

**“RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY”  
NAGPUR**



• SEMINAR •

**“ORGANS OF RESPIRATION IN ARTHROPODS .”**

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## **CERTIFICATE**

This is to certify that the seminar work entitled “Organs of respiration in arthropods” has been successfully completed by Mr. Komalchandra Rashimani Pandey of Semester 1, under my supervision for the submission to RTM Nagpur University, Nagpur in partial fulfillment for the requirement of Degree of Master Of Science in Zoology for the academic year 2021-2022.

The work is original and has not been submitted so far, in part or in full, for any other degree or diploma of any University. The work is complete and ready for evaluation.

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Mr. Komalchandra Rashimani Pandey

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## ❖ Introduction:-

- *What is an arthropod?*
- *An Arthropod* is an invertebrate living organism characterized by presence of multiple joints a chitinous exoskeleton , segmentation and an open circulatory system .
- They are bilaterally symmetrical .
- They have segmented bodies .
- They are triploblastic .
- Many have diverse and specialized mouth parts .
- The Arthropoda phylum includes over 85% of animals, such as *insects, shrimps, millipedes, spiders, and crabs*. The number of known and described arthropods is about 30 million species. Over one million of these species are insects.

## ❖ **Organs of Respiration in arthropods :-**

Respiration involves the exchange of gases between the body and the environment. There are two types of respiration in Arthropods they are –

- ***Aquatic Respiration***
- ***Aerial Respiration***

## ❖ **Aquatic Respiration :-**

- Aquatic respiration involves the utilization of oxygen dissolved in water. It occurs in aquatic arthropods.
- In aquatic arthropods, the respiration is carried out by following organs :
  - Gills
  - Epipodite
  - Branchiostegite
  - Rectal gills
  - Tracheal gills
  - Blood gills
  - Book gills
  - Branchial basket

# 1.Gills:-

The gills are delicate feather-like outgrowths of the thoracic appendages.

The gills are crescent-shaped. Each gill has a central axis and two or more rows of lateral lamellae. The lamellae have different shapes in the different crustaceans. Based on the shape of lamellae, the gills are

classified into three types. They are the following:

1. Phyllobranch
2. Dendrobranch
3. Trichobranch

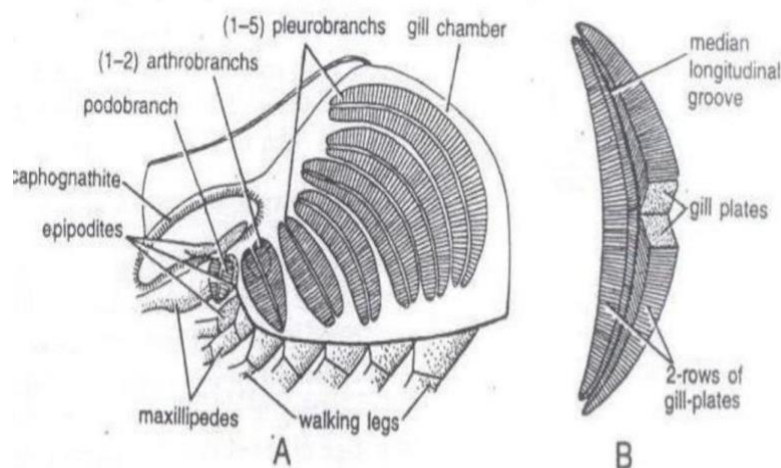
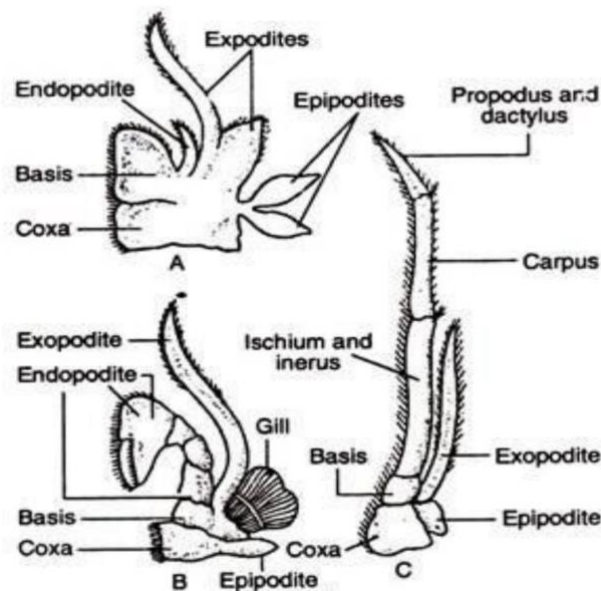


Fig. 19. *Palaemon*. A-Left gill-chamber exposed to show the gills. B-A phyllobranch.

## 2. Epipodites :-

These are membranous outgrowths of the intersegmental outgrowths of the integument arising from the thoracic appendages. *Penaeus* has 6 pairs of epipodites . located on the first 6 pairs of thoracic appendages. The first pair of epipodites is conical in shape. They are highly vascular and they exchange gases between the blood and the water.

EX. *Penaeus* , crustaceans



## 3. Rectal gills:-

The rectal gills are located in the inner surface of rectum. They are the form of soft lamellae. Water is drawn in and expelled out via for respiration,

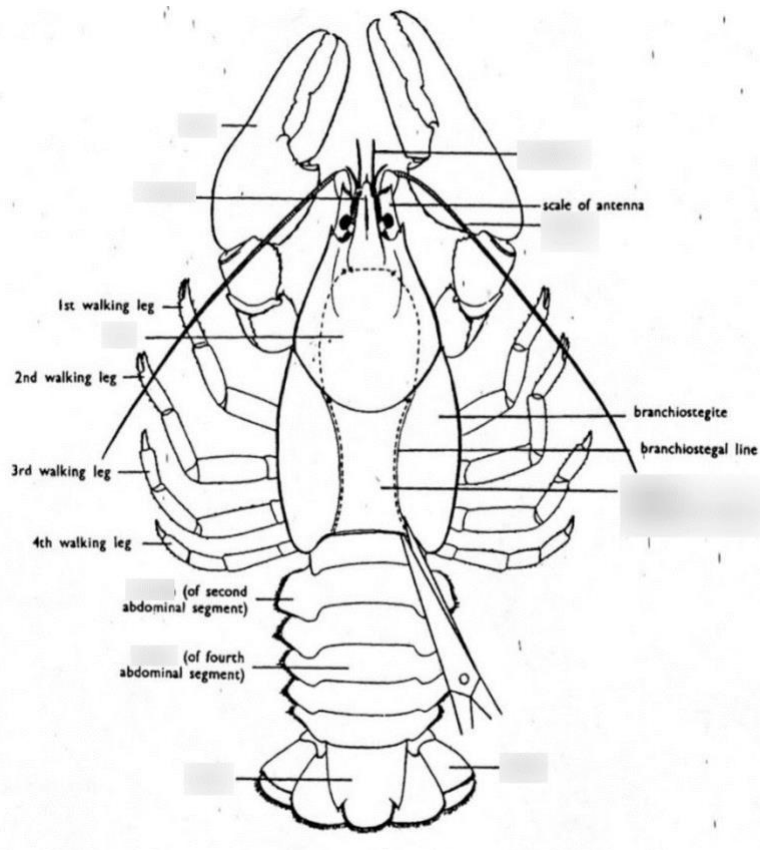
EX. naiads of dragonfly.



## 4. Branchiostegite :-

Branchiostegite is the gill-cover. It is the lateral extension of pereiopod. It encloses a cavity between itself and the body. This is called gill chamber. The inner lining of the branchiostegite is richly supplied with blood. Hence exchange of gases occurs between the water and the blood.

EX. Crustacean



## 5. Blood-gills :-

These are the gills of insect-larvae supplied with blood and not with tracheae. Blood-gills occur in Trichopeterus and Tipulid larvae.

EX. Tripulid larvae

## 6. Tracheal gills :-

These are the outgrowths of the body wall. They are finger-shaped or leaf-shaped. They contain a system of tracheae. The naiads (naiad = aquatic larva of insects) of mayfly contain 7 pairs of leaf-like tracheal gills on the sides of abdomen.

EX. The naiad of damselfly has three leaflike tracheal gills attached to the posterior end of the abdomen.



## 7. Book-gills :-

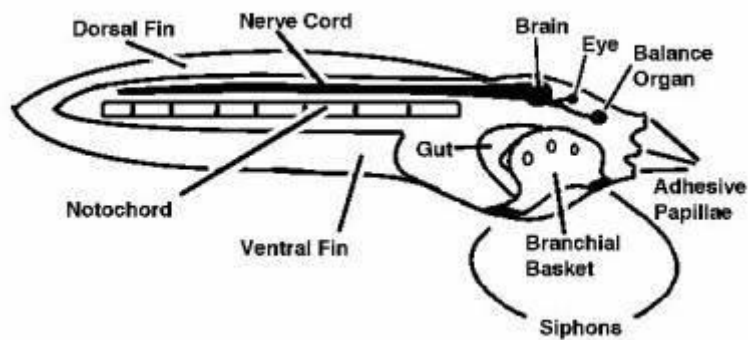
Book-gills are book-like gills. These are the respiratory organs of Limulus. Limulus has 5 pairs of book-gills. They are found attached to the last five pairs of appendages. Each book gill is formed of 150 to 200 leaf-like lamellae. The lamellae are richly supplied with blood.

EX. Limulus

## 8. Brachial- basket :-

The immature Odonates (Insects) have their rectum modified into a branchial basket. Its wall is contractile and richly supplied with the branches of tracheae. This kind of respiration is often referred to as anal respiration.

EX. Immature odonates



## ❖ Aerial Respiration :-

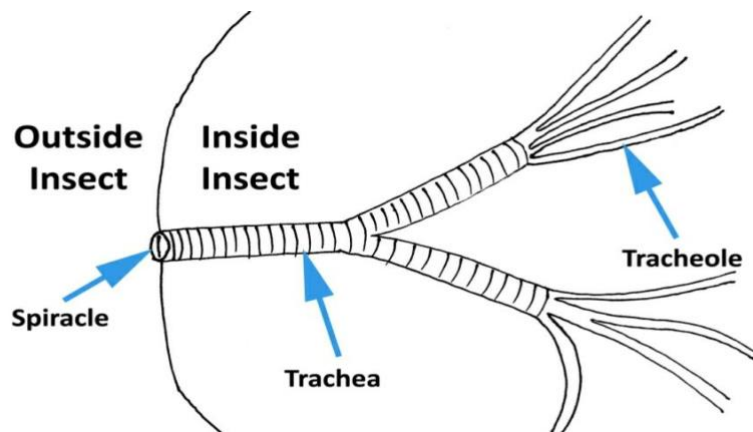
- Aerial respiration involves the utilization of oxygen present in the air. Aerial respiration occurs in terrestrial arthropods. The respiratory organs for aerial respiration are the following:

1. Tracheal system .
2. Spiracular gills
3. Book-lungs
4. Simple-lungs
5. Pseudotrachea
6. Anal respiration
7. Respiratory tubes

### 1.Tracheal system :-

Tracheal system is found in insects, centipedes, millipedes and many rachnids. It is a system of tubes ramifying the body. The tracheal system consists of spiracles, tracheae, tracheoles and air sacs.

EX. centipedes, millipedes and rachnids.



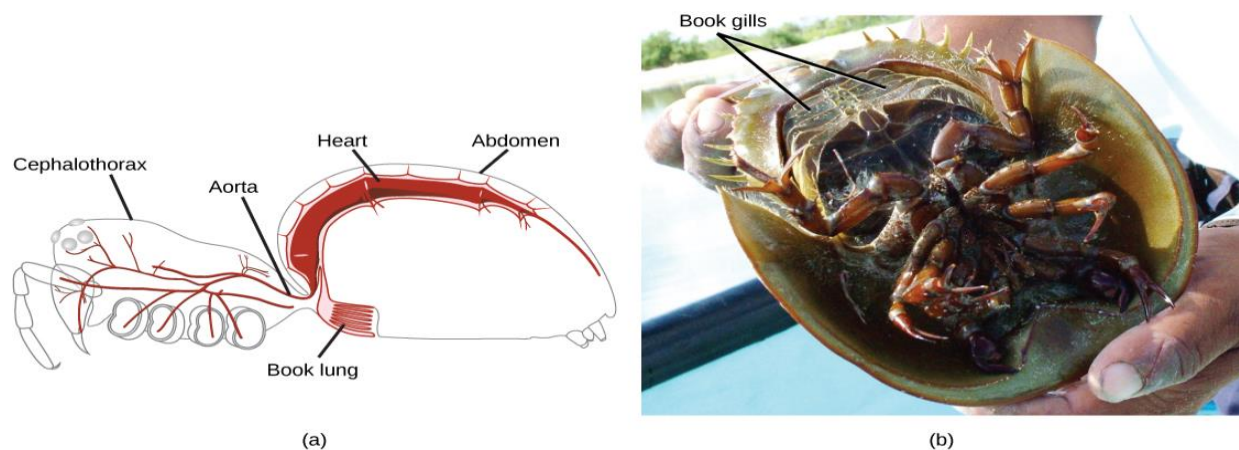
### 2. Spiracular gills :-

Spiracular gills are ectodermal outgrowths enclosing air Space They have connections with tracheae. They occur in the larvae of Teich mza and in the pupae of Simulium.

### 3. Book-lungs :-

are the respiratory organs of Scorpion. There are four pair of book lungs. They are found in the 3rd 4th 5<sup>th</sup> and the 6th segment of the mesosoma, one pair in each segment. Each book-lung like slit called stigma. The cavity of each bookthin cuticle which is formed into numerous folds called lamellae.

EX. Scorpionids ,spider



### 4. Simple-lungs :-

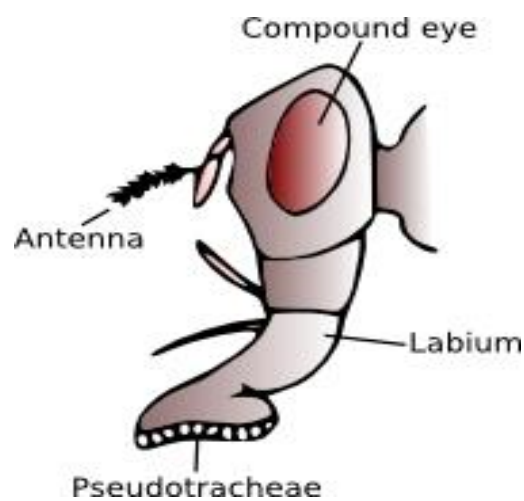
In the terrestrial coconut crab *Birgus*, the upper part of the gillah ber is separated from the rest as an almost closed air-filled cavity lung. Highly vascular epithelial folds hang from the roof of this and carry on aerial respiration

EX. coconut crab *Birgus*

## 5. Air-tubes or Pseudotrachea :-

The terrestrial crustacean Oniscus contains trachea-like respiratory tubes in its abdominal appendages for aerial respiration.

EX. Housefly, oniscus



## 6. Anal respiration :-

Many crustaceans perform rhythmical contractions of intestine taking in and expelling out water. Such anal respiration is common in lower crustaceans and is especially noticeable in cyclops .

EX. Cyclops

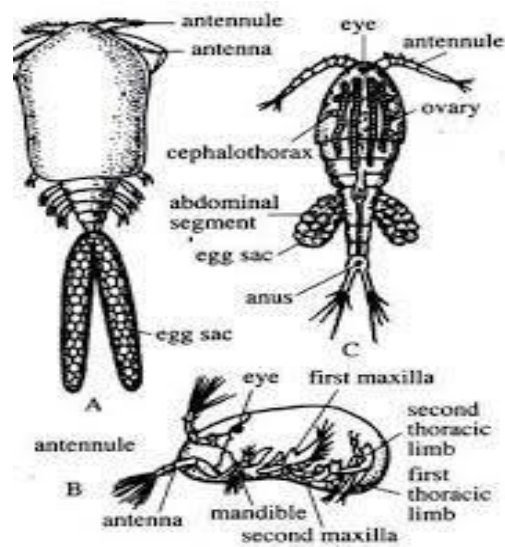
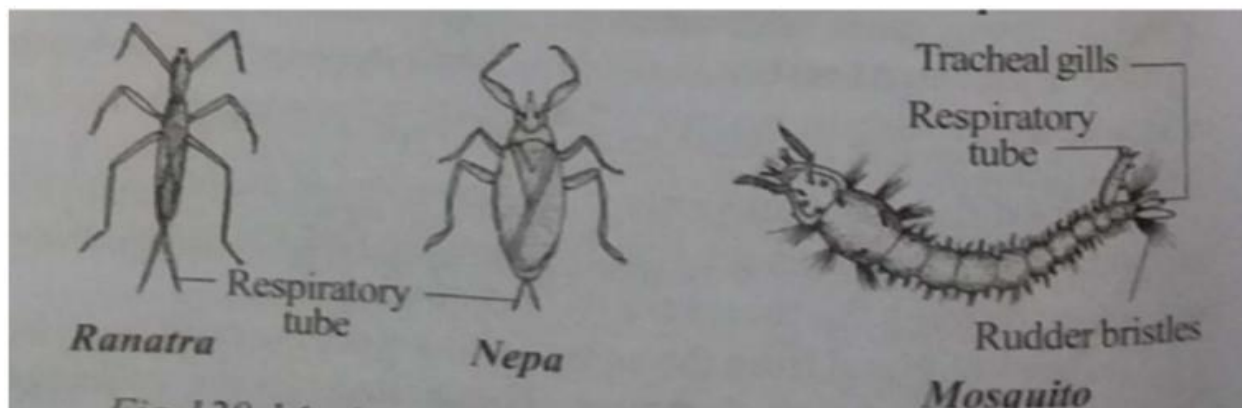


Fig. 1.107 : A. *Ergasilus*, B. *Cypris*, C. *Cyclops*.

## 7. Respiratory tubes :-

Respiratory tubes are found in the water-scorpions *Nepa* and *Ranatra*. They are located at the posterior end of abdomen. Each respiratory tube is formed by two cerci. The water scorpions come to the surface and fill the respiratory tube with atmospheric air.

EX. *Nepa* and *Ranatra*



Aquatic insect with respiratory tubes

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