PHYTOPLANKTON: DIVERSITY & STRUCTURE.

DIATOMS.
PLEUROSIGMA

COSCINODISCUS
FRUSTULE
PORES
EPITHECA
HYPOTHECA
PROTOPLAST
NUCLEUS
CHLOROPLAST

DINOFLAGELLATES.
PERIDINIUM
FLAGELLUM
SULCUS
CINGULUM
THECAL PLATES

GYMNODINIUM

SPECIES OF CHAETOCERUS

C. DECIPIENS
C. DIDYMUS
C. DIVERSUS
C. DEBILIS
C. DENTICULATUS
Beyond the shallow depths where marine flowering plants and the macroalgae grow, the sunlit layer of water is dominated by single-celled plants known as phytoplankton. Phytoplankton includes a variety of plant forms, all of which are autotrophic: they capture energy from sunlight, and require nutrients (phosphates, nitrates, etc.) and carbon dioxide (CO₂) for photosynthesis. A single liter of rich coastal sea water may contain dozens of different species of phytoplankton, and possibly as many as 10–20 million individual one-celled plants. Some species are small, flagellated forms, much too tiny to be captured in any animal’s finest-mesh plankton net. The larger, more common phytoplankton species are diatoms and dinoflagellates, which are found abundantly in temperate waters. These species can grow up to 1 millimeter across, but most are much smaller.

Begin by coloring the diatoms in the upper left. Color each diatom structure as it is discussed in the text, using a dark color for the pores (C). Diatoms are found in both marine and freshwater habitats. Marine diatoms are of two basic types: the elongated forms (Pennales or pennate diatoms), such as 

### Plate 46

Pleurosigma, which are usually found in very shallow areas; and the round or wheel-shaped forms, such as Coscinodiscus (Centrales or centric diatoms). In the case of Coscinodiscus, you see that the diatom consists of a two-part frustule which is made of silica and appears like a glass jewel when viewed under the microscope. On the top of the frustule, an elaborate pattern of pores radiates out from the center; the pores help reduce the weight of the floating diatom and allow diffusion of materials into and out of the cell. Viewed from the side, the shape of the frustule can be seen: the upper half, or epitheca, fits over the smaller bottom half, the hypotheca. Inside the frustule are the nucleus of the diatom, which contains the genetic material, and the chloroplasts, or photosynthetic organelles.

Now, color the dinoflagellates in the upper right corner.

Unlike the diatoms, the dinoflagellates have long flagella that are used for locomotion. The whip-like flagella are located in grooves — the longitudinal sulcus and the transverse cingulum — on the dinoflagellate. Dinoflagellates have a multi-layered covering of cell material. In the armored (thecate) dinoflagellates, such as Peridinium, the cell is encased in an expandable, overlapping layer of cellulose plates; this is absent in naked, or unarmored dinoflagellates, such as Gymnodinium. Many dinoflagellates are known to be bioluminescent (light-producing), and this group also includes the organisms that cause the sea water to turn red during the so-called ‘red tides’ (Plate 58).

Next, color the various species of the diatom genus Chaetocerus. Note the difference in the length and shape of the setae.

The dinoflagellates are able to swim and move up and down in the water column; diatoms cannot move under their own power, but have developed adaptations that keep them afloat. Within the widely distributed diatom genus Chaetocerus, a variety of adaptations are visible. The individual Chaetocerus cell is oval, with two pairs of thin spines or setae projecting from either end of the cell. These setae fuse with those of other cells to form long chains, thereby increasing the buoyancy of the chained group. As you see from the illustration, the length and shape of the setae vary with different species. Chaetocerus decipiens is found in cool, dense water, and needs only relatively short setae to stay afloat. Chaetocerus species living in warmer, less dense water have developed long setae that provide more resistance to sinking. Chaetocerus denticulatus has secondary spines on the setae to keep it from sinking in warm water.