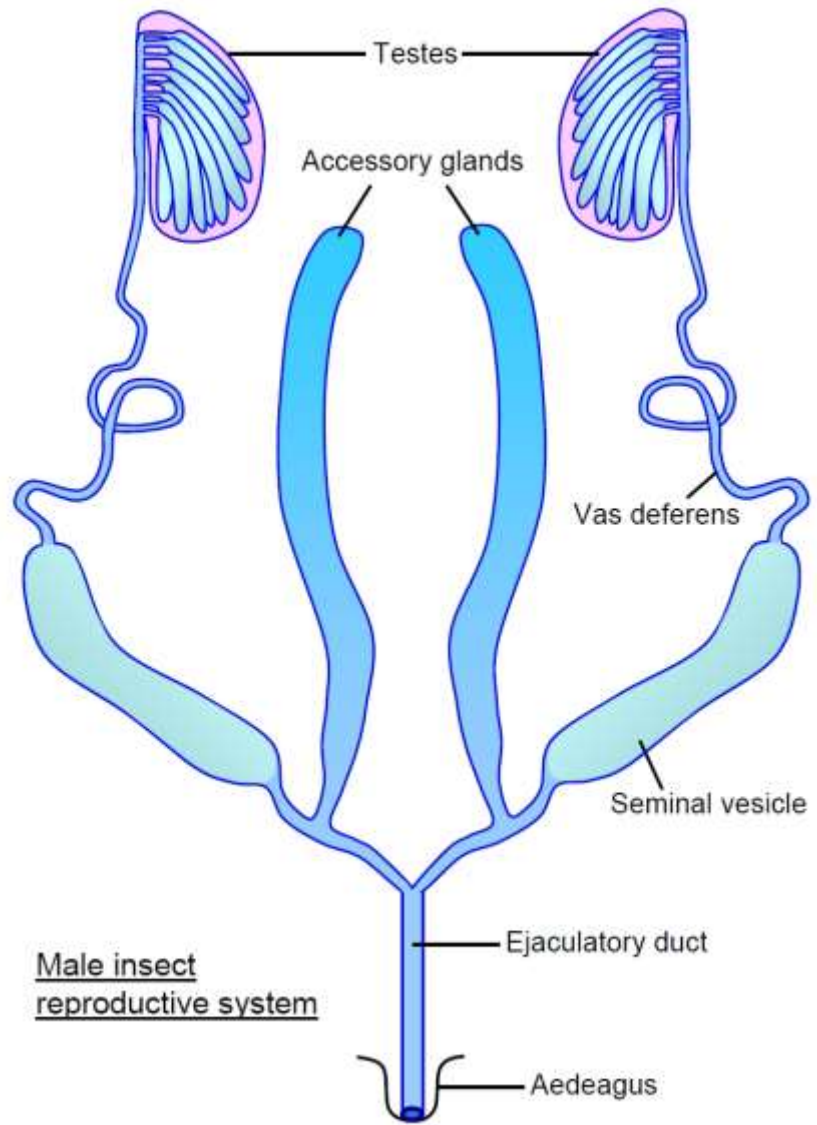
- Accessory glands of the female reproductive tract are often called as **colleterial or cement glands**, because their secretions surround and protect the eggs or cement them to the substrate. e.g. egg case production in mantis, ootheca formation in cockroach, venom production in bees.



Female insect reproductive system

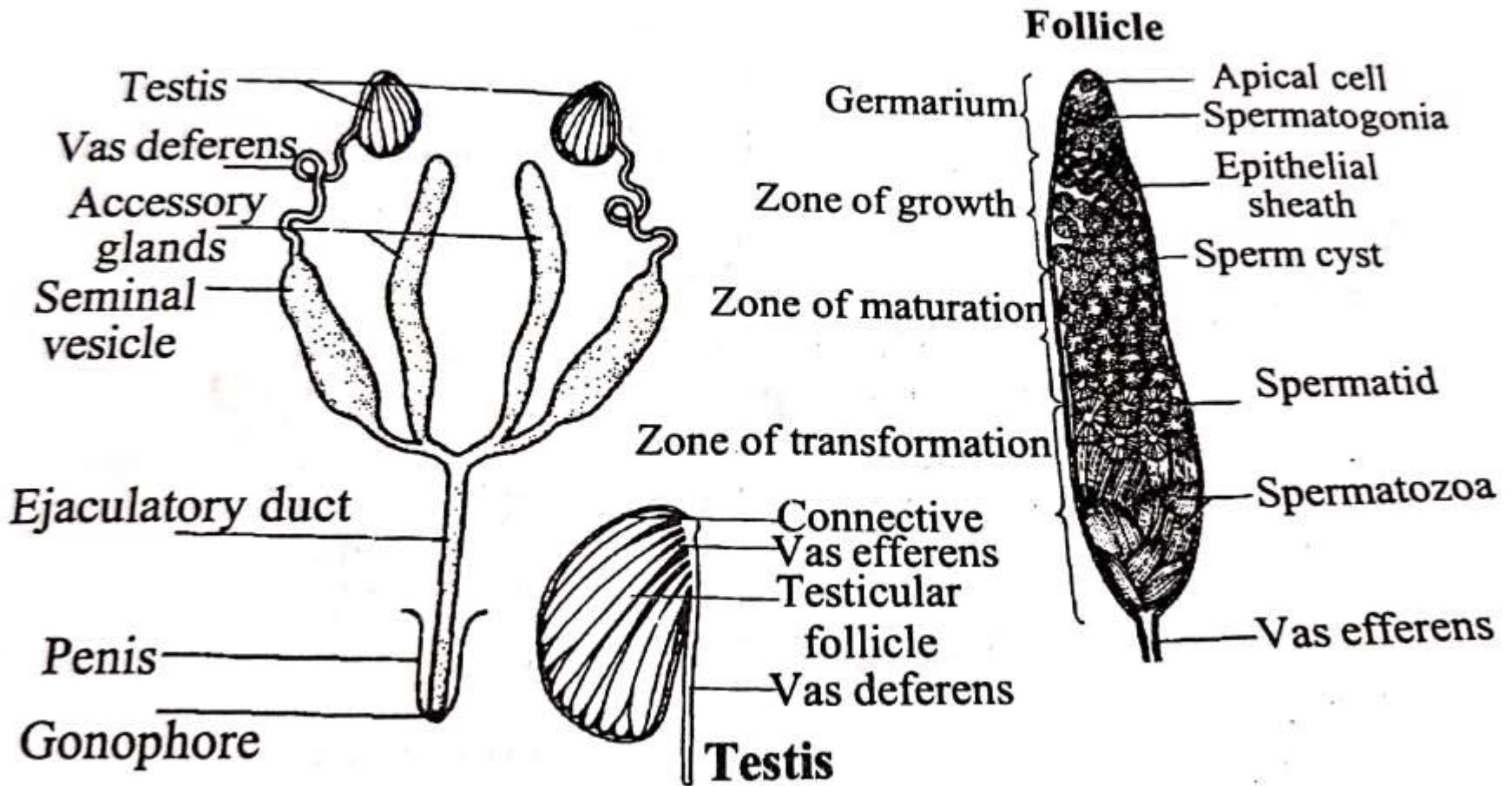


• Male reproductive system



Male insect reproductive system

spermatozoa swim from the seminal vesicle through the ejaculatory duct and reach the oviduct of the female.



Physiology of reproduction

Spermatogenesis (occurs inside sperm tube)	Oogenesis (occurs inside egg tube)
Spermatogonia	Oogonia
Mitosis	Mitosis
Primary Spermatocytes (2n)	Primary oocytes (2n)
Meiosis	Meiosis
Secondary Spermatocytes (n)	Secondary oocytes (n)
Mitosis	Mitosis
Spermatids (n)	Oocytes (n)
Spermiogenesis	Vitellogenesis
Sperms (n)	Ovum (n)

3. Sperm transfer:

- (i) **Intragenital:** Common method, through, aedeagus via vaginal orifice into female genital passage.
- (ii) **Haemocoelous:** Sperms transferred into the body cavity e.g. Bed bug.
- (iii) **External:** Spermatophores are ejected out into open place by male while female walk over it and gets inseminated e.g. Silver fish.

4. Fertilization: Sperm enter into egg to produce morphogenesis.

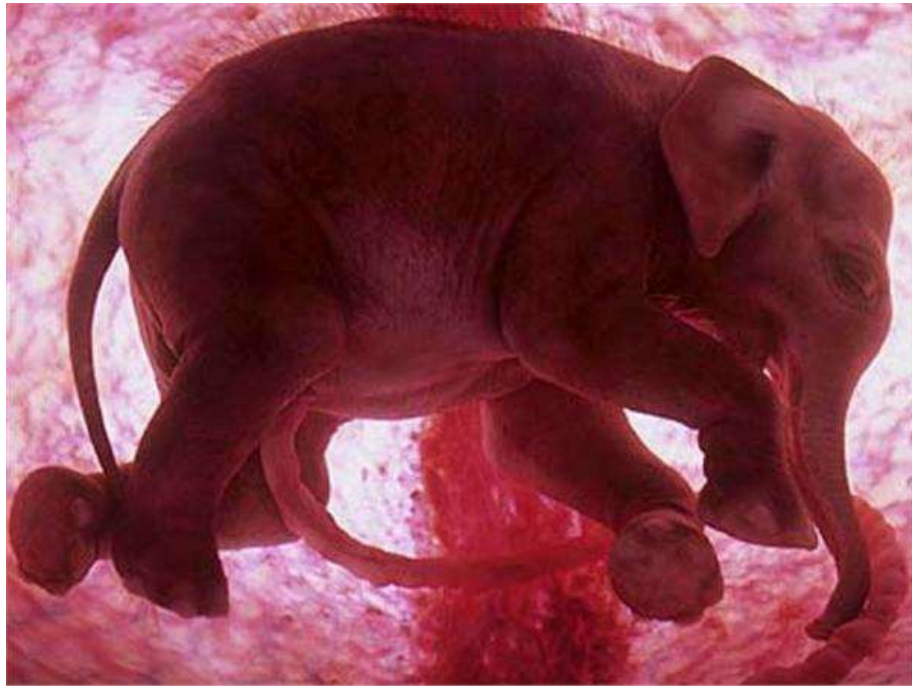
- Egg nucleus divides meiotically into female gamete nucleus and polar body. Then the fertilization occurs by the fusion of male and female gamete nuclei.

Types of Reproduction

1. Oviparity: Majority of female insects, are oviparous, lay eggs. Embryonic development occurs after oviposition by utilizing the yolk, e.g. Head louse, moths.



2. Viviparity: Unlike oviparous, here initiation of egg development takes place within the mother. The life cycle is shortened by retention of eggs and even developing young within the mother.



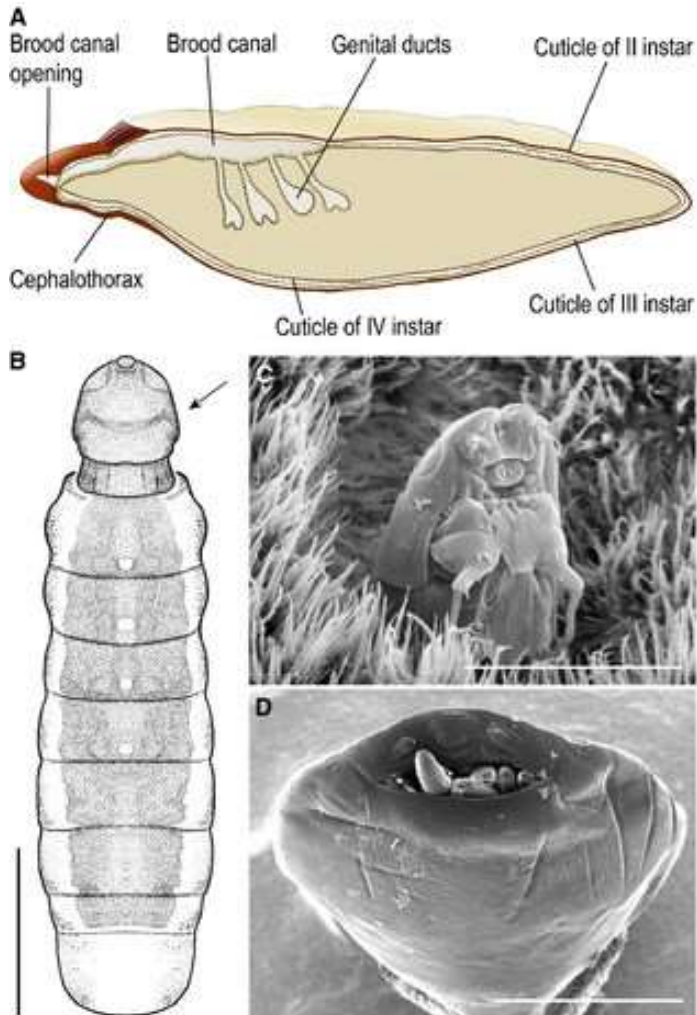
- Four main types of viviparity are observed in different insect groups.
 - Ovoviviparity:** Fertilized eggs containing yolk are incubated inside the reproductive tract of the female and hatching of egg occur just prior to or soon after oviposition e.g. cockroaches, few beetles, and flesh fly. Fecundity of this group is low. Thrips, some



ii. Pseudoplacental viviparity: This occurs when a yolk deficient egg develops in the genital tract of the female. The mother provides a special placenta-like tissue, through which nutrients are transferred to developing embryos. There is no oral feeding and larvae are laid upon hatching. e.g. aphids, some earwigs, psocids and polytenid bugs.

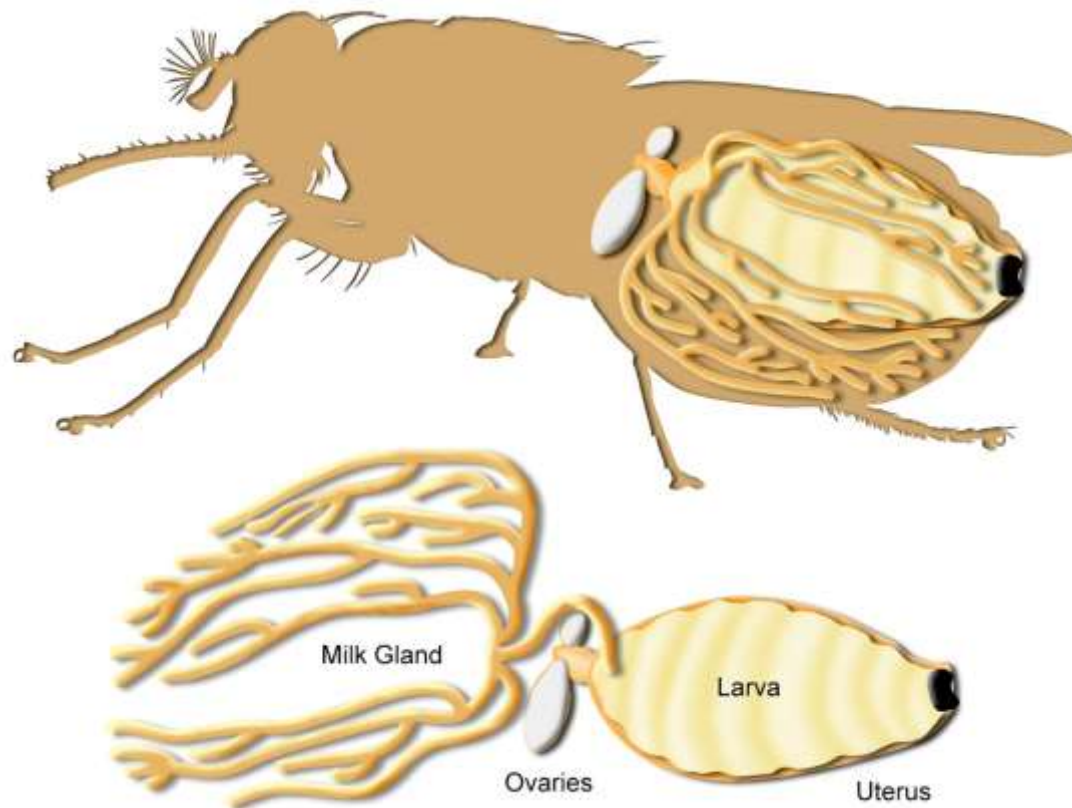


iii. Haemocoelous viviparity: This involves embryos developing free in the female's haemolymph with nutrients taken up by osmosis. This form of internal parasitism occurs only in sterpsiptera and some gall midges.



A, diagrammatic representation of neotenic female with brood canal and genital ducts (lateral view). B, neotenic female *Xenos vesparum*, cephalothorax (arrow) (ventral view). C, planidia larva emerging from genital duct of paternal female *Stichotrema dallatorreanum* [scanning electron micrograph (SEM)]. D, cephalothorax of female *Xenos vesparum* (SEM) with first-instar planidia larvae emerging from brood canal opening. Scale bars: (A, B) 1 mm; (C) 10 μm ; (D) 400 μm .

iv. Adenotrophic viviparity: This occurs when a poorly developed larva hatches and feeds orally from accessory gland (milk gland) secretion within the uterus of the mother. The full grown larva is deposited and pupates immediately (e.g.) Tsetse flies, louse, ked, bat flies.



3. Parthenogenesis: Reproduction without fertilization is parthenogenesis.

Different types of parthenogenesis are as follows:

a. Based on occurrence

i. **Facultative** (not compulsory) e.g. bee.

ii. **Obligatory or constant** (compulsory) e.g. stick insect

iii. **Cyclic/ sporadic:** alternation of gamic and agamic population. e.g. aphid.

Queen



© Alex Wild

Fertilized Egg
(Diploid)

Unfertilized Egg
(Haploid)

Female Offspring

Male Offspring



© Alex Wild

(Worker or Queen)

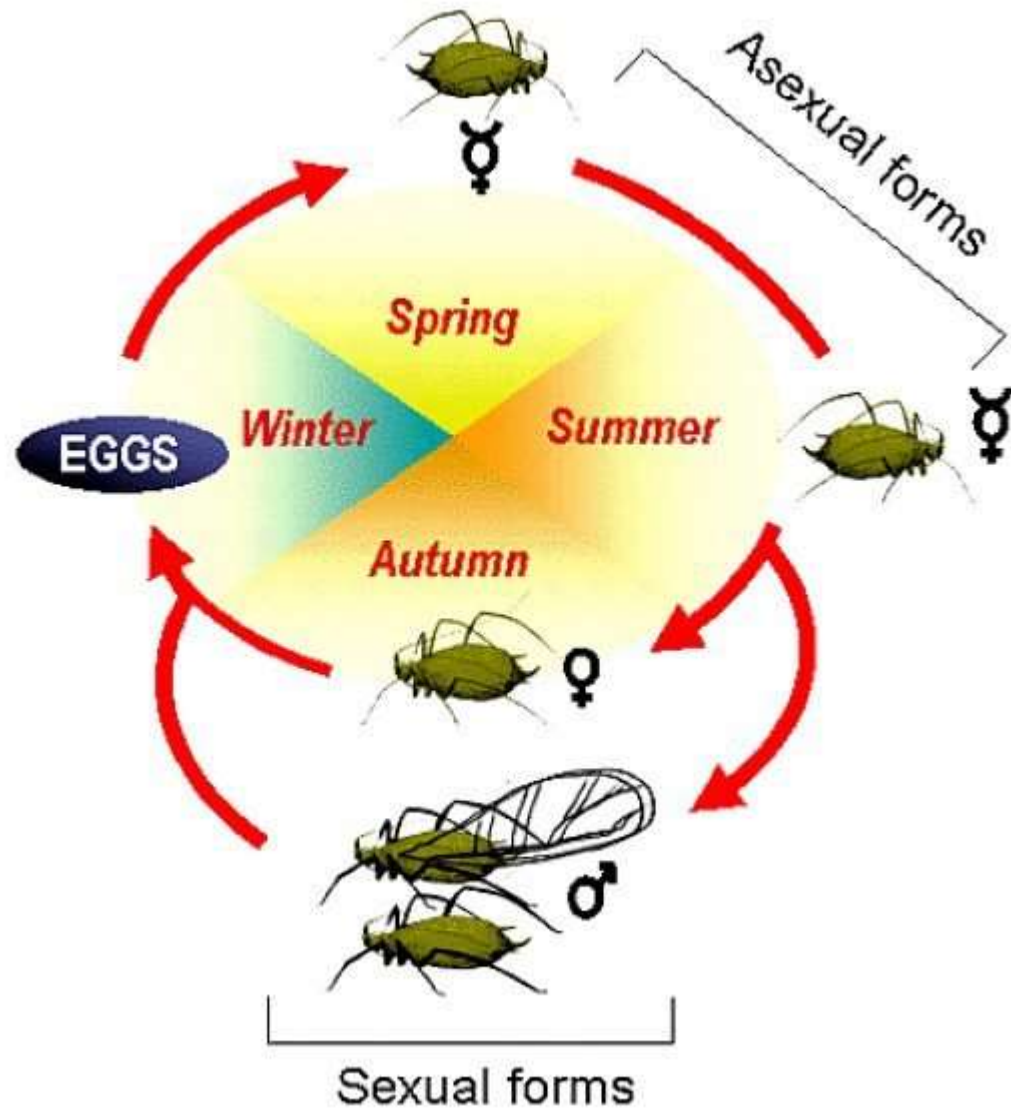


© Alex Wild

(Drone)



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b. Based on sex produced:

i. **Arrhenotoky:** Produce male e.g. bee

ii. **Thelytoky:** produce female e.g. aphids

iii. **Amphitoky / deuterotoky:** produce both male and female e.g.

Cynipid wasp.

4. **Polyembryony:** This form of asexual reproduction involves the production of two or more embryos from one egg by subdivision. Mostly observed in parasitic insects (e.g. *Platygaster*).

- Nutrition for a large number of developing embryo cannot be supplied by the original egg and is acquired from the host's haemolymph through a specialized enveloping membrane called **trophamnion**.



5. Paedogenesis: Some insects cut short their life cycles by loss of adult and pupal stages. In this precocious stage gonads develop and give birth to young one by parthenogenesis ie. reproduction by immature insects.

i. Larval paedogenesis - e.g. Gall midges

ii. Pupal paedogenesis – eg. *Miaster* sp.

