Chapter 1

Introduction and Plankton

1.1 Objectives

- Proper use of microscopes
- Observe local marine and freshwater plankton
- Practice observing and drawing organisms
- Learn several techniques to aid in observing small invertebrates

1.2 Description

Plankton [1] are organisms that live in the water, and cannot swim against the horizontal movement of water (i.e. currents). Thus, they passively drift. Plankton however, can swim, and many undertake amazing *vertical* migrations every day. Species that make up the holoplankton spend their entire lives in the plankton, whereas species that make up the meroplankton only spend part of their lives drifting with the currents.

Much of the plankton in lakes and oceans are invertebrates, both adult and larval stages. Most phyla of invertebrates have some, but typically many, species that develop through different stages. Typically these stages look dramatically different from the previous stage. Often the larval stage is microscopic and planktonic, and looks very different from the adult stage. In fact, in the late 1800s when biologists first discovered many different types of larvae, they believed these larvae were different species in different phyla than the adult stage! In addition to looking very different a larva often has a very different ecology than an adult, which has likely shaped the evolution of different stages.

A major biological discovery resulted from understanding the development of invertebrates. It was previously believed that similar genes controlled development of all life-history stages. Evolutionary changes that affect the larval stage would also have changes on the adult stages. However, by comparing the larval and adult stages of many invertebrates, it is clear this is not the case. For example, there are two species of sea urchin that cannot be distinguished from one another by looking at the adults. However, the larvae of each species are radically different from one another. The implies that selection can act on the larvae stage without influencing the adult stage.

[1] In Greek "plankt" means wandering.

Recent work on the evolution of development has demonstrated that this is likely a result of changes in the regulation of genes, not in dramatic changes in the genes themselves. In other words, evolution has altered the timing of when and where genes are turned on and off, not the proteins that these gene code.

1.3 Observing prepared animals

Observe larvae of the major phyla using the prepared slides in your box. If you are not familiar with what the adults of a group look like, then look through a copy of "Marine Life of the Pacific Northwest."

Early developmental stages. Development from the zygote through the gastrula has been well studied in echinoderms (seastars and sea urchins). Observe and sketch the developmental stages of a seastar, which is very similar in many species of invertebrates. What is different between these stages?

Common types of larvae. Observe and sketch the larval forms from a variety of animals. Think carefully about what structures these larvae need to survive. Then think about what functions the different structures might provide. For example, what are the arms of bipinnaria for?

- A jellyfish larva, which is called a planula, of *Aurelia* sp.
- Two types of mollusc larvae, trochophore and veliger. Species typically have either a trochophore or veliger or both.
- A barnacle larva. The early larval stages in barnacle development are called nauplii. After the nauplius stage, barnacles metamorphose into a cyprid, which looks like a very small football, before gluing its head to something hard and metamorphosing into the adult form.
- Two types of crab larvae, zoea and megalop. Crabs develop first into a zoea and then metamorphose into a megalop before settling to the seafloor and metamorphosing into the adult form.
- Two types of seastar larvae, bipinnaria and brachiolaria. Seastars develop first into a bipinnaria and then a brachiolaria before settling to the seafloor and metamorphosing into the adult form.
- A freshwater clam larva, called a glochidium. This specialized veliger is very cool. Ask your professor about it.
- A tunicate larva, called a tadpole.

1.4 Observing live animals

Your professor and wonderful teaching assistants were kind enough to spend the afternoon collecting plankton from Lake Padden (freshwater) and Bellingham Bay at Boulevard Park (marine).

- Find and sketch different planktonic organisms you find.
- Use the guides available in class to identify them.

- Observe how these animal do all things necessary for life. How do they swim and eat?
- Observe how these animals behave.
- Design small experiments to answer questions you might have about these animals. For example, use a light to observe whether particular species are attracted to or repelled from a light. What about gravity?