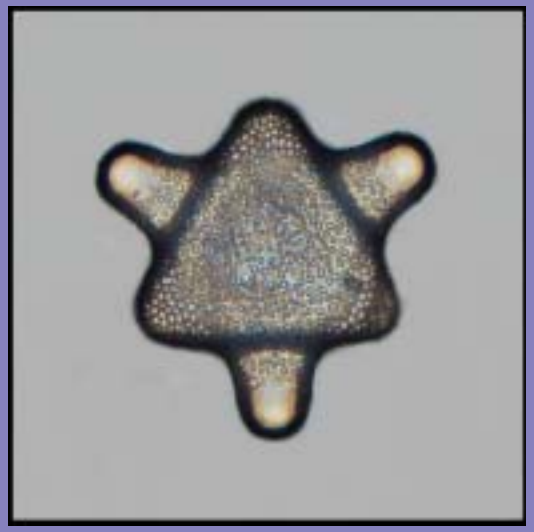
# Key to the common macroalgae of Waipi`o Valley (Hi`ilawe, Lalakea and Hakalaoa Streams)



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## Dichotomous Key to the common genera of macroalgae of Waipi`o Valley (Hi`ilawe, Lalakea and Hakalaoa Streams):

1. a. Alga doesn't have clearly defined cells under the microscope; filaments appear tubular and lack the "cross-walls" dividing the tube into a series of cells; the plant does not stain positively with Lugol's Iodine solution - ***Vaucheria*** (Tribophyta, or yellow-green algae) - p. 13

   b. Alga has clearly defined cells (2)

2. a. Cells are colored blue-green, olive-green, green-grey or pink when viewed using the microscope - Cyanobacteria and Rhodophyta (3)

   b. Cells are colored grass-green, or else golden-brown or yellow-green when viewed using the microscope - Chlorophyta and Bacillariophyta (10)

3. a. Algal cells do not contain organelles such as chloroplasts and nuclei when viewed under the microscope; the insides of cells are either smooth or with grains - Cyanobacteria, or the blue-green algae (4)

   b. Algal cells under the microscope with organelles; chloroplasts easily seen as colored bands or discs (red or blue colored) - Rhodophyta, or the red algae (9)

4. a. Filaments of the alga gradually tapering in diameter along their length (ie. they are not cylinders of a constant width) - ***Dichothrix*** - p. 6

   b. Filaments of the alga not tapering along their length (5)

5. a. Alga has occasional branches (these are called "false branches" in most Cyanobacteria); many of the filaments have clearer, rounded cells at one end that are slightly larger than the other cells (called heterocysts) - ***Microchaete*** - p. 6

   b. Filaments not branched at all (6)

6. a. Cells bead-like or barrel-shaped, like pearls on a string, filaments curved and sometimes twisted around one another (7)

   b. Cells rectangular in shape (8)

7. a. Alga with a thick outer layer of mucous-like material that gives the plant a very definite shape - ***Nostoc*** - p. 5

   b. Alga without a thick outer layer of mucous-like material; the plant doesn't easily keep its shape when it is removed from the water - ***Anabaena*** - p. 5

8. a. Only one filament is usually contained within a clear sheath, the filaments are usually entangled together and forming mats that can be blue-green, grey or red in color - ***Phormidium*** - p. 4

   b. Sometimes several filaments can be contained within a single clear sheath - ***Microcoleus*** - p. 4

9. a. Filaments arranged in short tufts, either red or grey-blue in color; under the microscope appear branched, often with rounded cells at the tips of the filaments (monosporangia) - ***Audouinella*** - p. 10

   b. Filaments quite thick, the main part of the filament bead-like in appearance - ***Compsopogon*** - p. 10

10. a. Cells with grass-green chloroplasts that stain positively (a blue-black color) with Lugol's Iodine solution - Chlorophyta, or the green algae (11)

    b. Cells with yellow-green or golden-brown chloroplasts, but not positively staining with Lugol's Iodine solution - Bacillariophyta, or the diatoms (18)

11. a. The alga is composed of unbranched filaments (12)

    b. The alga is composed of branched filaments (16)

12. a. Cells with one or more spiralled-shaped chloroplasts - ***Spirogyra*** - p. 7

    b. Cells without one or more spiralled-shaped chloroplasts (13)

13. a. Cells with a single band-shaped chloroplast that may either be lying in a flat plane or else twisted once - ***Mougeotia*** - p. 7

b. Cells with chloroplasts that differ from 13a (14)

14. a. Some cells have a very noticeable set of rings at one end; the chloroplast looks like a net within the cell - ***Oedogonium*** - p. 7

b. Cells with chloroplasts that differ from 14a (15)

15. a. Cells with a very dense series of chloroplasts inside the cell (when viewed under high magnification with the microscope), and the chloroplasts do not have a regular spiralled pattern - ***Rhizoclonium*** - p. 8

b. Filaments look like a chain of delicate, glass-like cells; cells are rectangular but with small ornamentations on the edges - ***Desmidium*** - p. 9

16. a. The plant is branched; the chloroplasts are very dense and seem to fill the entire cell; the branches of the plant are fairly large and the branching pattern can be seen without using a microscope - ***Cladophora*** - p. 8

b. The plant is branched, and the ends of the filaments are smaller in diameter than the main part of the plant (17)

17. a. The difference in diameter between the main axis and the first few branches is not very large; ends of the filaments taper to a point or end in a long hair - ***Stigeoclonium*** - p. 9

b. The difference in diameter between the main axis and the first few branches is quite large; ends of the filaments do not taper to a fine point or end in a long hair - ***Cloniophora*** - p. 8

18. a. Cells arranged in long filaments (chains of cells) (19)

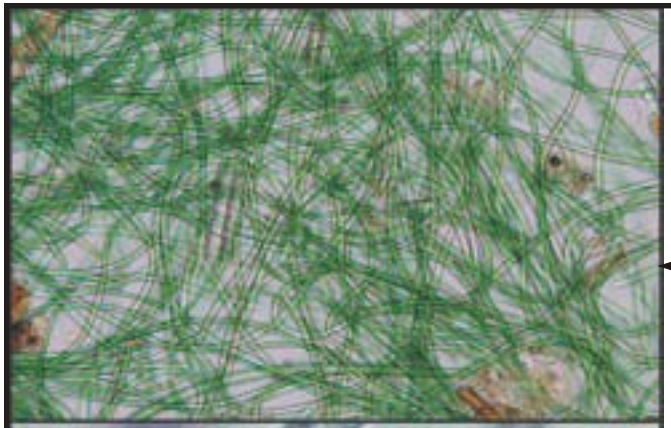
b. Cells arranged in either short filaments (chains of less than about 10 cells), or star-shaped colonies that look like small pin-cushions (20)

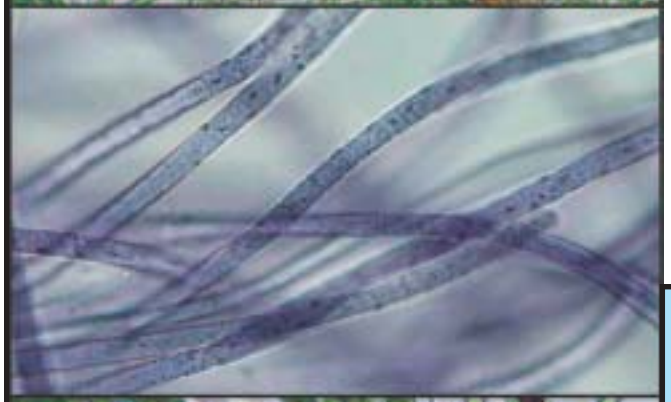
19. a. Filaments composed of chains of cells, each of which look like small cylinders with a fine line dividing the cylinder into two halves; cells contain many small, disc-like chloroplasts that are golden-brown colored - ***Melosira*** - p. 12

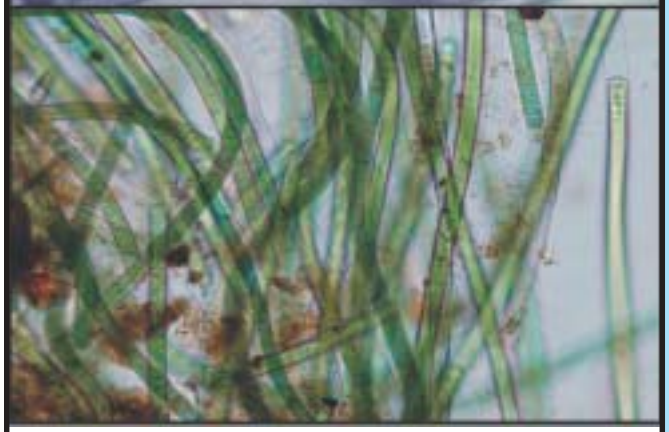
b. Cells of the filament appear rectangular, but when they are individually separated and flipped on their side they appear rounded with six bumps around the outside of the cell - ***Hydrosera*** - p. 11

20. a. Cells arranged in needle-like colonies that look like small pin-cushions under low magnification, and like small stacks of needle-like rectangles under high magnification - ***Synedra*** - p. 12

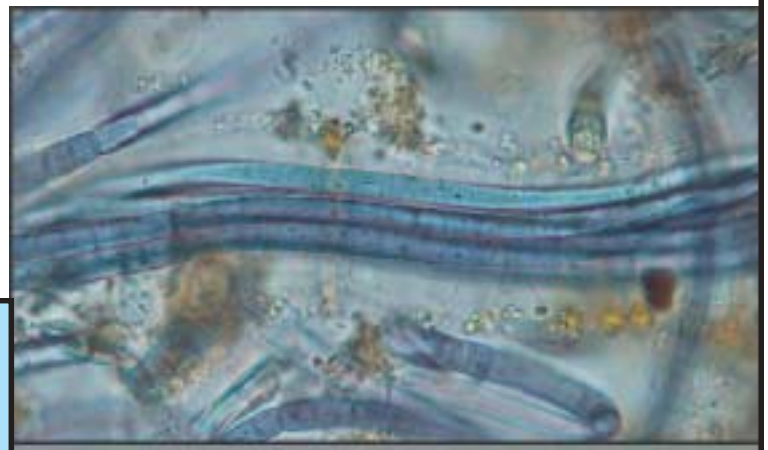
b. Cells can be in chains of up to about 10 cells (they appear like stacks of rectangular-shaped cells), but when separated and flipped on their side can be seen to have three bumps along the length of the cell - ***Achnanthes*** - p. 11





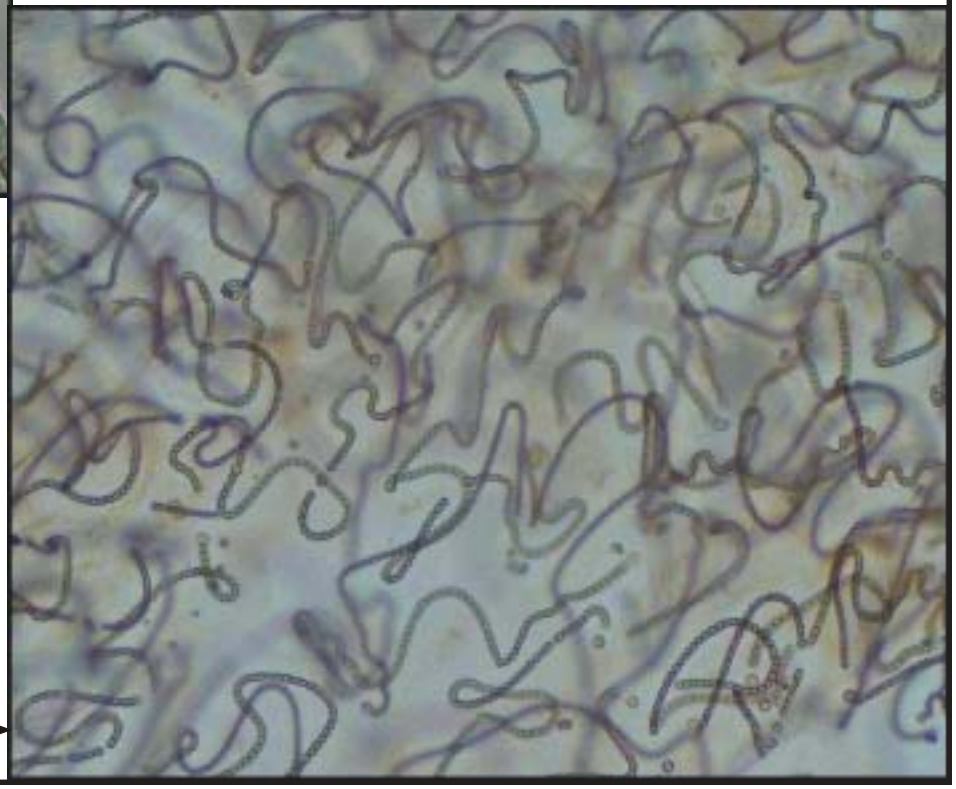


***Phormidium*** - filaments unbranched, tangled into a mat. Color can vary widely from blue-green, red, purple or grey. Sometimes a colorless sheath can be seen surrounding the filaments (when viewed at high magnification).



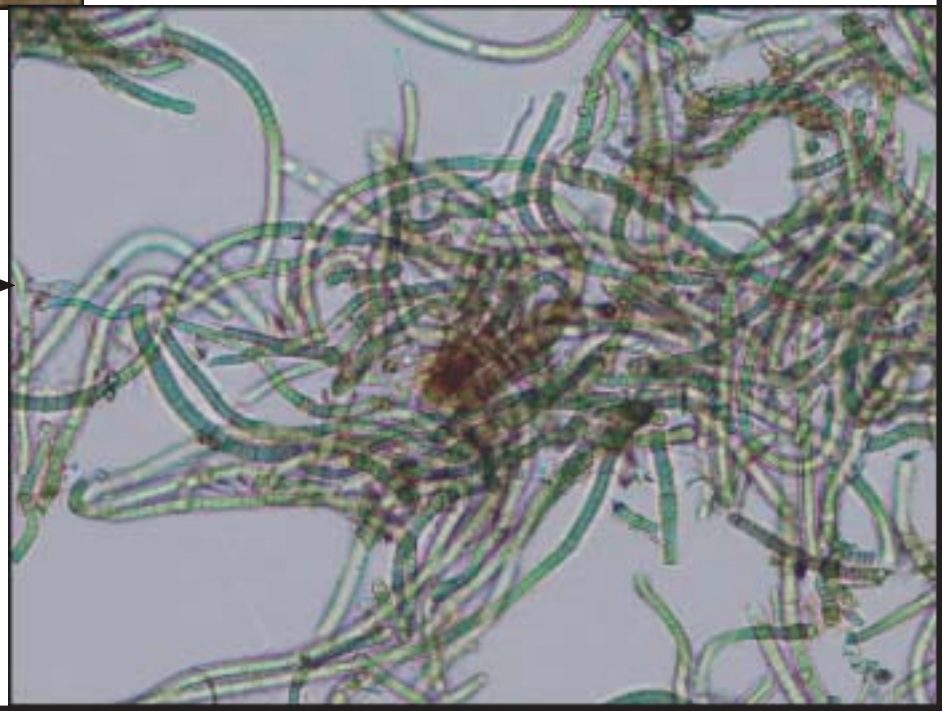
***Microcoleus*** - several to many individual filaments can be seen bundled together within a common sheath. Usually the cross walls between cells are slightly constricted (in the species found in Waipi`o Valley). Color is purple.

***Anabaena*** - filaments are composed of a series of barrel-shaped or bead-like cells, which are stuck together in a stringy mass. When the clump is removed from water it doesn't keep a solid shape (there is no firm sheath surrounding the filaments and the entire algal mass). Compare below with *Nostoc*.



***Nostoc*** - filaments composed of a series of barrel-shaped or bead-like cells, which are held together in a firm outer coating of mucilage. In the stream these appear as small brown balls (like slightly squishy marbles), and can be removed easily while still retaining their shape. Compare this with *Anabaena*, since the two look very similar using the microscope.

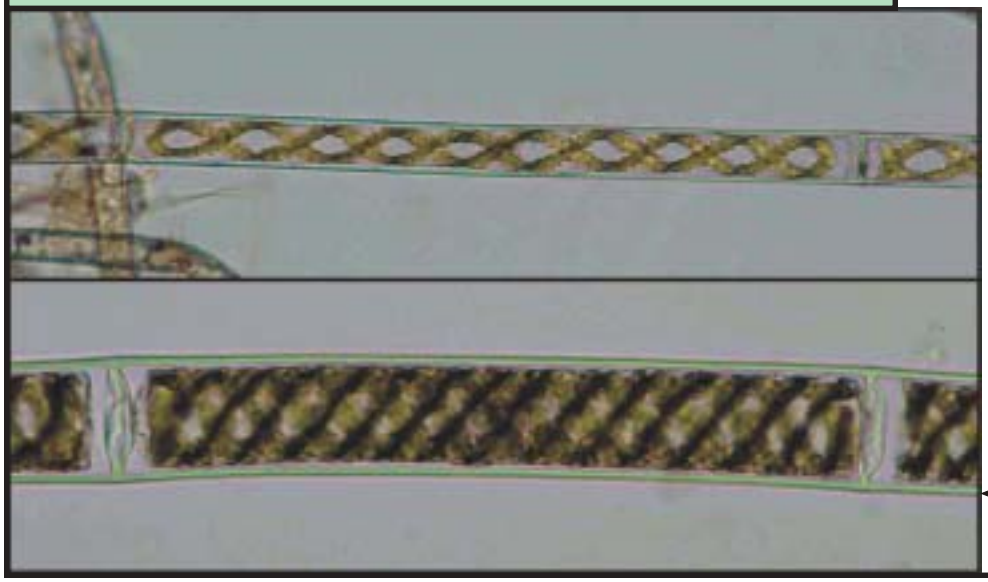
***Dichothrix*** - filaments surrounded by a fairly thick, colorless sheath. Branching can be seen within a single sheath (see photo at left). Filaments gradually taper in diameter. Slightly larger, less densely colored cells are at the base of the filaments (called heterocysts). Filaments are found tangled in a brown clump in the stream.



***Microchaete*** - filaments surrounded by a colorless sheath (clear), but not tapering in diameter from one end of the filament to the other. Slightly larger, more lightly colored cells are also at one end of many of the filaments (heterocysts). Filaments are usually tangled in a clump and are green-blue to grey-black in color.

***Mougeotia*** - this is found as fine yellow-green filaments, usually in slower flowing water. Filaments are unbranched. When looking under high magnification with the microscope, the chloroplast can be seen as a large plate, sometimes twisted once around itself.

***Oedogonium*** - this is found as yellow-green to grass-green colored filaments in streams. Filaments are unbranched. The chloroplast under the microscope can be seen as a net-like structure that weaves through the cell. At one end of some of the cells, small rings of cell wall material can be seen.

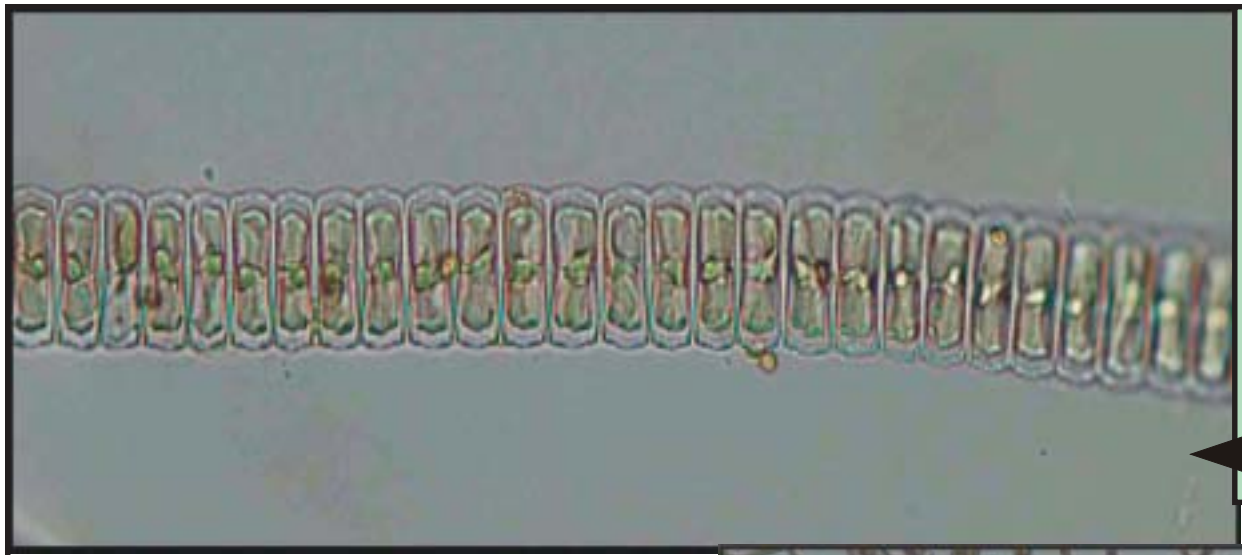


***Spirogyra*** - found as grass-green to dark-green filaments in the stream. The filaments are unbranched. Under the microscope the chloroplast(s) have a spiralled shape (there can be one to many chloroplasts in a single cell).

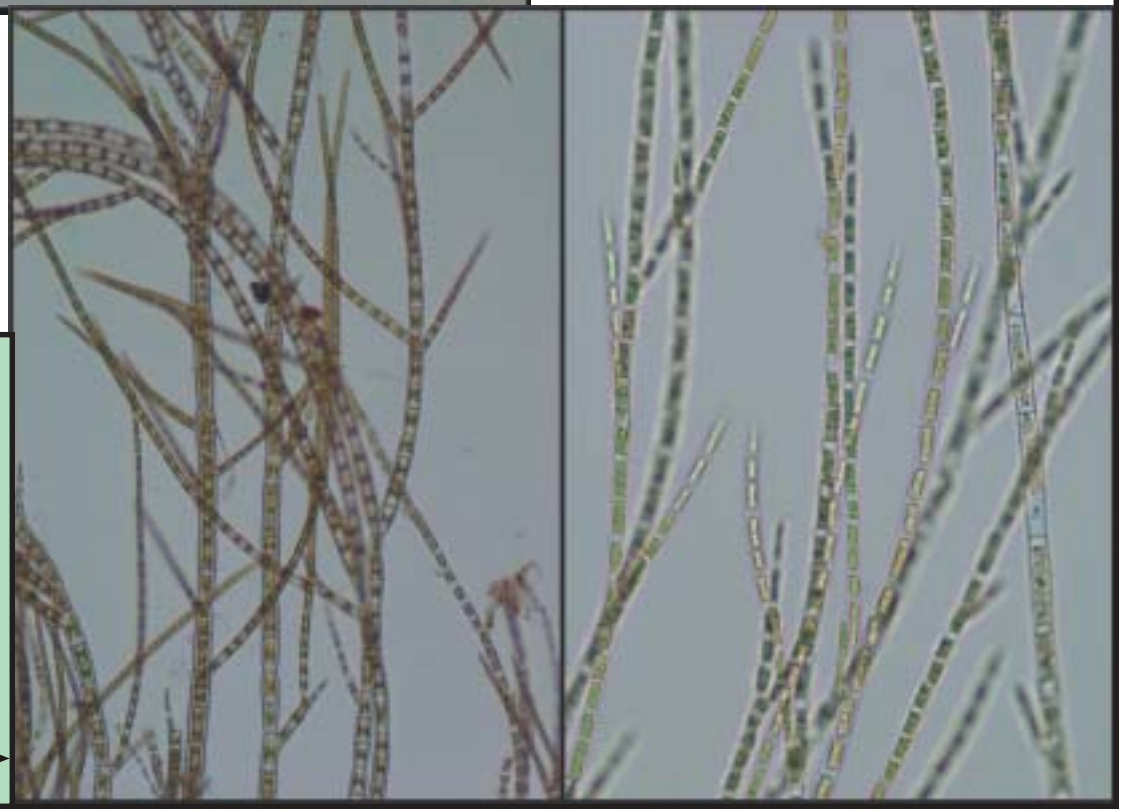
***Cladophora*** - filaments are branched, with more branches appearing toward the tips of the filaments. Under the microscope the chloroplasts seem to fill the entire cell (the cell looks like it is densely filled with dark colored material). Clumps of this alga are usually quite coarse when you touch them (not slimy).

***Rhizoclonium*** - filaments are unbranched, but otherwise look very much like *Cladophora* (above). In the stream this alga appears as long, dark green filaments.

***Cloniophora*** - filaments are branched. The plants are usually a grass-green color and are quite small when seen in the stream, although as a group they can cover a fairly large area. Under the microscope the chloroplasts (especially on the main axis of the plant) can be seen as bands that wrap around the cell. The diameter of the branches is substantially less than the diameter of the main

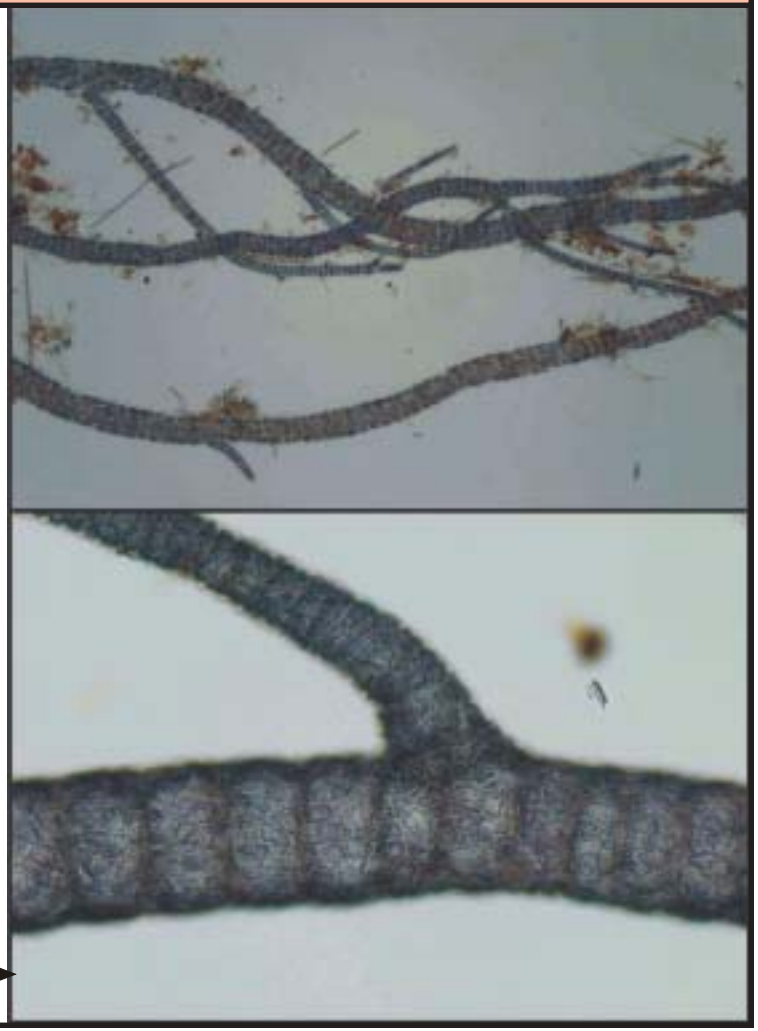


***Desmidium*** - filaments of this alga are unbranched. They appear as a clump of yellow-green filaments in the stream. Under the microscope the cells appear fancy or decorated, with small notches along the upper and lower sides of the cells.

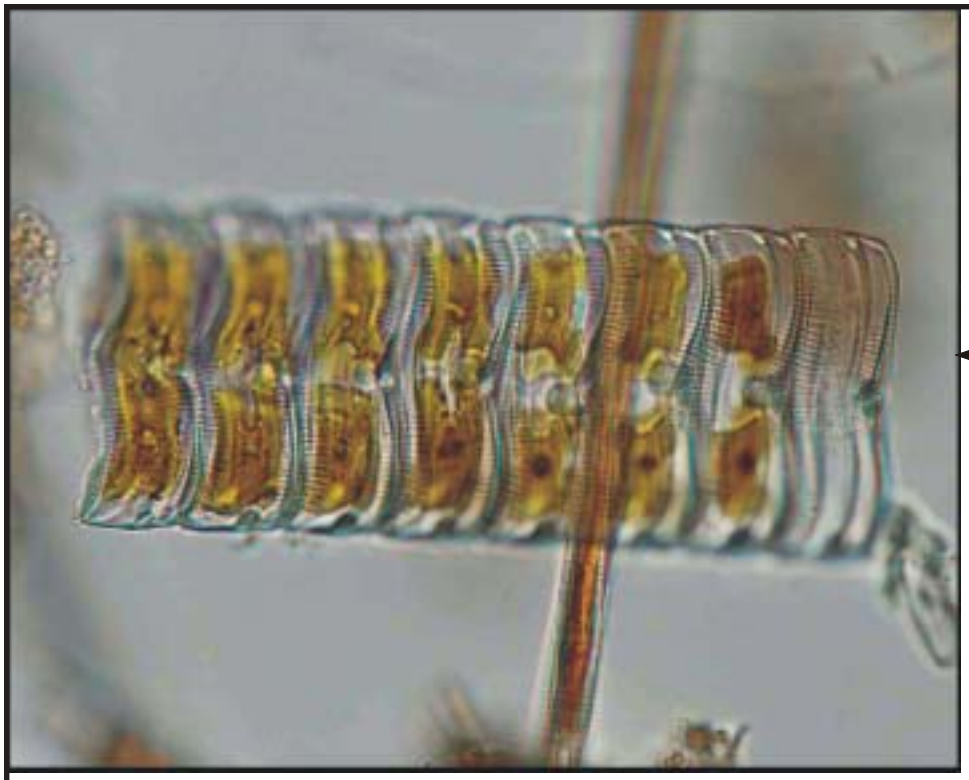


***Stigeoclonium*** - filaments are branched, and the diameter of the branches is not obviously much smaller than the diameter of the main axis. In the stream this alga appears as yellow-green feathery tufts. Under the microscope the chloroplasts (especially on the main axis) can be seen as bands that circle around the cell.

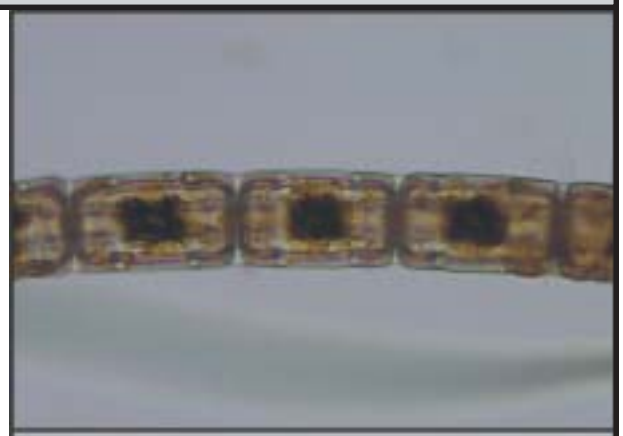
***Audouinella*** - in the stream these appear either as grey-blue tufts on rocks, or as red-purple tufts on mosses. Under the microscope you can see the blue or red colored chloroplasts in the cells. The filaments are branched, and often have rounded, larger cells at the tips (monosporangia).



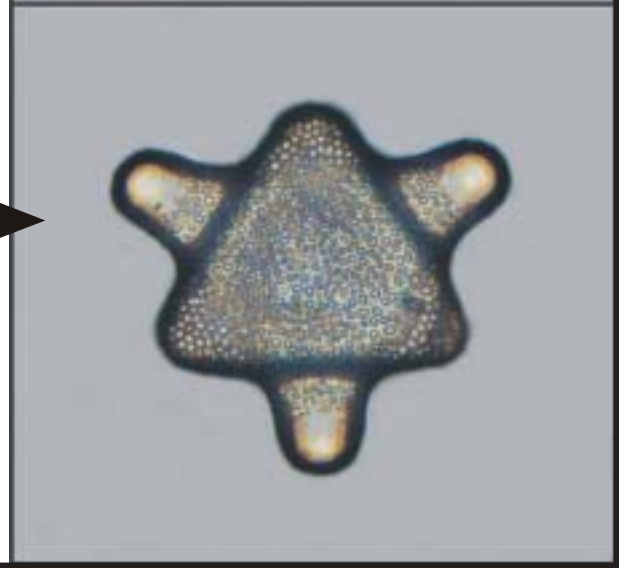
***Compsopogon*** - in the stream this alga appears as grey-blue or green-blue filaments, which can be quite coarse feeling when you touch them. Filaments are branched. Under the microscope the large parts of the filaments can be seen to be covered with small cells (cortical cells), which are blue-grey in color.



***Achnanthes*** - this alga can typically only be seen in detail under the microscope. Cells stack together to form short, unbranched filaments, which seem to be rippled along their length. Some decorations or ornamentations can be seen on the cell walls.

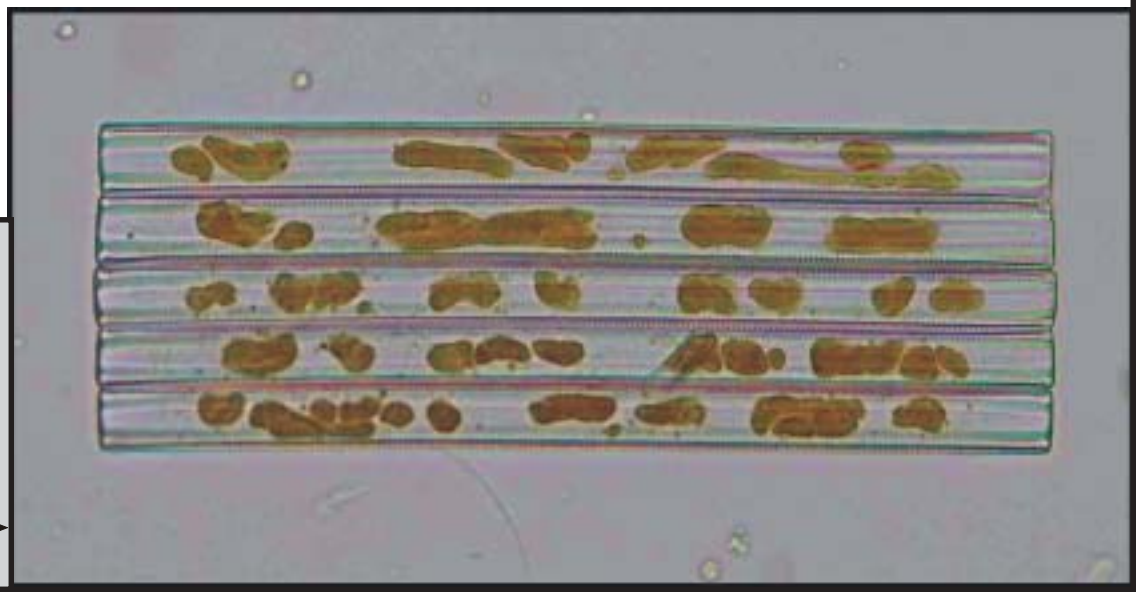


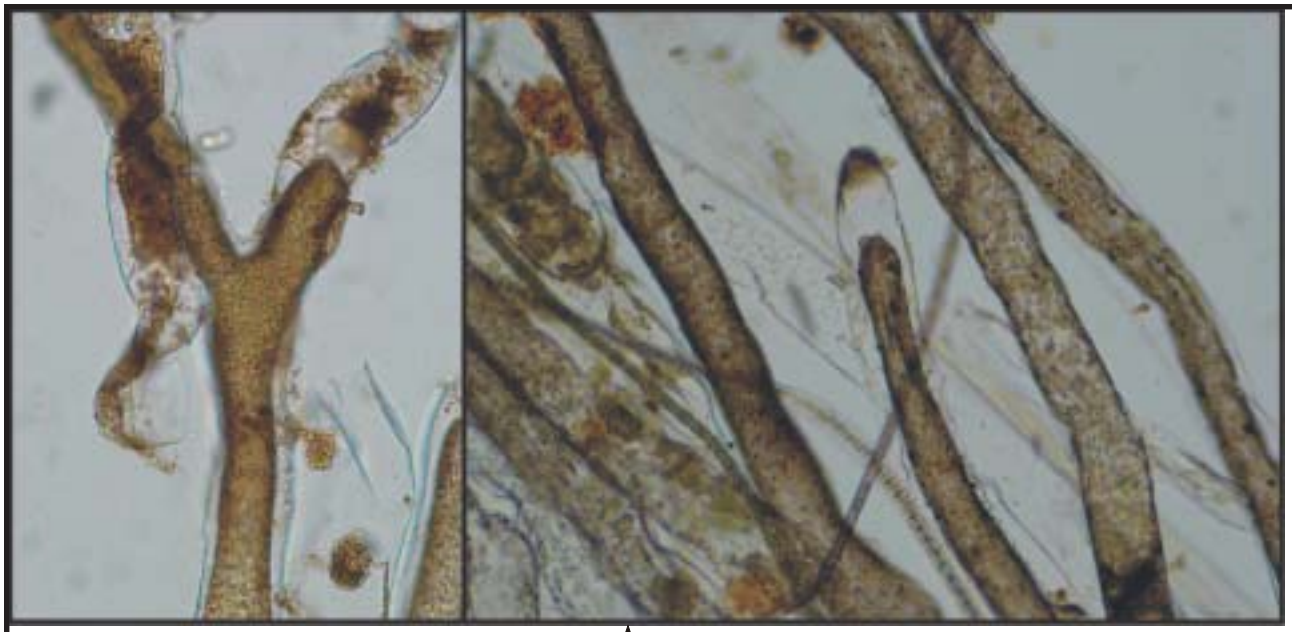
***Hydrosera*** - cells can be linked together in quite long filaments. In the stream these can sometimes be seen as brown colored filaments covering mosses. Under the microscope the individually linked cells can be seen. When cells break off the end of the filament and flip over in the other view, they can be seen as six-pointed cells (see photo at right).



***Melosira*** - cells link together to form long, unbranched filaments. Cells are cylindrical and very regular in appearance. Several brown or golden chloroplasts can be seen within the cells. In the stream these appear as golden filaments growing on different kinds of surfaces, such as rocks, sticks and plants.

***Synedra*** - cells link together to form short stacks, which are sometimes joined together in radiating clusters. Under the microscope the chloroplasts can be seen as golden-brown colored blobs within the cells.





***Vaucheria*** - filaments are branched, and usually grass-green in color or a yellow-green color. They can form thick mats within the stream or on damp walls. Under the microscope you can see that they do not have most cross walls (walls that divide the filaments into individual cells). The chloroplasts can be seen as a large number of small, round discs inside the filaments.