Biology 337 *NAME:* ________________________ **Lab worksheet**
Biology of Invertebrates *LAB TIME:* ____________________ **Dr. Bob Podolsky**

LAB L. PLANKTONIC COMMUNITIES and INVERTEBRATE LIFE HISTORIES

In the final lab we focus on the plankton as a community of organisms that interact in 3-dimensional space and include representatives of many taxa. The **plankton** is defined as the portion of pelagic organisms that are too small and weak to control their horizontal movement in the water column (recognizing that many water currents move horizontally). Many of them do, however, migrate vertically, sometimes to "pick up" currents that move them horizontally (to keep them in a bay close to adult habitat, for example). Plankton are distinguished from **nekton**, the portion that are large enough to control their horizontal position through swimming.

The plankton includes both adult and developmental (embryonic and larval) stages of "**holoplankton,**" organisms that spend their entire life-history in the pelagos. It also includes developmental stages of many "**meroplankton**," organisms that typically spend the adult stage in the benthos. The latter "biphasic" life cycle is typical of marine invertebrates. In such cases, it is worth thinking about how different are the challenges and opportunities of the larval and adult worlds. Suspended food is abundant, especially near the ocean surface, and among the three main life-history strategies, the most common (1) involves larvae gaining nutrition by suspension feeding. By turning tiny eggs into larger juveniles, feeding larvae enable adults to maintain high fecundity (egg number) by limiting egg size. Such feeding and long-lived larvae, on the other hand, must find their way back to suitable adult habitat. Other life-history patterns involve (2) planktonic non-feeding development (typically involving larger eggs and larvae) and (3) brooded development (where young hatch at an advanced stage from eggs held in a clutch).

In this lab you will have a chance to see how a plankton net operates and then spend most of the period looking patiently through your samples to identify and draw planktonic diversity.
NB: *treat live microscopic animals with care—they easily overheat or dehydrate.*

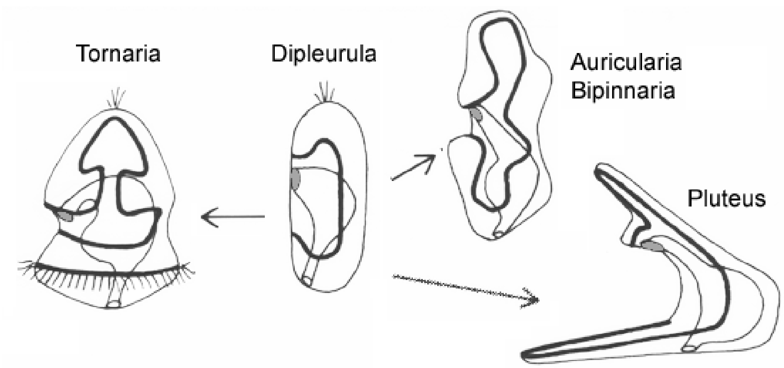
I. Plankton samples

Your goal is to isolate, draw, and describe as much of planktonic diversity as you encounter. Use the guide to distinguish what you find in terms of **taxonomy, size, morphology, and life-history stage**. Try to get past copepods, which will dominate the sample. As you isolate animals, focus not only on names, but also on the four functional themes you examined last week: **feeding, locomotion, protection, and reproduction.** You should isolate individual adult and larval stages onto microscope slides and show what you've found on the high definition screen. Be sure to let me know if you find anything that does not look like a copepod!

TQ1: Using information collected, calculate by what ratio your plankton sample was concentrated. For credit, show your calculations.

TQ2: What does the answer in TQ1 imply about your odds of encountering a larva in unconcentrated seawater?

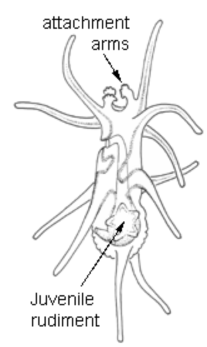
II. Deuterostome larvae are rarer to see in plankton samples than protostomes. After doing your survey of the plankton, use the stations to examine and see some of this diversity.



Echinoderms. The larval forms of echinoderms and hemichordates are thought to be elaborations of a generalized larval form known as a **dipleurula**. Cilia of the main ciliated band of a dipleurula (shown as a heavy line, below) encircle and generally beat away from the mouth (shown as a gray circle). In this sense, the mouth is **upstream** of the normal direction of ciliary beating, and such larvae are said to engage in "upstream" particle capture. When suspended particles come close to and are detected by the ciliated band, cilia in that local region reverse beat and drive particles toward the mouth. (The ciliated band must therefore also have a sensory capability). The diplueurula is elaborated into different forms represented by the hemichordate **tornaria**, the asteroid **bipinnaria**, and the holothuroid **auricularia**. The **pluteus** larval forms of ophiuroids and echinoids are further elaborations that use an internal calcite skeleton to elongate the ciliated band along the edges of several projected larval arms.

>> Examine the prepared slide of an asteroid **bipinnaria** larva. In your sketch, note the position of the ciliated band and the functional digestive system, as well as the plane of bilateral symmetry.

>> Examine the prepared slide of an asteroid **brachiolaria** larva. →.
The bipinnaria develops into a brachiolaria close to metamorphosis. Note the greatly elongated ciliated band along the body projections, the juvenile rudiment forming on the posterior portion of the body, and the brachiolar arms (used for attachment at settlement).



>> Now compare the **pluteus** larval form of an ophiuroid (an **ophiopluteus**) to the pluteus of an echinoid (an **echinopluteus**). Both larval forms use a calcium carbonate skeleton to elongate the ciliated band on a set of larval arms. However, these two plutei are thought to have evolved independently, through convergent evolution. As with the bipinnaria, you should see at least three parts of the digestive system (mouth, esophagus, and stomach) while the intestine is smaller and ventral, so may be hidden behind the stomach. Note how *different* the adults are of the these two similar larvae.

>> Examine the prepared slides of newly metamorphosed asteroid and ophiuroid **juveniles**. Most features of the bilateral larvae have been resorbed, leaving behind a juvenile with radial symmetry (in the asteroid, an unusual six-part radial symmetry). Note how *similar* the juveniles (and adults) are, despite how *different* their two larval forms were (bipinnaria and pluteus).