

Daphnia

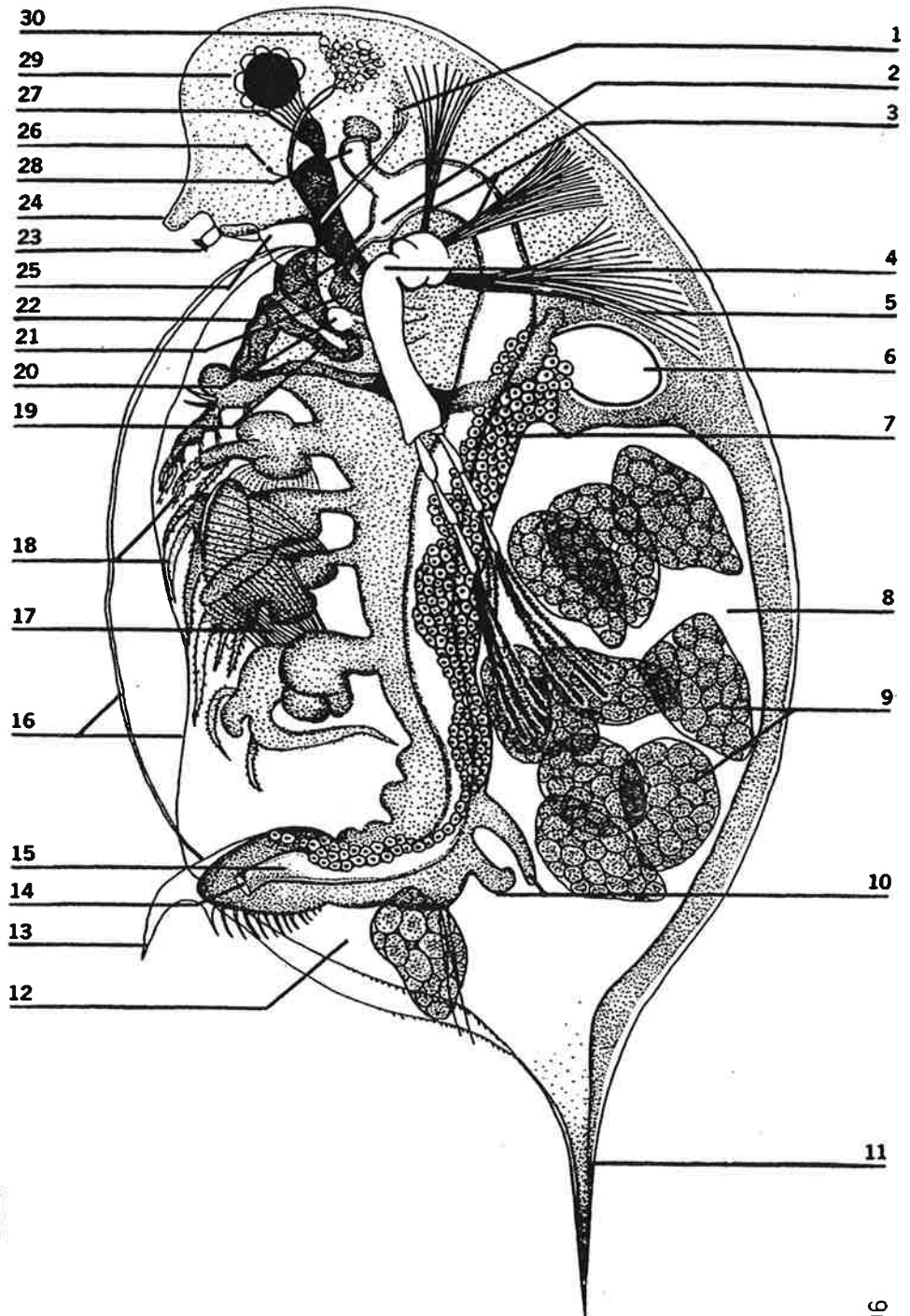
Form and Structure
Study Sheet
87 W 5205

Name _____

Date _____

Figure A
Daphnia
Diagrammatic Anatomy of Female

- 1 Frontal organ
- 2 Esophagus
- 3 Antennal adductor muscles
- 4 Antenna
- 5 Antennal levator muscle
- 6 Heart
- 7 Ovary
- 8 Brood chamber
- 9 Thin-shelled "summer eggs"*
- 10 Abdominal process
- 11 Apical spine
- 12 Post abdomen
- 13 Post abdominal claw (paired)
- 14 Anus
- 15 Rectum
- 16 Carapace
- 17 Filter setae
- 18 2nd and 3rd thoracic appendages
- 19 Shell gland
- 20 Maxillae (vestigial)
- 21 Mandible
- 22 Mouth
- 23 Antennule
- 24 Rostrum
- 25 Labrum
- 26 Ocellus or nauplius eye
- 27 Optic ganglion
- 28 Hepatic caecae
- 29 Compound eye with optic nerve
- 30 Nuchal or neck organ



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* See figures B and C. "Summer eggs" (Figure B) developing parthenogenetically; "winter eggs" (Figure C) develop after being fertilized. Winter eggs have thick shells and are produced in smaller numbers; brood chamber is molted to form a protective ephippium.

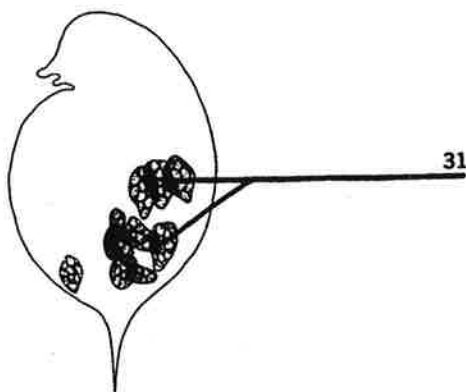


Figure B
Diagrammatic representation
of position of "summer eggs"
31 "Summer eggs"

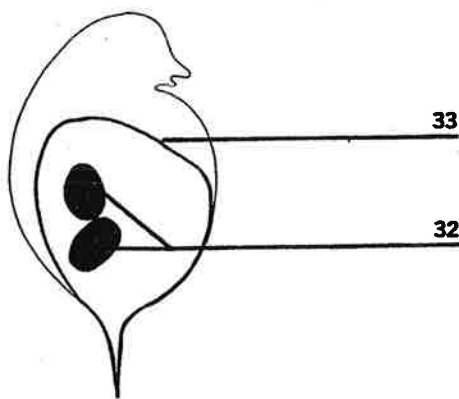


Figure C
Diagrammatic representation
of ephippium and position of "winter eggs"

32 "Winter eggs"
33 Ephippium

Natural History

Due to their varied habitats and complex but easily studied anatomy, the "water fleas" are favorite subjects for classroom study. Aside from rapid streams, brooks, and heavily polluted waters, Cladocerans are common everywhere. The two most common inhabitants of ponds, permanent pools, and temporary pools are *Daphnia magna* and *D. pulex*. Most members of the Cladocera are between 0.2 - 3.0 mm in length. *Daphnia magna* (usually supplied) is approximately 3.0 mm long. It is suggested that DETAIN II (37 W 7952), Ward's Invertebrate Slowing Agent, be used to retard motility to allow for ease of observation of internal structures.

For the most part, *Daphnia* moves in a series of "hops," produced by rapid strokes using its feathery, paired antennae. *Daphnia* feeds on a myriad of smaller protists, using its thoracic legs to produce micro water currents, sweeping these small morsels up into its mouth. Although the complex muscular system obscures some of *Daphnia's* smaller anatomical features, the essential parts of most organ systems can be easily distinguished. The most visible feature is the long, bent, dark-colored intestine. The simple football-shaped heart is readily visible behind the head on the dorsal side of the animal. At room temperature it beats about as rapidly as you can open and close your fist. Heart rate is variable with water temperature, making these creatures interesting forms for physiological studies. *Daphnia* possesses no actual blood vessels, its colorless blood plasma being guided throughout the animal by a series of minute mesenteries.

Cladocera are of great importance in the aquatic food chain and are a principle food staple for young and adult fish. Many studies have shown that analyzed stomach contents of various fish can contain up to 95% Cladocera by volume. Water fleas are also the choice delicacies of *Hydra* and both immature and mature insects.

Development in *Daphnia*

In *Daphnia*, as well as other cladocerans, reproduction is parthenogenic (the development of the egg without fertilization) during the year, in most habitats, with only females being produced. The number of eggs per clutch (or group of eggs) varies among species; *Daphnia magna* carries approximately 10 - 15. Parthenogenic eggs undergo development in the brood chamber and hatch there as fully developed young. The adult liberates them by moving the post abdomen downward. Normally one clutch is released during each adult instar or molt. Generally, there are population "peaks" of *Daphnia* in spring and in autumn. As the water temperature reaches about 12° C, active reproduction begins. This heavy asexual cycle is again repeated, usually in the fall. During these times, special "sexual" males and females may be produced, most often in response to a varied mix of environmental circumstances such as: excessive crowding of females, a decrease in food, impending deleterious change in environmental conditions (i.e., a pond drying up), and an increase in water temperature. Males will copulate with specialized females who are induced to produce special haploid eggs. Fertilized eggs are housed in the brood chamber, the walls of which thicken and darken to form an ephippium. This specialized capsule usually contains one or two "winter eggs" and separates from the rest of the carapace at the time of the next molt. Upon release, ephippia either sink to the bottom or float on the water's surface. In each case, they are at the mercy of currents, winds, and even other animals to distribute them. Ephippia and their eggs are capable of withstanding the rigors of winter and summer drought. They are of special value in the instance of temporary ponds which dry up in the summer and usually fill up again in the fall. Ephippial eggs will hatch parthenogenic females. The length of *Daphnia's* life cycle ranges from 10 - 40 days, depending upon water temperature. The number of instars for *D. magna* is between 6 - 22, their duration lasting from one day to several weeks, depending upon environmental conditions.

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