"Department of biology"

General entomology

Second year class

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Phylum Arthropoda

General characteristics

1- **Bilateral symmetry , metameric body , tagmata of head and trunk , head, thorax and abdomen or cephalothorax and abdomen .**
2- **Appendages jointed , primitively , one pair to each somite (metamere) , but number often reduced , appendages often modified for specialized functions.**
3- **Exoskeleton is of cuticle containing proto lipid chitin and often calcium carbonate secreted by underlying epidermis and shed (molted) at intervals .**
4- **Muscular system complex with exoskeleton for attachment , striated muscle for organs no cilia .**
5- **Coelom reduced ,most of body cavity consisting of haemocoel (sinuses or spaces in the tissues) filled with blood .**
6- **Complete digestive system , mouthparts modefied from appendage and adapled for di methods of feeding .**
7- **Circulatory system open , with dorsal contractile heart , arteries , of haemocoel .**
8- **Respiration by body surface , gills , trachea (air tubes) or book lungs .**
9- **Paired excretory glands called coxal , antennal , or maxillary glands presents in some, homologous to metameric nephridial system of annelids , some with other excretory organs .**

10-Nervous system with dorsal brain connected by a ring around the gullet to a double nerve chain of ventral ganglia, fusion of ganglia in some species , well – developed sensory organs.

11- Sexes usually seperate , with paired reproductive organs and ducts , usually internal fertilization , oviparous or ovoviviparous, often with metamorphosis , parthenogenesis in few forms ; growth with ecdysis

Entomology : means the study of insects .

Insectsa : is a class of the phylum Arthropoda .

Tagmata :- **A compound body section of an arthropod resulting from embryonic fusion of two or more segments for example head , thorax , abdomen .**

Chitin :- **A horny substance that forms part of the cuticle of arthropods**

A nitrogenous polysaccharide insoluble in water , alcohol dilute acids and digestive juices of most animals.

Haemocole :- **Main body cavity of arthropods ; may be subdivided into sinuses through which the blood flow.**

Oviparity :- **Reproduction in which eggs are releases by the female , development of offspring occure outside the maternal body .**

Ovoviviparity :- **Reproduction in which eggs developed within the maternal body without additional nourishment from the parent and hatch within the parent or immediately after lying .**

Parthenogenesis :- **unisexual reproduction involving the production of young by females not fertilized by males .**

Metamorphosis :- **sharp changes in form during postembryonic development .**

*** Ecdysis : shechding of outer cuticular layer (moulting) as an insect or Crustacea .**

Although all types :-

1- Carnivorous .
2- Omnivorous .
3- Symbiotic.

The majority are herbivorous

*** Most aquatic arthropods depend on algae for their nourishment**
*** the majority of land from live chiefly on plants .**

"Why have arthropods achieved such great diversity and abundance ?"

The arthropods have achieved a great diversity , number of species , wide distribution , variety of habitats and feeding habitats , and power of adaptation to changing conditions .

Characters of the main classes of phylum Arthropoda

	Class Onychophora	Class Crustacea	Class Arachnida	Class Myriapoda Chilopoda DiploPoda		Class Insecta
Body regions	**Un recognized head (one region)**	**2-regions cephalo thorax and abdomen**	**2-regions cephalo thorax and abdomen**	**Head and long trunk**	**3 regions not clear recognized**	**3 regions Head thorax and abdomen**
antenna	**One pair**	**2 pairs**	**No antenna**	**One pair**	**One pair**	**One pair**
legs	**One pair on each segment**	**4 pairs at least ,for walking on cephalo thorax**	**4 pairs on cephalo thorax**	**One pair on each segmen t**	**Two pairs on each segment**	**3pairs on thorax segments**
wings	**No wings**	**No wings**	**No wings**	**No wings**		**Usually 2 pairs on thorax**
respiration	**Trachea**	**Gills**	**Trachea**	**Trachea**		**Trachea**
Excretion	**Nephridea**	**Green gland**	**Malpighian tubules, green gland or both**	**Malpighian tubules**		**Malpighian tubules**
cample	**Peripatus**	**Astacus**	**Scorpion**	**Millipede**	**centipep a**	**grasshopper**

"Class Insecta"

The body is divided into 3 regions :-

1- Head :- composed of six segments (confused) and bears
- **a- Ocelli (2-3)**
- **b- One pair of compound eyes.**
- **c- Mouth parts (mandibles – maxilla) and babium.**
- **d- One pair of antenna.**

2- Thorax : with three segments bearing the following appendages :
- **a- The first segment (prothorax) : bears first pair of legs.**

  The second segment (mesothorax) : bears the second pair of legs + ist pair of wings .
- **b- The third segments (metathorax) bears the third pair of legs and the second pair of wings usually .**

3- Abdomen: composed of 11 segment , without appendages except the reproductive appendages.

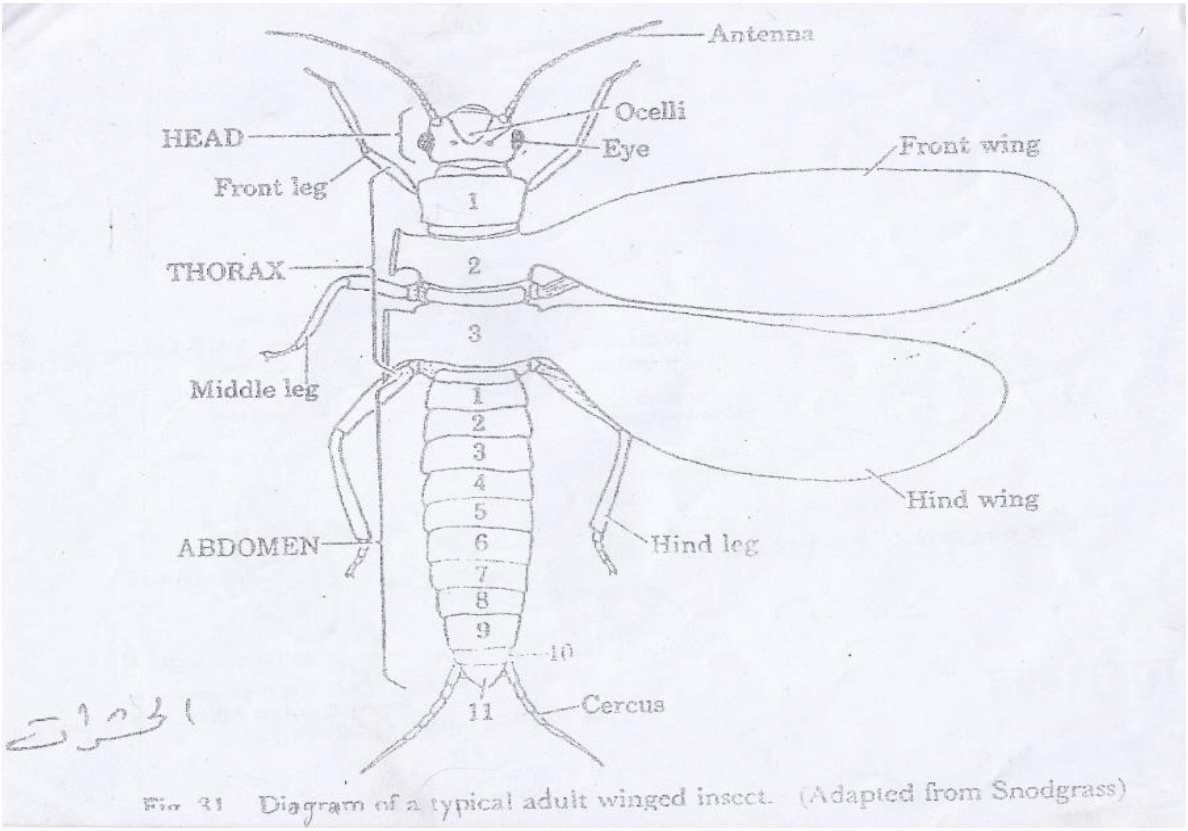


Fig. 31 Diagram of a typical adult winged insect. (Adapted from Snodgrass)

Why insect are so successful ?

Insects are incredibly successful group, about 90 % of all species are insects, about million species of insects are described, but the total number of species is estimated between 2.5 – 10 million.

Why insect are so successful on earth?

1- **Small size.**
2- **Having wings.**
3- **Adaptability.**
4- **The exoskeleton.**
5- **Complete metamorphosis.**
6- **High fecundity.**
7- **Short life cycle.**
8- **Persistence.**
9- **Mimicry.**

The advantages of the insects:

1- **Pollination of the flowers.**
2- **Production of slik , honey ….**
3- **Production of coloring material from scales of some insects used for coloring food .**
4- **Decomposing of organs material.**
5- **Recycling of carbon, nitrogen and other essential nutrients.**
6- **Using them in the biological control.**
7- **Using some of them as food for human.**
8- **Using some of them in biological research.**

The disadvantages of the insects:

1- **For plants :**
   a- **Sucking plants juices .**
   b- **Burrowing the leaves , stems and the roots .**
   c- **Chewing the leave .**
   d- **Making galls on some plants .**
2- **Transmitting of diseases to the human and his domestic animals.**
3- **Damaging the human possessing .**

"Insects morphology"

The exoskeleton : is of cuticle .

The body wall is composed of :

1- **Single layer of cells .**
2- **Supported on a non – cellular basement membrane . out side of these cells lies the cuticle which contain protein – lipid chitin and often calcium carbonate secreted by the under lying epidermis and shed (molted) at intervals . The cuticle may be soft and pliable but usually it is sclerotized or hardened in definite areas forming plate like structure called (sclerites)the lines or the narrow areas separating the sclerites are called sutures .**

The cuticle composed of :-

1- **Thin layer epicuticle , impermeable and non chitinous.**
2- **Exocuticle.**
3- **Endocuticle.**

Apodem **: an invagination of body wall to provide areas for attachment .**

On the body wall are found small spicules, hairs , spines , scales and setae .
The body wall associated with nerve ending and have a sensory functions , in addition there are many glands .

The functions of the body wall :-

1- **It proved physical protection for internal organs .**
2- **Reduces water loss .**
3- **For muscular attachment .**
4- **It prevent entry of foreign materials , both living and non- living into an insect .**
5- **The color of insect is also a function of the cuticular components.**

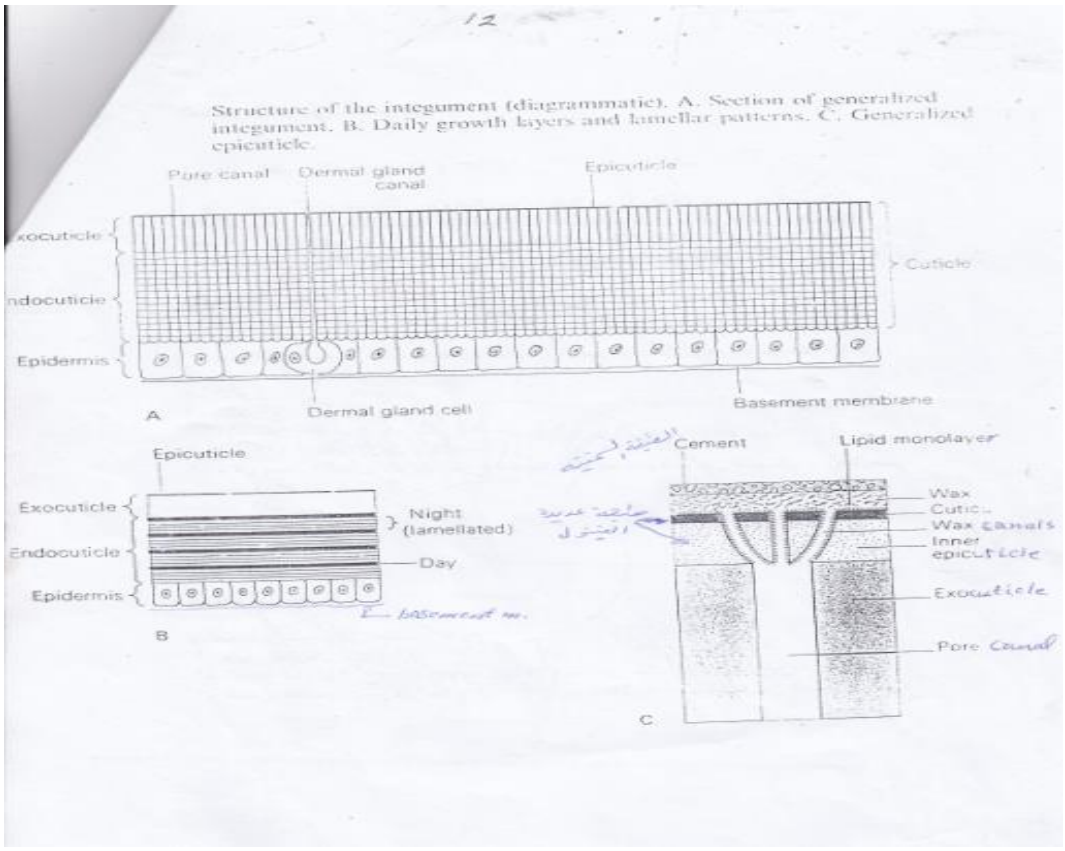
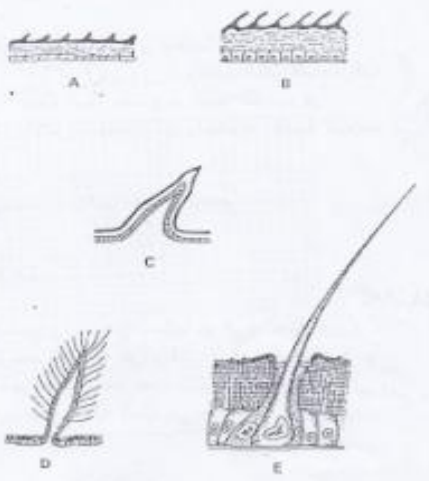


FIGURE 5-3. Some of the more common types of cuticular protuberances of insects. A. and B. Noncellular surface configurations such as ridges and spurs, C., D. and E. Cellular processes such as setae and multicellular spines. (Adapted from Snodgrass, 1935.)



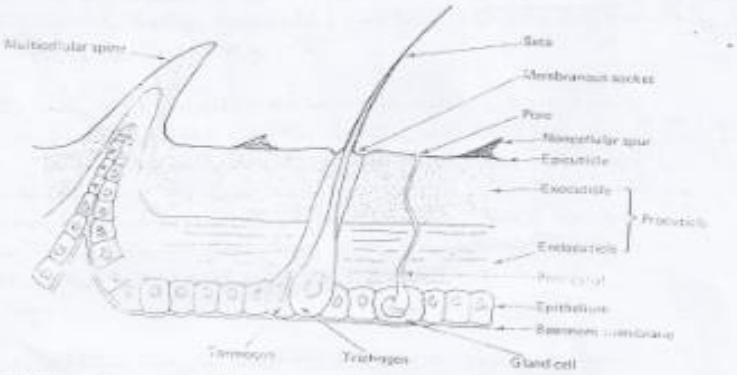


FIGURE 5-1. A diagrammatic cross section of the integument of an adult insect.