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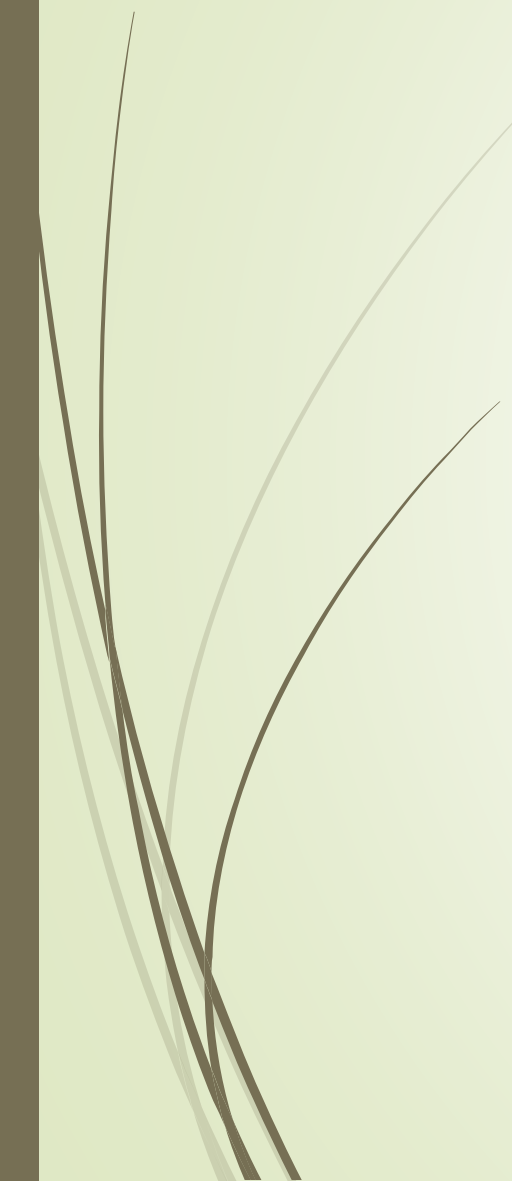
- COURSE TITLE : RESPIRATION IN COCKROACH
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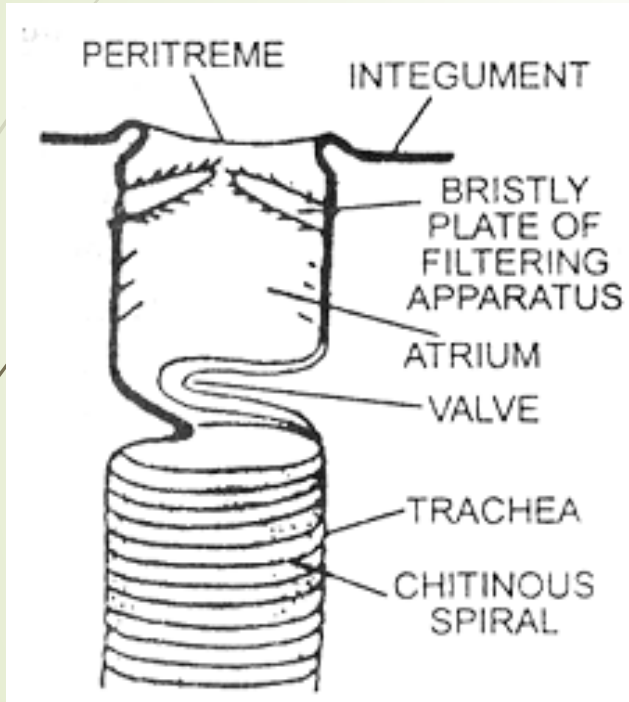
RESPIRATION IN COCKROACH



RESPIRATORY SYSTEM

- In cockroach respiratory system is well developed.
 - The trachea play a vital role in the transport of respiratory gases hence respiratory system is also called tracheal system.
 - The tracheal system includes
 - a) Stigmata or spiracles
 - b) Trachea
 - c) Tracheoles
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STIGMATA OR SPIRACLES



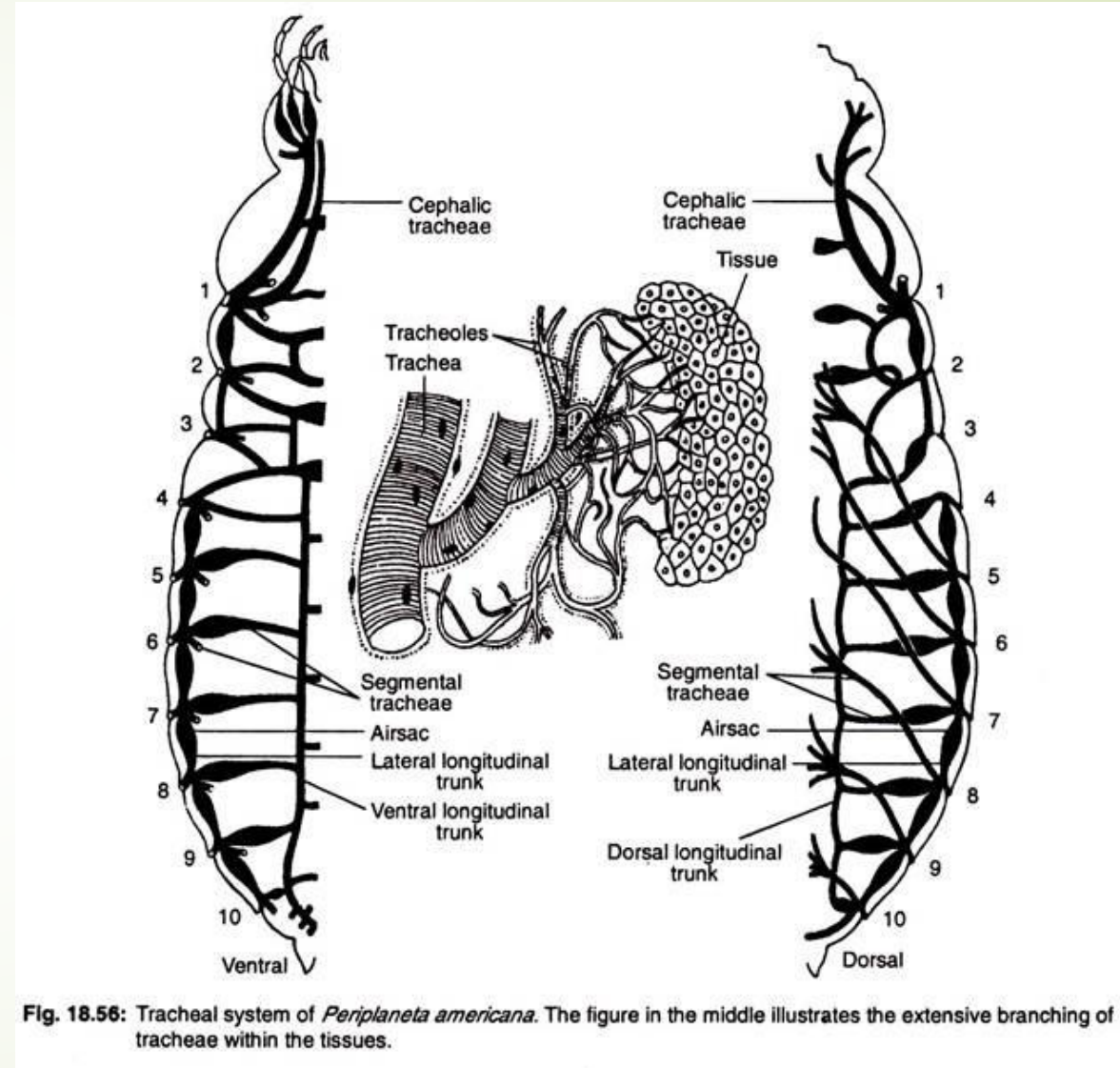
- External openings of the tracheal system.
- Lateral in position
- Only one pair of spiracle on a segment.
- Slit like aperture in an oval sclerotic area guarded by bristles
- Bordered by **peritreme**
- Closed and opened by valves regulated by **spiracular muscle**.
- Stigmata leads into small chamber called atrium.
- Atrium leads into trachea.

CLASSIFICATION OF INSECT RESPIRATORY SYSTEM

- **Keilin(1944)** classified respiratory system on the basis of the number and distribution of spiracles:
- 1. **Polypneustic**: At least 10 pairs of functional spiracles.
 - a. **Holopneustic**: 2 thoracic + 8 abdominal
 - b. **Peripneustic**: 1 mesothoracic + 8 abdominal
 - c. **Hemipneustic**: 1 mesothoracic + 7 abdominal
- 2. **Oligopneustic**: 1 or 2 pairs of functional spiracles.
 - a. **Amphineustic**: 1 mesothoracic + 1 post abdominal
 - b. **Metapneustic**: 1 post abdominal
 - c. **Propneustic**: 1 mesothoracic
- 3. **Apneustic**: no functional spiracle

Arrangement of spiracles in cockroach

- ▶ The arrangement of stigmata in cockroach is **holopneustic**.
- ▶ They are 10 pairs in number. Among the stigmata **2 pairs** are present in thoracic region and **8 pairs** in the abdominal region.
- ▶ In cockroach stigmata are absent in **prothorax, 9th and 10th** abdominal fragments.





TRACHEA

- Large tubes running inwards from the spiracles usually breaking up into finer branches.
- Formed by the invagination of the ectoderm and forms a network throughout the body
- The **thoracic spiracles** lead into several **horizontal trachea**.
- Each **abdominal spiracle** leads into **atria**.
- From each abdominal spiracle 3 tracheal tubes arise.
- All these tracheal tubes of one side open into three separate longitudinal tracheal trunks.

TRACHEAL TRUNKS

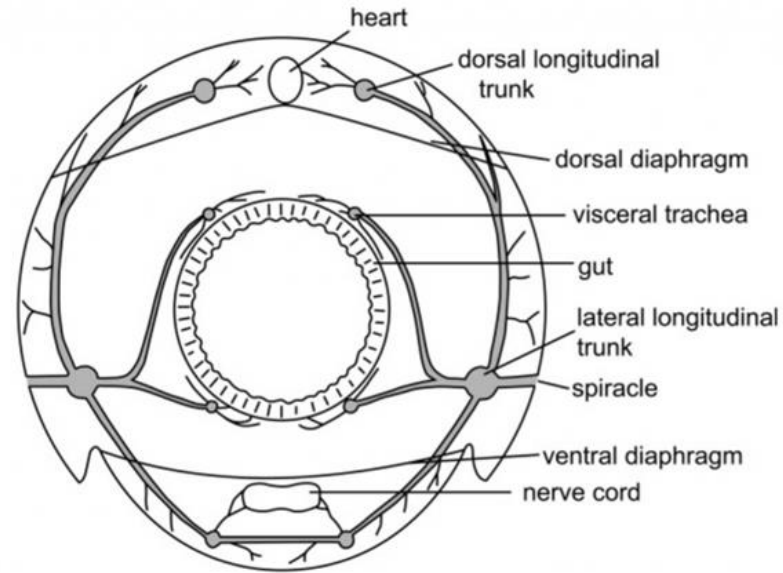


Fig. 2.19. Diagram showing cross-section of an insect's abdomen showing the principal elements of the ventilatory system.

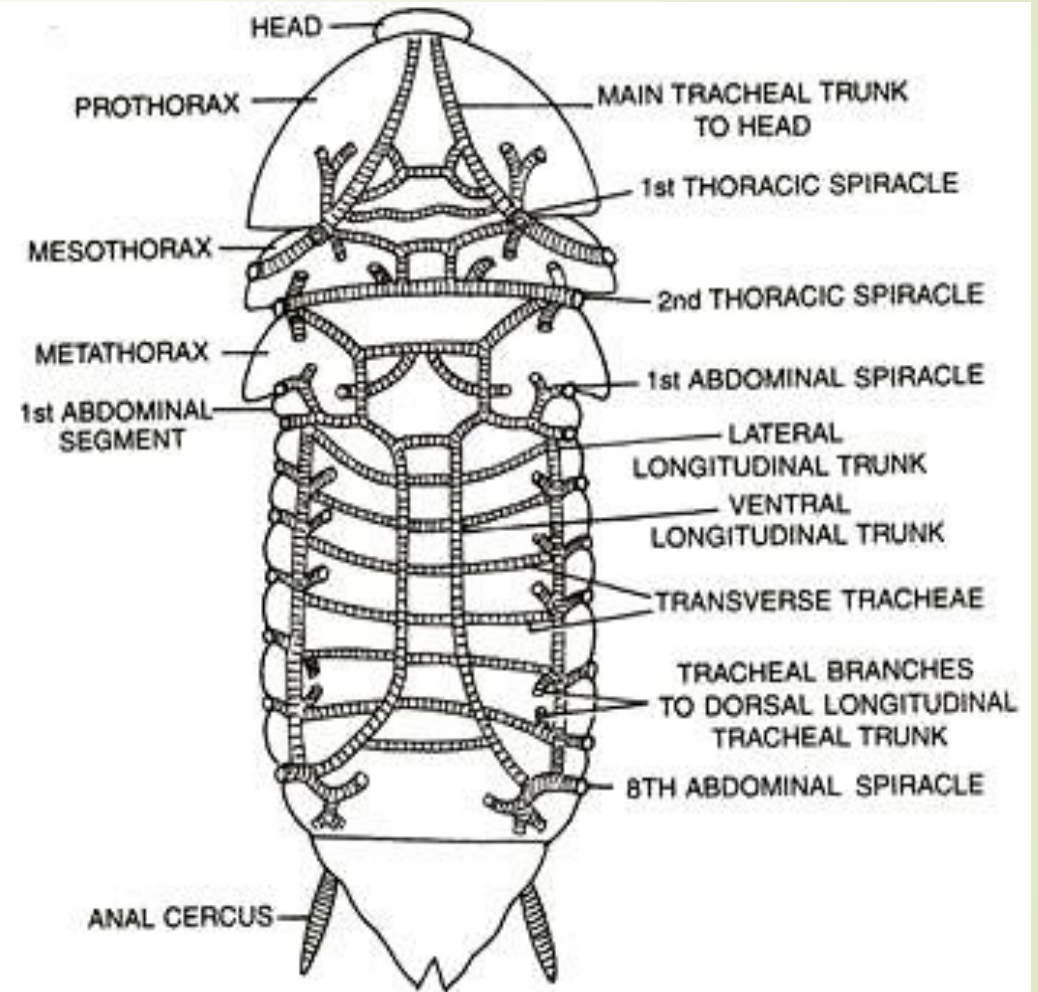


Fig. 7A-31. Tracheal system of cockroach in ventral view.

TRACHEAL TRUNKS

- They are
 - ✓ **lateral,**
 - ✓ **dorsal and**
 - ✓ **ventral longitudinal trunks.**
- ✓ The three pairs of longitudinal tracheal trunks of both the sides are interconnected by many **commissural tracheae**

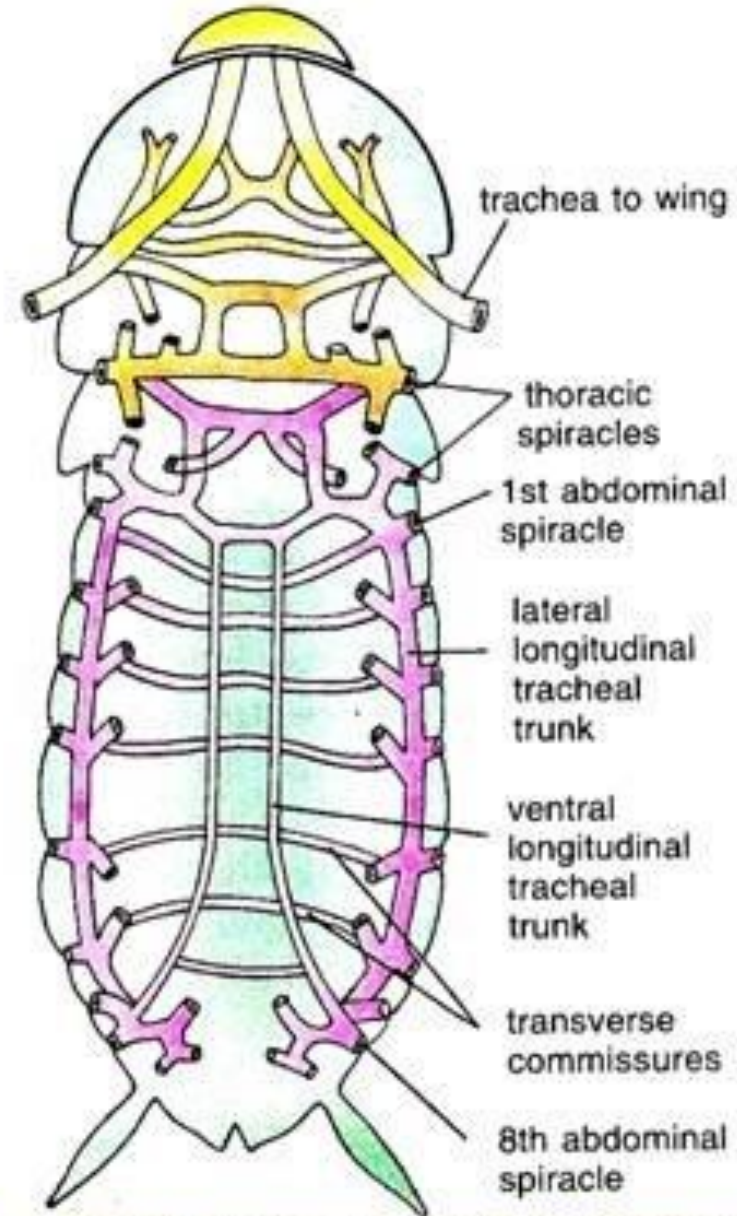
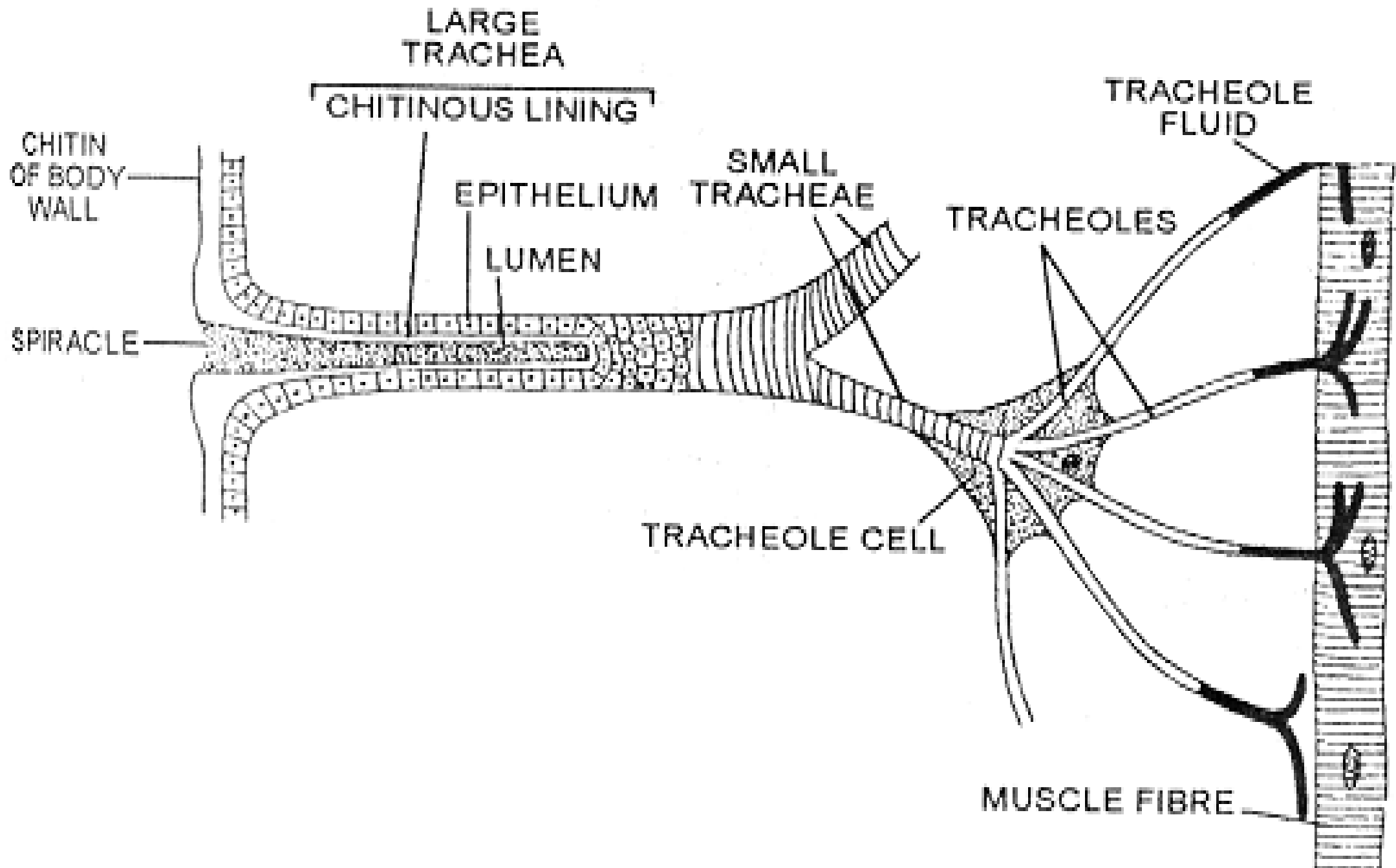
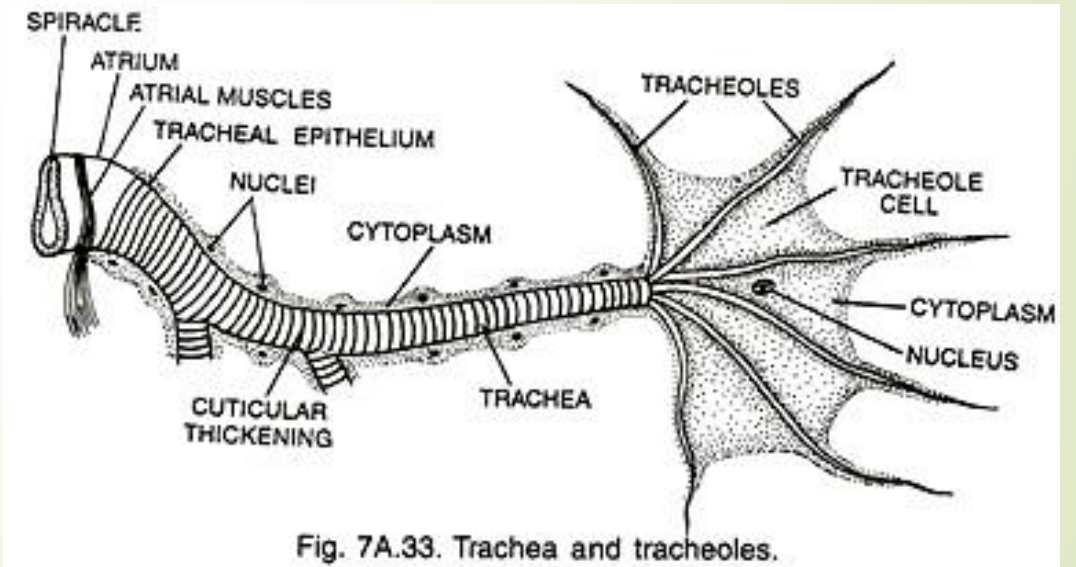


Fig. 73.22. *Periplaneta*. Tracheal system in dorsal view.



TRACHEOLES

- The fine branches of trachea are called tracheoles.
- The tracheole cell is the terminal structure of the tracheal tube ending close to the tissues.
- Taenidia are absent in tracheoles .
- Tracheoles are internally lined by a protein called trachein.
- Tracheolar fluid is present inside the tracheoles . The level of the tracheolar fluid varies with metabolic activity of the insect it is more when the insect is inactive and completely reabsorbed into the tissues when insect is more active.





TERGO-STERNAL MUSCLES

- In cockroach the muscles which help in respiration are called **Tergo-sternal** muscles.
- They are attached between tergal and sternal plates.
- **Relaxation** of tergosternal muscles helps in inspiration and
- **Contraction** of tergosternal muscles helps in expiration.

MECHANISM OF RESPIRATION

► In cockroach respiration includes two phases

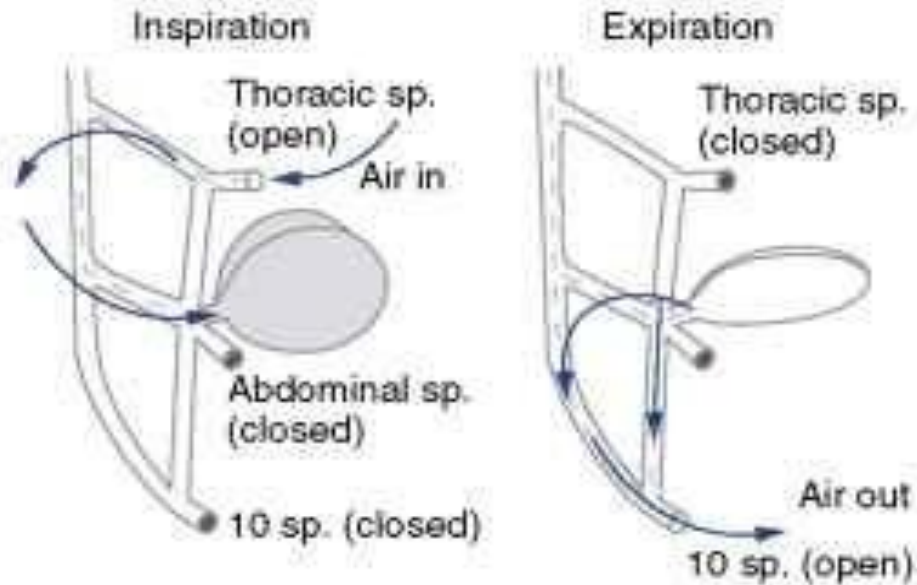
(i) Inspiration and

(ii) Expiration. In take of atmospheric air or O_2 into the tracheal system is called as inspiration.

Inspiration: Inspiration is a passive process in cockroach.

- ❑ Tergosternal muscles relax.
- ❑ The space present in the body cavity increases and pressure decreases.
- ❑ **Thoracic spiracles are kept open and the Abdominal spiracles are kept closed.**
- ❑ Later, that air is carried towards tracheoles and diffuses into tissues through tracheolar fluid.
- ❑ Due to metabolism CO_2 produced in tissues.

MECHANISM OF RESPIRATION



- **Expiration** : • Expiration is an active process. Elimination of $C02$ is known as expiration.
- Tergosternal muscles contract.
- The space present in body cavity decreases and pressure increases.
- Thoracic spiracles are closed and abdominal spiracles are kept open.
- In cockroach major amount of $C02$ is sent out by diffusion method through cuticle.
- In cockroach respiratory movements are controlled and coordinated by nervous system.



AIR SACS

- ▶ In an insect of fixed external dimensions they will assist flight by lowering the specific gravity.
- ▶ They increase the volume of tidal air during respiration and so reduce the distance over which oxygen must diffuse to reach the tracheal
- ▶ The flight muscles of many insects have large tracheæ, with elliptical cross-section, between them. The muscles are automatically ventilated during flight by the compression of these intramuscular air sac.
- ▶ Even when the air sacs are of no great importance in ventilation they will serve to reduce the mechanical damping of the wing movements by the hæmolymp.
- ▶ The large air sacs in the front of the abdomen of *Lucilia*, *Calliphora*, are distended with air, or collapsed, according to the state of other organs in the abdomen; in this way they ensure that the external form of the abdomen remains unchanged at all times.
- ▶ The air sacs of aquatic insects have a hydrostatic function..