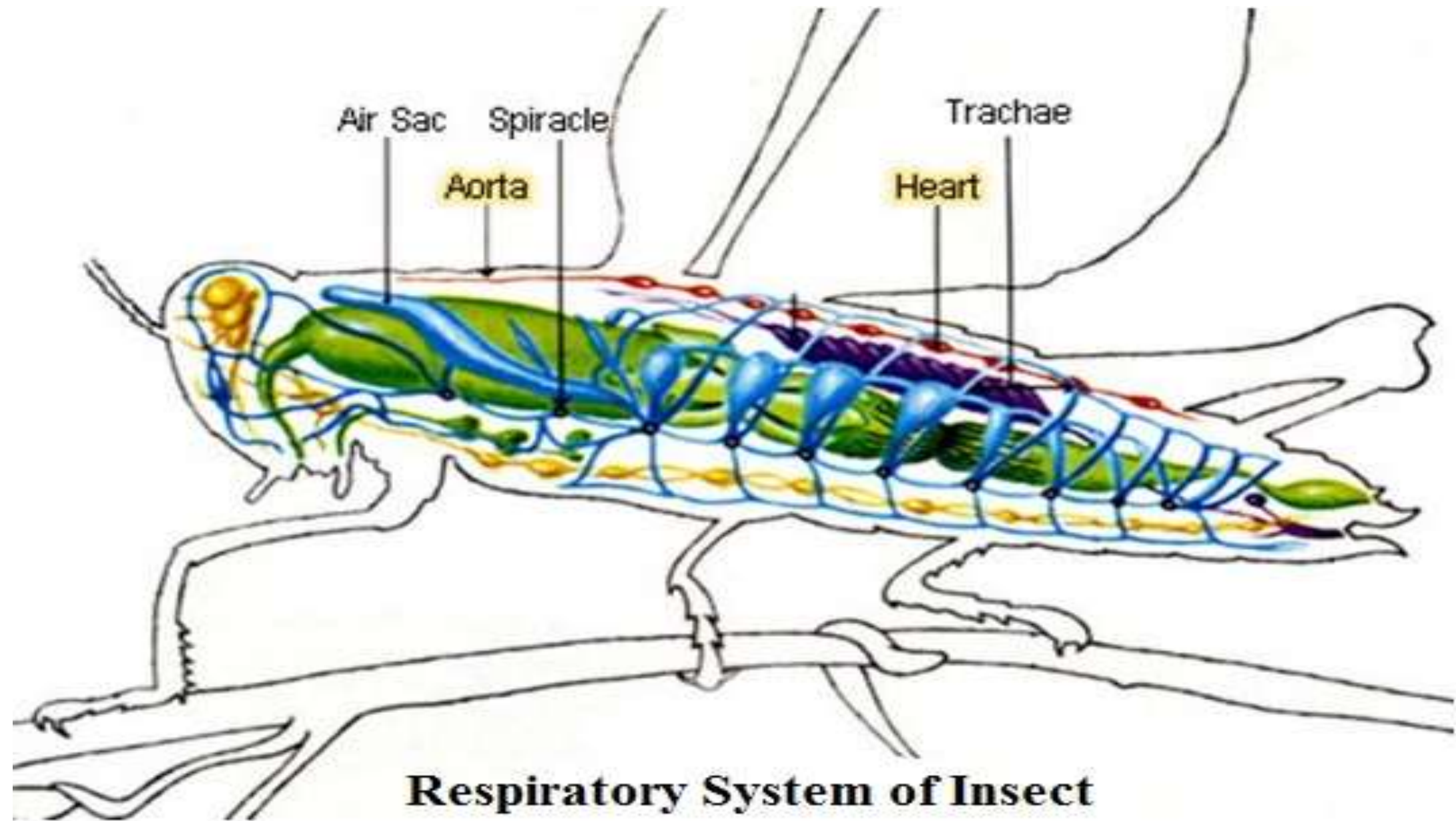


Respiratory **S**ystem of **I**nsects

Respiratory systems

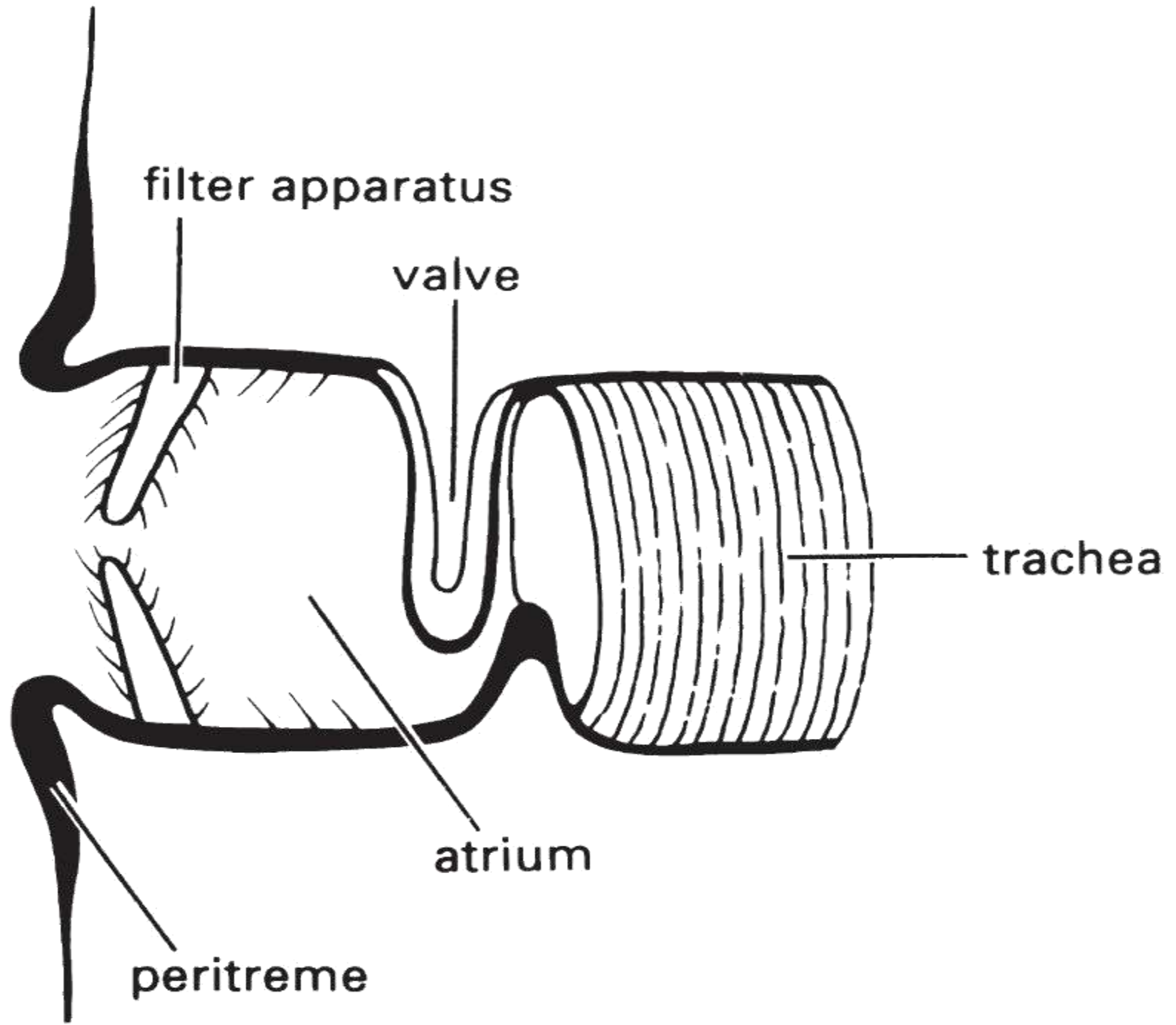
- Allow **oxygen** to body for cellular respiration
 - Remove **carbon dioxide** from cells
 - Respiratory systems of insect are developed from ectoderm.
-
- ✓ All insects are aerobic organisms
 - ✓ They get oxygen directly from environment





Spiracles

- Air enters into body through tiny holes **spiracles**
- Use to avoid water loss
- A cavity **atrium** or entrance is present
- Air passage is controlled by Valves
- Surrounded by **peritreme**.



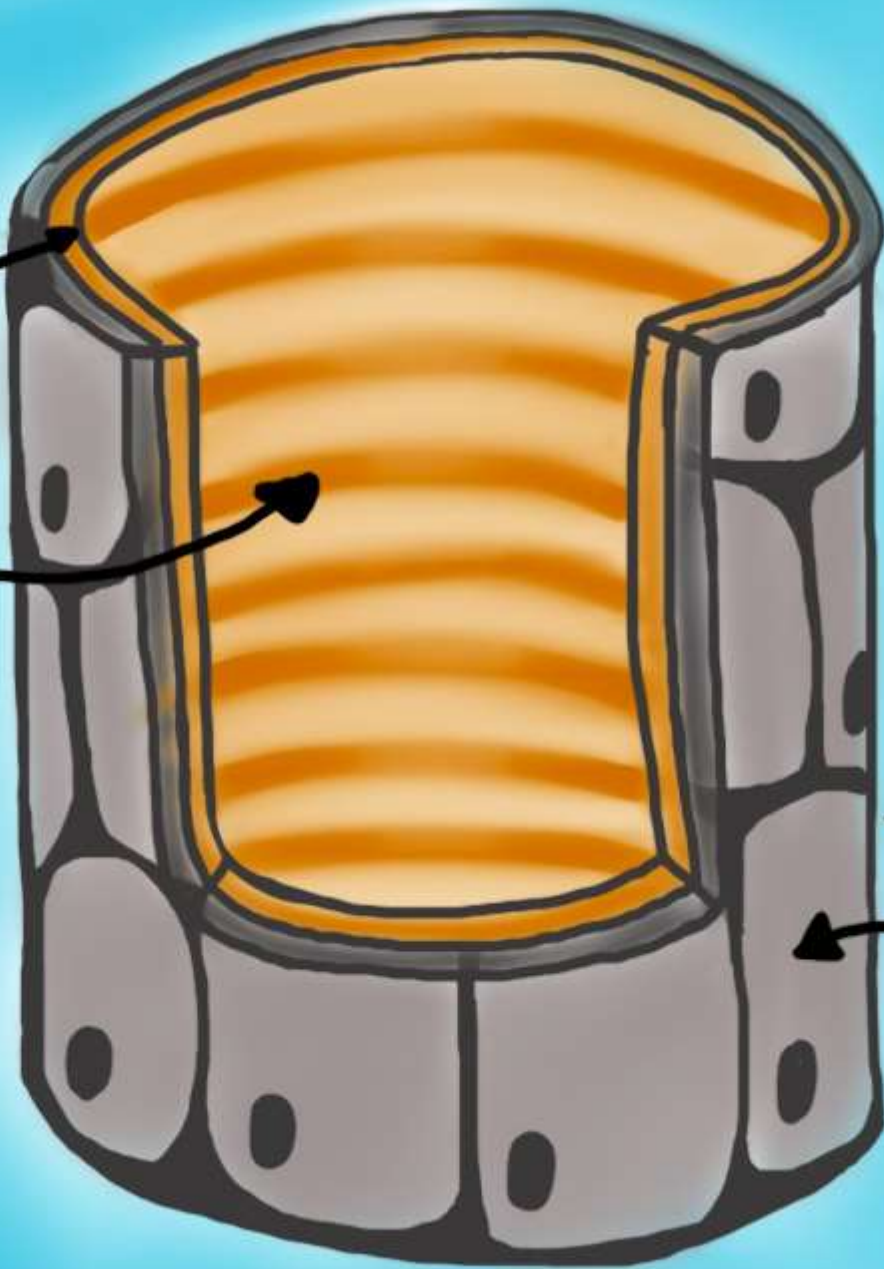
Tracheae

- Elastic in nature
- Cuticular pipe like apparatus
- Thick, helical and thread like layer **taenidia**
 - ✓ give flexibility
- Filled with air shows silvery appearance

Intima

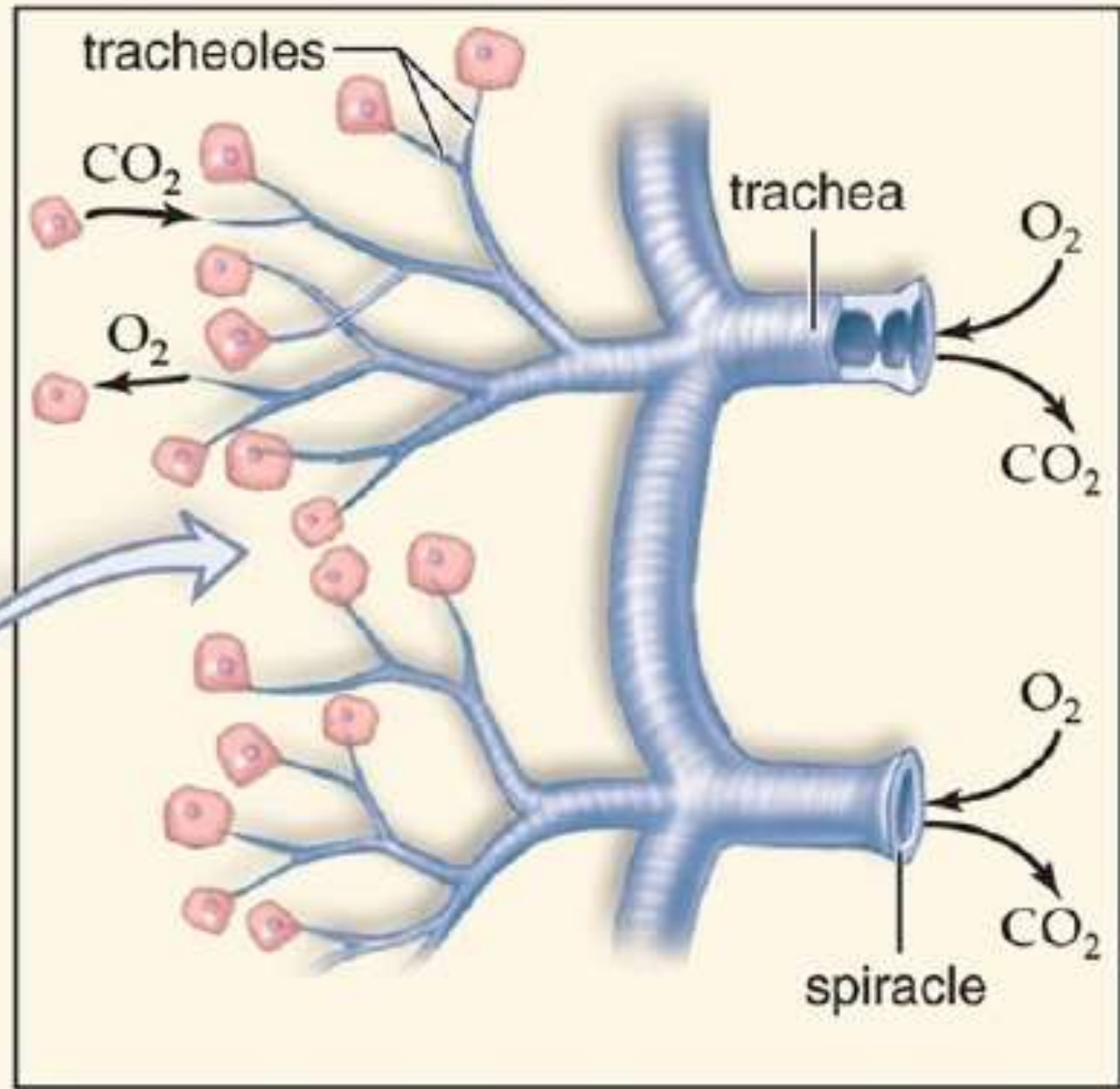
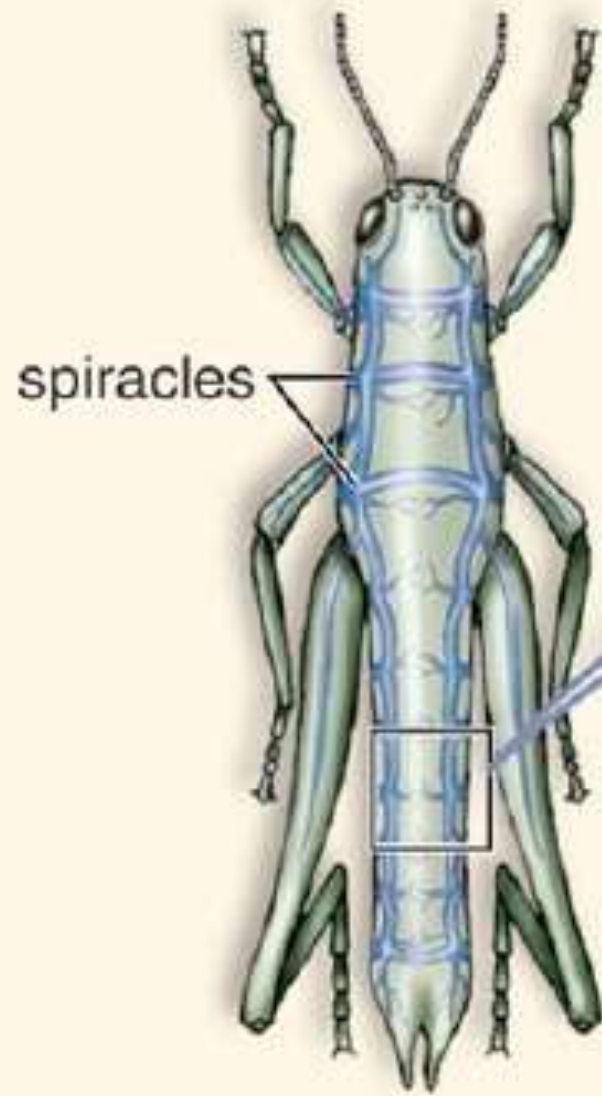
Taenidia

Tracheal
Epithelial
Cell



Tracheoles

- The network of tracheae
- Diameter less than $1\mu\text{m}$ (**$0.2-0.3\mu\text{m}$**)
- ✓ Gaseous exchange
- ✓ Lie within each cell
- ✓ Its lining not shed down on molting

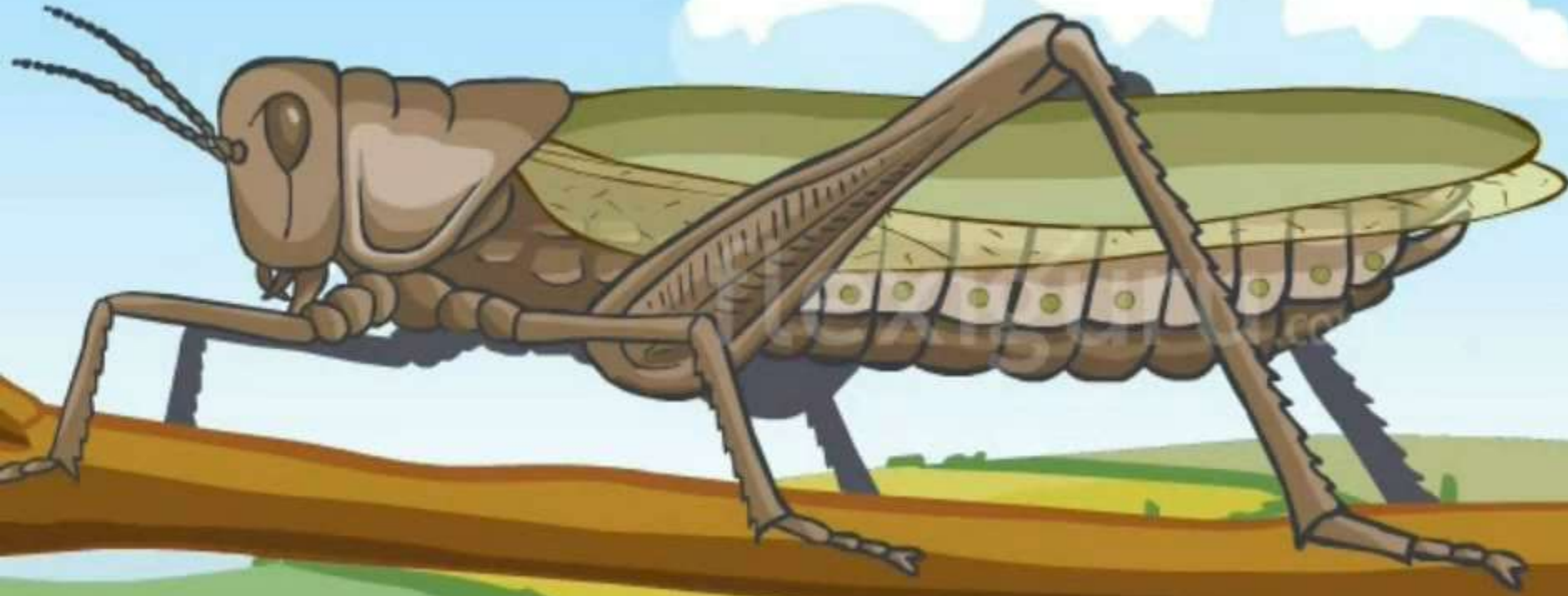


Air-Sacs

tracheae are expanded in many parts to make thin walled, collapsible structure

- ❖ act as **air reservoir**
- ❖ shiny white vesicle, filled with air
- ❖ Assist flight by reducing gravity of insects
- ❖ Sound resonator of tympanic membrane
- ❖ Heat insulations

Respiratory system in Insects



Air enters the insect body through tiny holes known as **spiracles**.

Number and Arrangement of Spiracles in Insects

In the developed embryo, 12 pairs of spiracles

According to number and position of spiracles, respiratory system is classified as

1. Holopneustic Respiratory System

8 pairs of spiracle on first 8 abdominal segments

2 pairs found on metathorax and pro or mesothorax

Example: Dipterans and some Hymenopterans

2. Hemipneustic Respiratory System:

10 pairs of spiracle present; one or two pairs are non-functional.

Example: common in insect larva

3. Peripneustic Respiratory System:

Spiracles on abdomen and prothorax open

metathorax are close

Example: Neuroptera, Lepidoptera, Coleoptera, Mecoptera, and Hymenoptera

4. Amphipneustic Respiratory System:

Only 2 pairs of spiracles are open

On prothorax

Posterior abdominal segment.

Example : Dipteran's larva.

5. Propneustic Respiratory System:

One pair of prothoracic spiracle is functional.

Example: most rare and found in some pupae of Diptera family.

6. Metapneustic Respiratory System:

Last abdominal spiracles pair is functional.

Example: 1st larval instars of aquatic Coleoptera, Family Culicidae.

7. Apneustic Respiratory System: (Closed circular system)

All spiracles are closed

Respiration takes place through gills and general body surface

Example: Naiad of Mayfly, nymph of Ephemeroptera, Odonata and many endoparasites (Hymenoptera).

Respiration in Aquatic Insects

Biological Gills

Appendage permits liquefy oxygen from the water

Example: Larvae of mayflies and damselflies

- Gills are situated on lateral or posterior sides of abdomen
- leaf like in appearance
- Insects contact with water due to fanning actions



Biological Gills

Breathing Tubes

Aquatic insects submerged under the water

Take oxygen directly from surface by hollow tube **Siphon tube**

Example: Larva of mosquito

Siphon tube



Air Bubbles

Few aquatic insects have bubble of air with them

- In diving Beetles it is prominent.
- Cover one or more spiracle
- Gives short-term supply of oxygen



