Insect Morphology

Lecture 1

Why Study Morphology ?

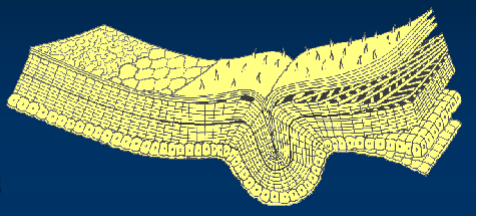
- An understanding of the external structure of the insect is necessary…

  - to allow the identification of insects and other arthropods

  - to understand their biology and control

Exoskeleton

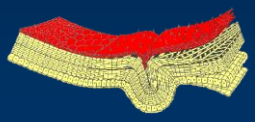
- Outer layer or “skin”



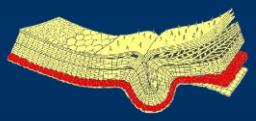
- Functions:
  - Protection of soft parts
  - Muscle attachment
  - Support
  - Site for sensory organs
  - Helps prevent desiccation
  - Reduces pathogen entry

Components of the Exoskeleton

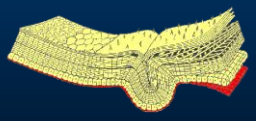
- Cuticle
  - non-living



- Epidermis
  - living
  - secretes the cuticle



- Basement membrane
  - non-living
  - function not known



Cuticle

- **Key contributor to the success of insects**
  - **barrier between living tissue/environment**
  - **restriction of water loss**
  - **abrasion protection**

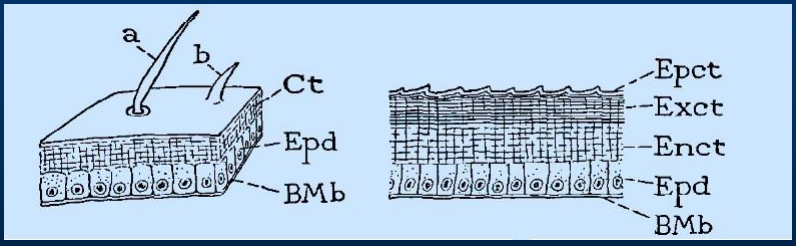


Fig: Structure of body wall. A, piece of body wall bearing a movable seta (a) and immovable process (b).Ct: cuticula; Epd: epidermis; Bmb: basement membrane. B, vertical section of body wall, Epct: epicuticula; Exct: exocuticula; Enct: endocuticula.

Sclerotization

- **The most important feature of insects' body wall is its ability to produce definitely limited sclerotic areas in the cuticula.**
- **It mainly served for protection.**
- **the presence of integumental plates having the muscles attached on the body wall gave the possibility of a new mechanism of movement and locomotion.**

Sclerotization

Sutures:

- **The terms suture comes from the latin word *suere*, is to sew.**
- **It is a narrow space separating sclerotic areas of the cuticula**

Four distinct varieties of sutures:

1. **External grooves of linear inflections of the cuticula that form internal plates to strengthen the skeletal walls to increase surfaces for muscle attachments.**
2. Lines where the Sclerotization of cuticula has become secondarily discontinuous in order to give flexibility.
3. Lines where Sclerotization has never taken place.
4. True sutures or lines of union between originally distinct sclerites.

The majority of insects sutures belong to the first category.

Sclerotization

Apodemes:

- **Any internal cuticular process of the body wall is apodeme.**

Types of apodemes:

1. **An inflection of cuticula (A, B& C).**
2. **solid cuticular ingrowth (D & E).**

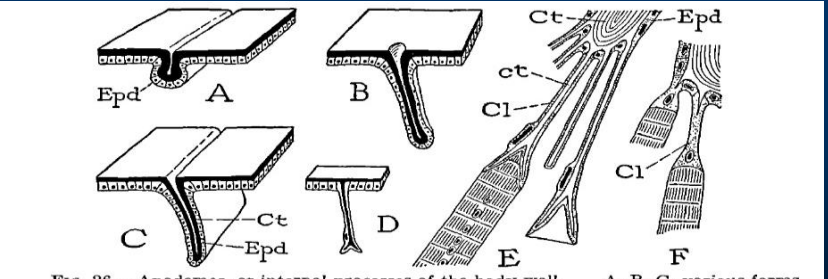


FIG. 26.—Apodemes, or internal processes of the body wall. A, B, C, various forms of multicellular apodemes, diagrammatic. D, a unicellular apodeme. E, unicellular muscle "tendons" at the end of a multicellular apodeme. F, formative stage of the same. (E, F *from Janet*, 1907.)

Articulations

- **Where there is a line of movement in the body wall.**
- **The flexible area or joints is the nonsclerotized cuticula between two adjacent regions of Sclerotization. (fig, A)**
- **The movements possible at the joints will depend on the extent of the articular membrane.**
- **if the articular membrane is wide and completely separates the sclerotic parts, as between the segments of the abdomen, (fig, B) the movement is unrestricted.**

Articulations

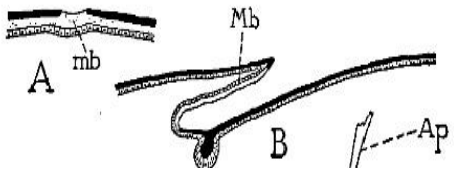
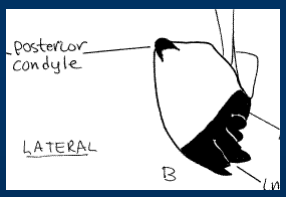


FIG. 27.—Sutures, joints, and articulations, diagrammatic. A, section through a simple membranous "suture." B, a conjunctival membrane (*Mb*) between two body

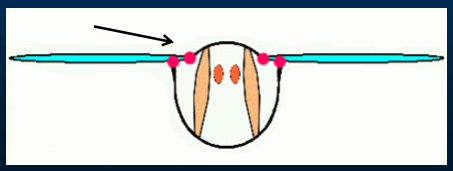
Articulations

According to whether an articulated joint has one pair or two pairs of articulating surfaces it is said to be:

- **Monocondylic (joint have a partial rotary movement) – antennae and mandibles**



- **Dicondylic (joint is restricted to hinge movement).Wings**



Articulations

Articulations are of two types of structure:

- **Intrinsic articulation:**

Points making contact are sclerotic prolongations within the articular membrane (The articulations of the legs with the body or between leg segments "the pleuro- coxal articulations". (Fig , C, e& f).

- **extrinsic articulation:**

The articulating surfaces are areas of contact on the outside of skeletal parts
(are usually of the ball and socket type and found in the articulation of mouth appendages with the wall of the cranium. (Fig 3, D, a & c),

Articulations

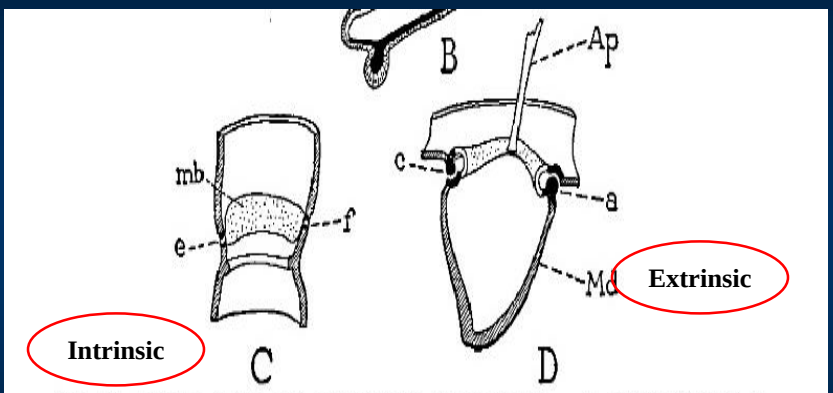
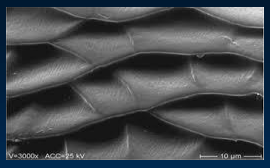


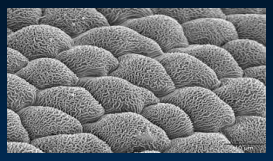
FIG. 27.—Sutures, joints, and articulations, diagrammatic. A, section through a simple membranous "suture." B, a conjunctival membrane (*Mb*) between two body segments. C, a dicondylic leg joint with intrinsic articulations (*e*, *f*). D, the typical extrinsic dicondylic articulation of the mandible with the cranium.

External processes of the body wall

- The outer surface of the cuticula is rare smooth or bare.
- It presents a great variety of microscopic roughening in the form of points, pits, ridges, and sculptured designs, and it is covered with larger outgrowths that take the shape of spicules, spines, hairs, and scales.

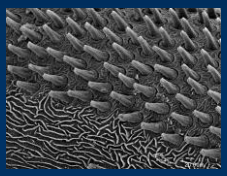


pits



ridges

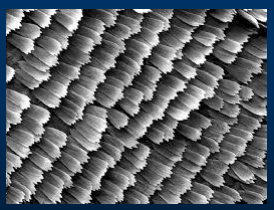
points



spicules

hairs

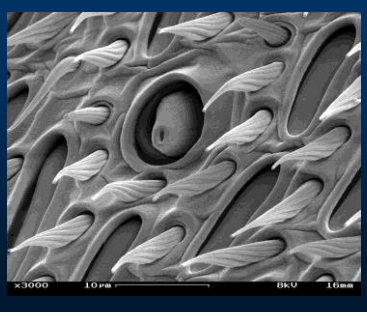
spines



scales

External processes of the body wall

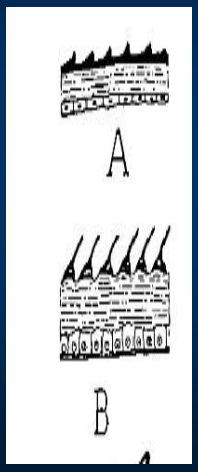
External processes of the body wall may be classed in **two groups** according to whether the epidermal cells take a direct part in their production or do not:



External processes of the body wall

Noncellular process:

- They have the form of minute points or nodules (spicules, small spines, hairs).
- cytoplasmic processes of the epidermis when the outer layers of the cuticula are being generated and become solid. (Fig A & B).



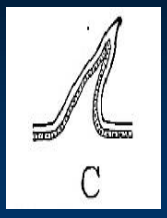
External processes of the body wall

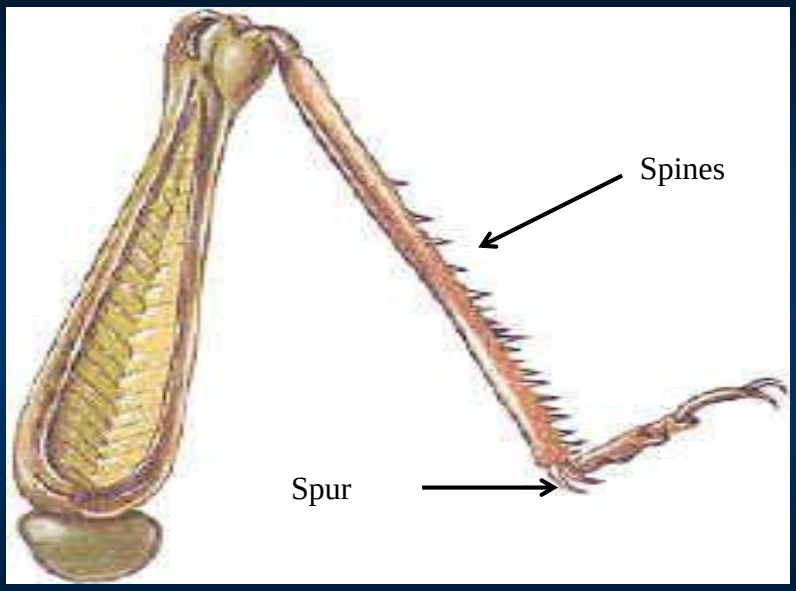
Cellular process:

- **Multicellular process:**

1. hollow outgrowths of the entire body wall and are lined by a layer of epidermal cells.(C)
2. large and spine-like, and they are strongly fixed to the surrounding cuticula, but some are set in membranous ring and are movable (D).

Movable structure (spurs) , Immovable (spines)





External processes of the body wall

Unicellular process:

The typical outgrowths of the body wall in this class are the hairlike processes, termed **setae**, which constitute the principal body covering of most insects.