PHYLUM ARTHROPODA

ARTHROPODS

The arthropod body is segmented and usually divided into distinct units, of head, thorax, and abdomen. Frequently the head and thorax are fused into a single unit, the cephalothorax. Jointed appendages and simple and/or compound eyes are present. An exoskeleton of chitin provides support and protection and serves as a basis for muscle attachment. Gas exchange with the environment is by gills, trachea, or book lungs. Either green glands or malphighian tubules serve as excretory glands.

Arthropods are subdivided into seven groups:

1. Peripatus
2. Shrimps; crabs; crayfish; sow bugs - Class-- Crustacea
3. Insects - Class--Insecta
4. Centipedes - Class--Chilopoda
5. Millipedes - Class--Diplopoda
6. Spiders, scorpions, and ticks - Class--Arachnida
7. Horshoe crabs

Examine the representative demonstration specimens and note the similarities and differences. Your instructor may request use of the crayfish here as a representative arthropod. If so, written instructions, including parts to be found, will be placed on the board in the front of the laboratory. Labeled drawings of this crustacean are included in this exercise for your assistance.

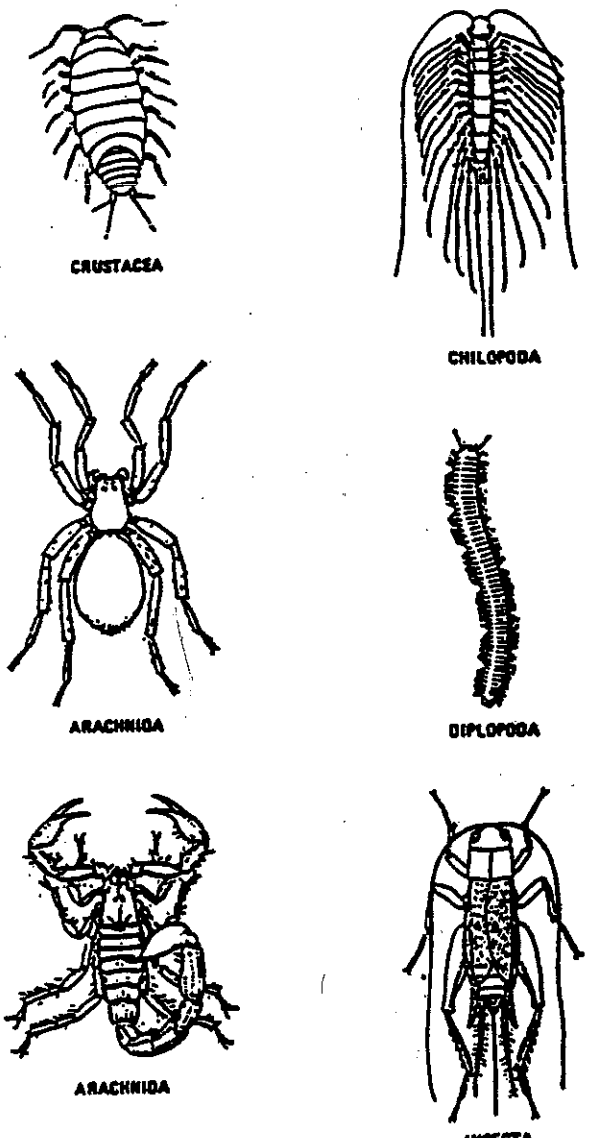
ARTHROPODA

I. Characteristics of Phylum Arthropoda

- A. Bilateral symmetry
- B. Triploblastic
- C. Joined exoskeleton
- D. Metameric
- E. Hemocoel
- F. Dorsal circulatory system
- G. Ventral nervous system

II. Classification

A. Class Crustacea -- Crayfish, lobsters, shrimp
B. Class Chilopoda -- Centipede
C. Class Diplopoda -- Millipedes
D. Class Insecta -- Insect
E. Class Arachnida -- Spiders, scorpions, mites, ticks



Courtesy U.S. Dept. Agriculture

Figure 17.4

ARTHROPODA, REPRESENTATIVES OF MAJOR CLASSES

III. A representative Crustacean -- The Crayfish

A. External anatomy -- Doral view, ideal cross section and ventral view

1. Antenna (sensory)
2. Cheliped (offense and defense)
3. Rostrum
4. Cervical groove
5. Walking leg (locomotion)
6. Uropod
7. Telson
10. Cephalothorax
11. Abdomen
12. Tergum
13. Pleuron
14. Protopodite
15. Exopodite
16. Endopodite
17. Antennule (sensory)
18. Third maxilliped
19. Mouth
20. Walking legs
21. Swimmerets
22. Anus

B. Internal anatomy

1. Antennule
2. Brain
3. Cardiac stomach
4. Pyloric stomach
5. Heart
6. Pericardial sinus
7. Testis
8. Dorsal abdominal artery
9. Intestine
10. Telson
11. Uropod
12. Anus
13. Sternal artery
14. Ventral nerve
15. Digestive gland
16. Third maxilliped
17. Mouth
18. Green gland

C. General dorsal appearance

Your instructor may indicate parts to be labeled.

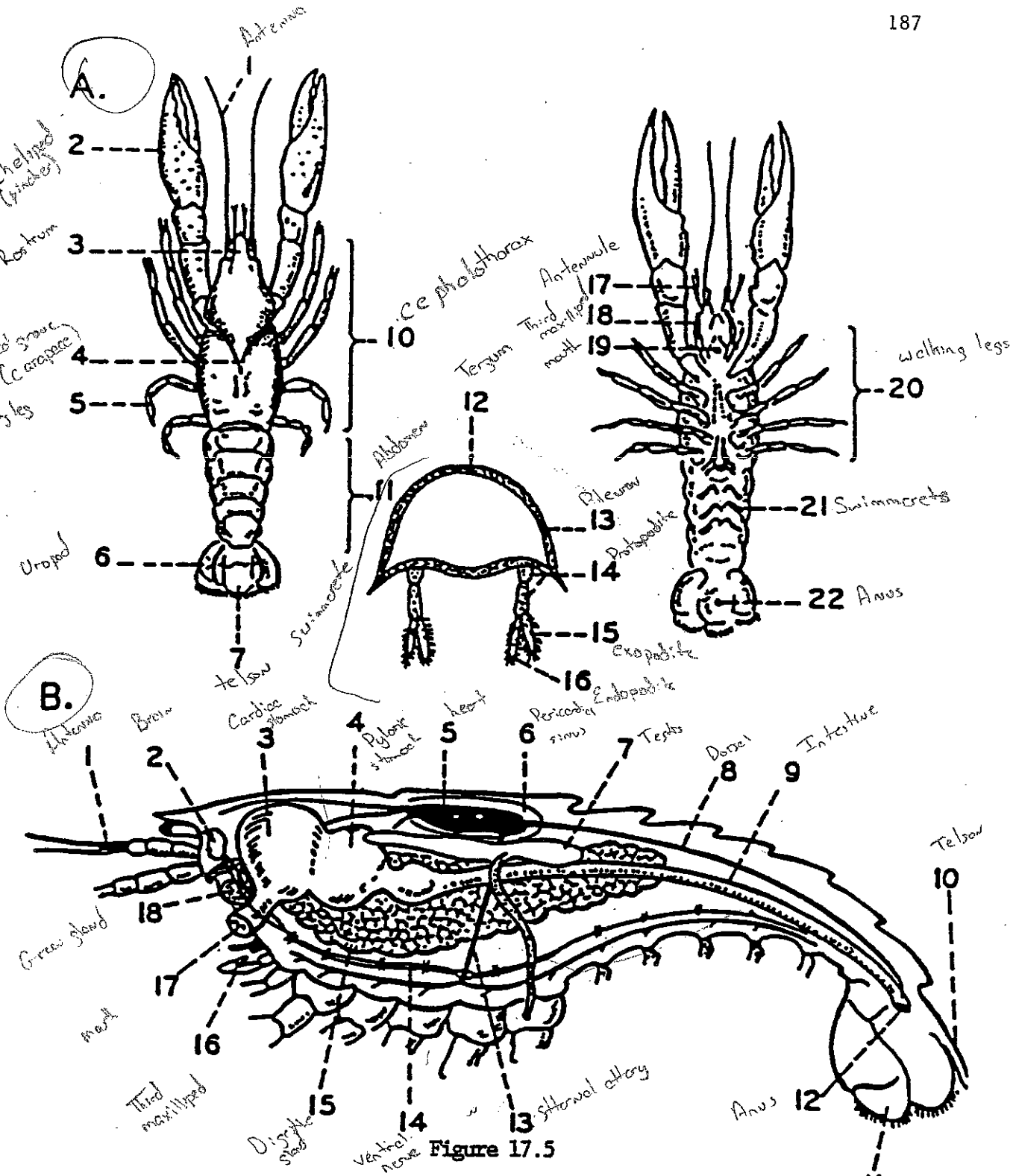


Figure 17.5

PHYLUM ARTHROPODA

CLASS CRUSTACEA

THE CRAYFISH

Obtain a crayfish from the storage container. Using your laboratory manual and the Bio Cam photographs of the concise Crayfish locate the structures and areas discussed. below.

1. Note that the crayfish is divided into an anterior cephalothorax and a posterior abdomen. Locate these.

2. From the cephalothorax identify the (a) carapace (b) cervical grove (c) rostrum (d) stalked compound eyes (e) antenna (f) antennules (g) chelipeds (h) 4 pr. of walking legs.

3. From the abdomen identify the (a) six segments (b) telson and (c) uropods.

4. Turn the crayfish over exposing the ventral side. Can you locate these? (a) mandible (b) 3rd maxilliped (c) swimmerets. Careful dissection will reveal the 2nd and 1st maxillipeds and the 1st and 2nd maxillas.

5. Carefully remove most of the dorsal carapace. Most of the cavity is filled with the yellow-white digestive gland. Remove both stomachs intact with your tweezers. Cut the cardiac stomach to reveal the teeth of the gastric mill.

6. Carefully remove the digestive gland and locate either the ovaries or testes just beneath the heart on the surface of the digestive gland.

7. Remove any muscle tissue necessary to locate the "green glands" behind the eyes.

8. Sides of the carapace cover the delicate featherlike gills. Cut, lift or gently pry the gill cover away from the body and locate the gills. (You may want to use your scissors.)

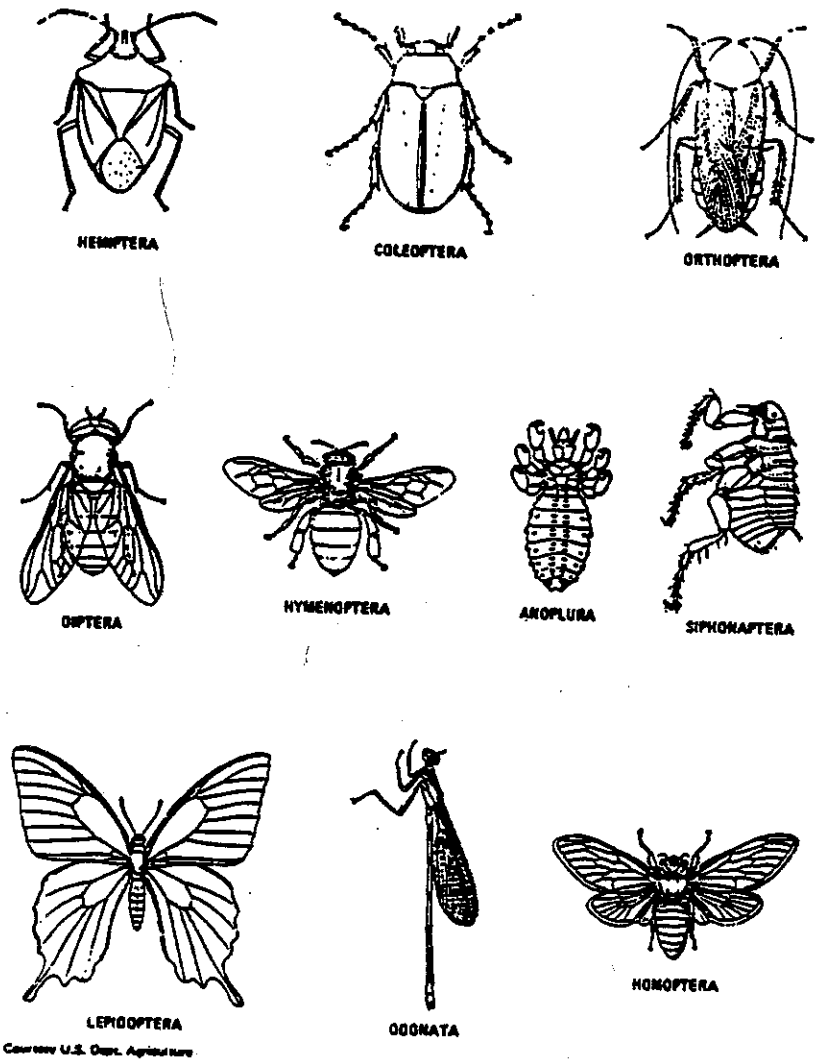
9. Can you locate the ventral nerve cord?

IV. Characteristics of Class Insecta

A. Body divided into three regions: Head, thorax, and abdomen
B. Exoskeleton of Chitin
C. Respire by trachea
D. Three pairs of legs
E. Separate sexes

V. Classification

A. Order Thysanura -- Silverfish
B. Order Protura -- Proturan
C. Order Isoptera -- Termite
D. Order Orthoptera -- Grasshopper; cricket
E. Order Lepidoptera -- Butterfly
F. Order Hemiptera -- Stink bug
G. Order Diptera -- Flies
H. Order Odonata -- Dragon fly
I. Order Hymenoptera -- Wasp; bee
J. Order Coleoptera -- Beetles
K. Order Siphoraptera -- Fleas



INSECTS, REPRESENTATIVES OF MAJOR ORDERS

Figure 17.7

THE GRASSHOPPER

Insects are a large and economically important group of arthropods (See figure ___). We will include a brief external study of the grasshopper in our laboratory work. Living specimens may be obtained in the spring, summer, and fall in most sections of the United States and preserved specimens may be used when the living forms are not available.

Study the morphology of the grasshopper from killed fresh specimens or from preserved specimens. Clip away the wings from one side of the body in order to expose the structures beneath. Note the differences between the front and hind pair of wings. The body of the grasshopper will be seen to consist of three distinct body parts. Move the abdomen up and down with your fingers and note how flexibility of this body part is obtained in spite of the hard exoskeleton.

The head bears two large compound eyes and three small eyes, the ocelli, arranged in a triangle in front of the compound eyes. The antennae also project from the head and mouth parts may be seen on the ventral side.

Posterior to the head is the thorax. This is divided into an anterior prothorax, a middle mesothorax, and posterior metathorax. All three divisions bear a leg on their ventral surfaces and the posterior two bear wings on their dorsal surfaces. Each leg consists of five parts. Study these first on the front pair of legs. The coxa is the first segment and is attached to the thorax by a tough membrane. The second segment, the trochanter, is a very short part of the leg. The third, the femur, is long and well developed. The fourth, the tibia, is more slender than the femur, but about the same length. The final segment, the tarsus, consists of three smaller subdivisions and bears a pair of claws at its termination. Now identify these parts on the second and third pair of legs. Note the reduced size of the trochanter on these legs.

The posterior division of the body is the abdomen. This is composed of eleven segments. The anterior segment bears a large tympanic membrane or auditory organ. Find the spiracles just above the lateral line that separated the abdominal segments into dorsal and ventral portions. If your animal is a female, the posterior end of the abdomen will be modified to form an ovipositor. This is used in pushing the abdomen in the ground in order to lay the eggs. The ovipositor tends to project somewhat downward. In the male the posterior segments are wider at their ventral

margin which causes an upward twist to the posterior of the abdomen. Study both sexes.

Now review by utilizing the labeled drawings in this exercise.

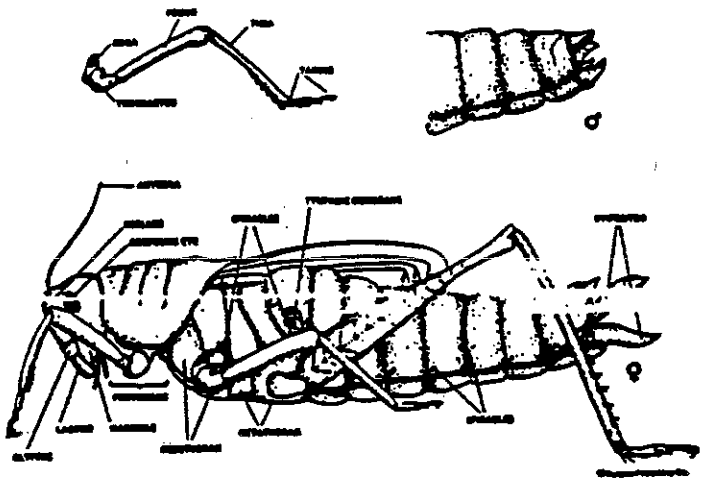


Figure 17.8

III. A representative insect -- The Grasshopper

A. External Anatomy

2. Thorax
3. Abdomen
4. Antenna
5. Head
6. Cover wing
7. Tympanum
8. Femur
9. Ovipositor
10. Tibial spines
11. Trochanter
12. Coxa
13. Pulvillus
14. Spiracle
15. Tarsus
16. Tibia
17. Compound eye

B. Grasshopper Head

1. Vertex
2. Ocellus
3. Labrum
4. Maxillary palp
5. Gena
6. frons
7. Clypeus
8. Antenna

C. Grasshopper Mouth Parts

1. Labrum
2. Mandible
3. Maxilla
4. Labium

D. Internal Anatomy

1. Circumpharyngeal connective
2. Esophagus
3. Subseophageal ganglion
4. Brain
5. Crop
6. Gizzard
7. Gastric cecum
8. Aorta
9. Heart
10. Ovary
11. Ileum
12. Colon
13. Rectum
14. Anus
15. Seminal receptacle
16. Genital opening
17. Vagina
18. Malphighian
19. Nerve Cord
20. Stomach
21. Hemocoel
22. Salivary gland
23. Salivary duct
24. Labrum

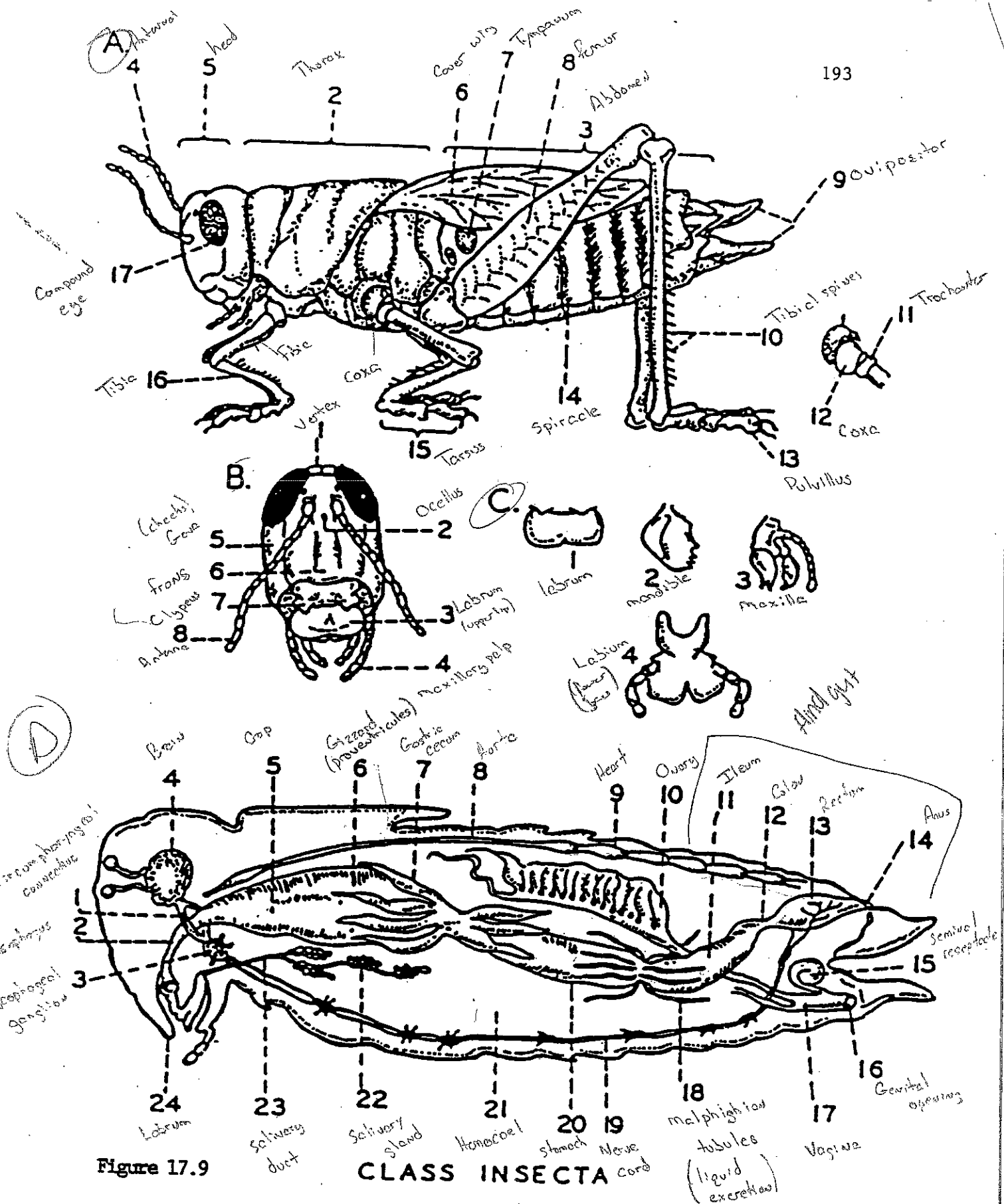


Figure 17.9 CLASS INSECTA