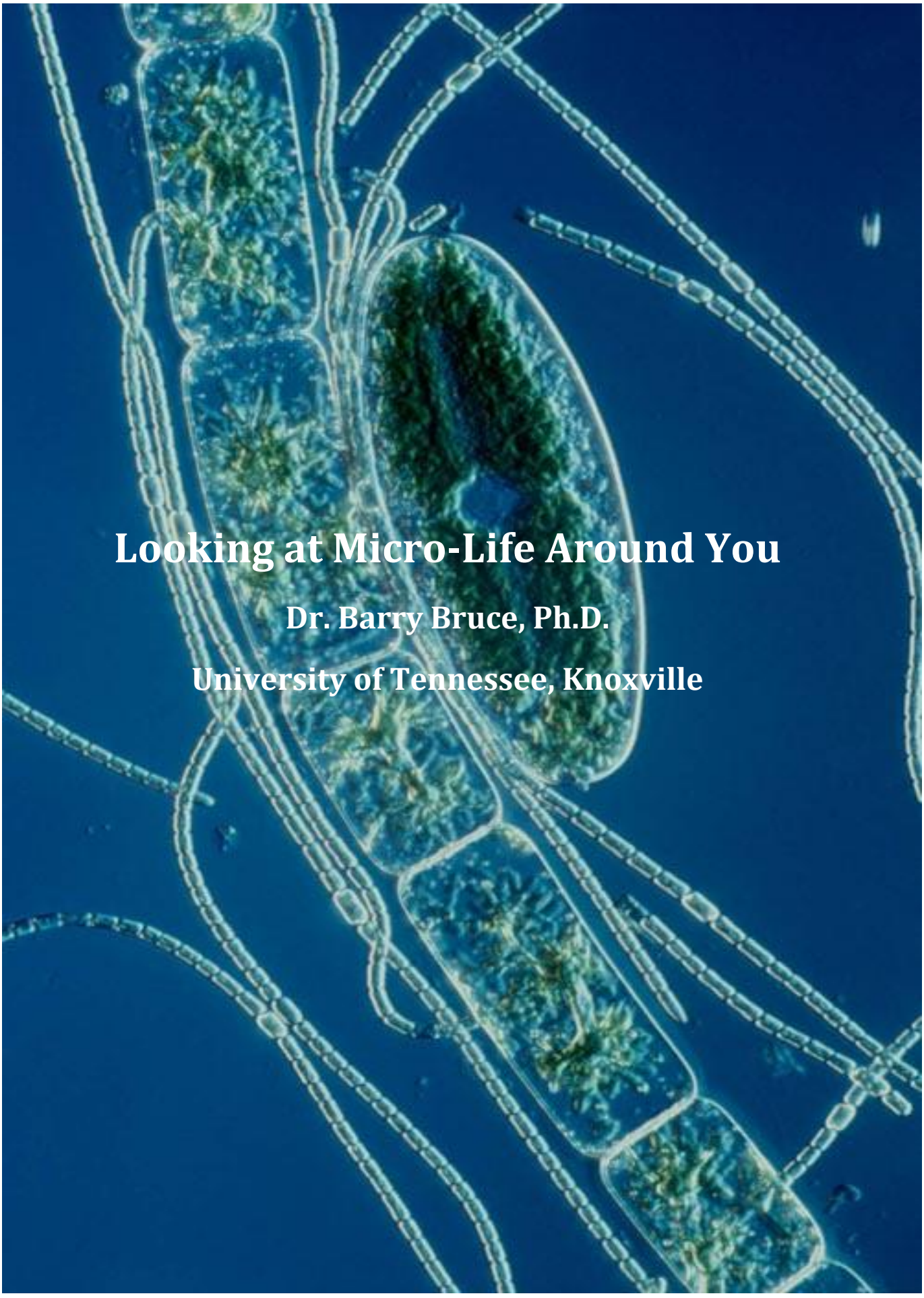


Looking at Micro-Life Around You

Dr. Barry Bruce, Ph.D.

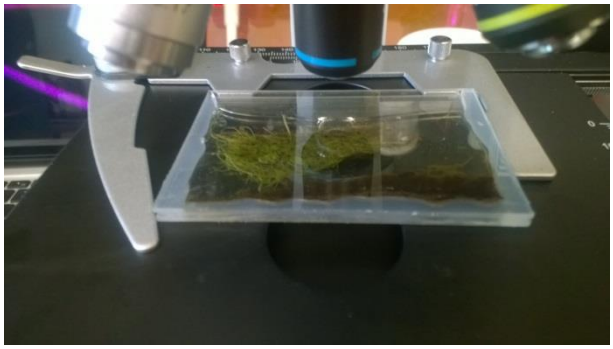
University of Tennessee, Knoxville

Making the Micro-Aquarium

1. Use a pipette to fill the chamber and transfer organisms (add dirt, pond water, and small selection of plant material) to your micro-aquarium
2. Cover the top of the aquarium so it does not dry out.
3. The micro-aquarium is best maintained at room temperature in diffuse light (room lighting will be adequate).

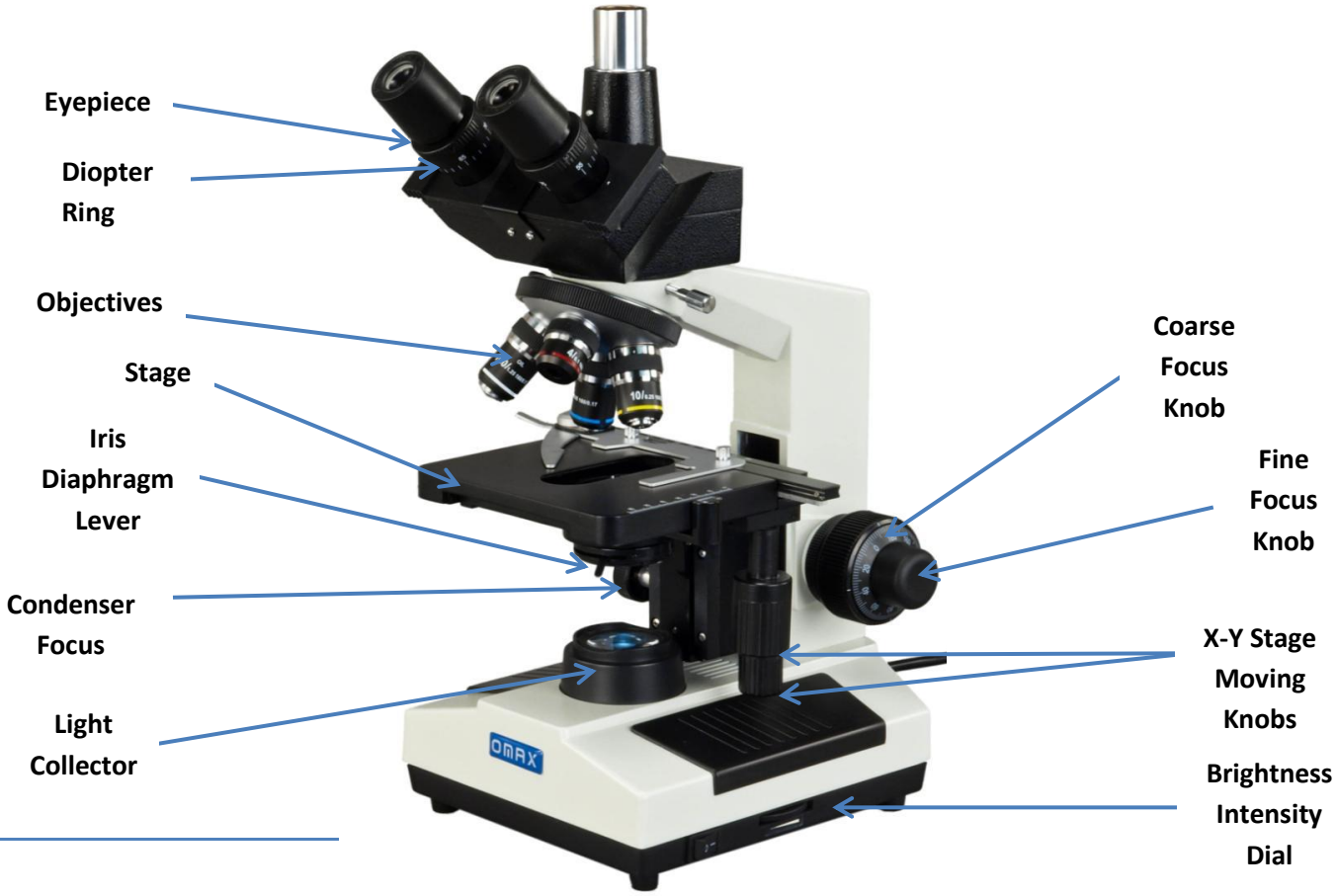
4. **Guidelines for Use:**
    1. The MicroAquarium can be easily broken by pressure to the face of the glass. To avoid breaking handle by the edges, and do not press on the face of the glass.

    2. When laid flat on the microscope without the lid the micro-aquarium will not spill, due to **capillary retention of water**. Adhesion of water to the walls of a vessel will cause an upward force on the liquid at the edges and result in a meniscus which turns upward. The surface tension acts to hold the surface intact**.** Capillary action occurs when the adhesion to the walls is stronger than the cohesive forces between the liquid molecules.



    3. Tilting the micro-aquarium or holding it upside down will spill the contents. Therefore use of the lid is recommended.

Using the Microscope

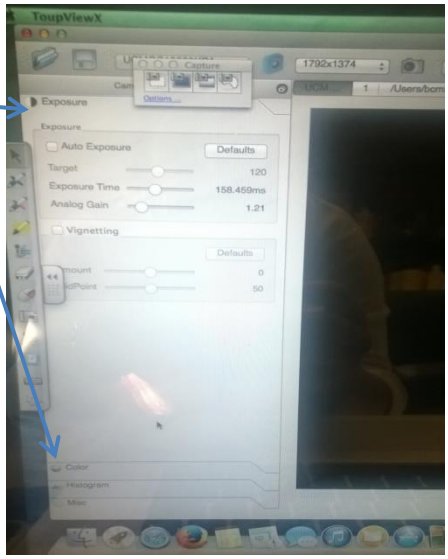


1. **Adjusting the eyepiece:** Using the 10X objective slide the eyepiece tubes in and out and when the left and right fields of view converge completely into one image. Rotate the diopter rings on the eyepiece tubes until its numerical value is the same your interpupillary distance. For example, if there is a distance of 70 then set the diopter at 70.

2. **Focusing:** With the 10X objective in position, raise the mechanical state using the coarse focus knob until the specimen is close to the objective and in focus. Use the fine focus knob to obtain a sharp image. After the image in is focus the 20X objective can be used. **NOTE*** To fine focus your picture on the computer screen the fine focus will need to be adjusted approximately 10-11 (on the 10X**

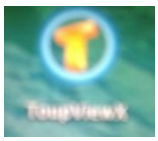
objective) numerical numbers counterclockwise using the right fine focus knob for a sharp focus on your picture. On the 20X it will be approximately 35 numerical numbers counterclockwise using the fine focus knob.

3. **Controlling the Lighting:** Lighting can be controlled by moving the brightness intensity dial and iris diaphragm lever for the microscope image. **NOTE**** **For your picture on the computer light should be adjusted on the computer screen rather than the microscope. Use the color and exposure icons on the ToupViewX program to adjust the lighting.**

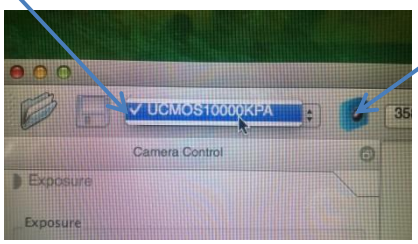


Starting the Microscope Program

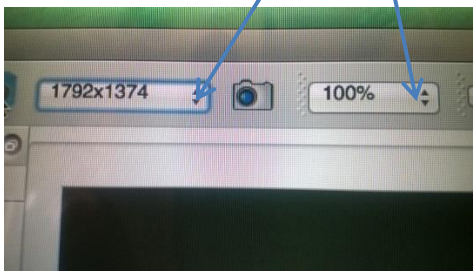
1. Click the **ToupViewX** icon



2. Pull up the camera by selecting **UCMOS10000KPA** at the top of the screen and click the **camera** icon next to it.

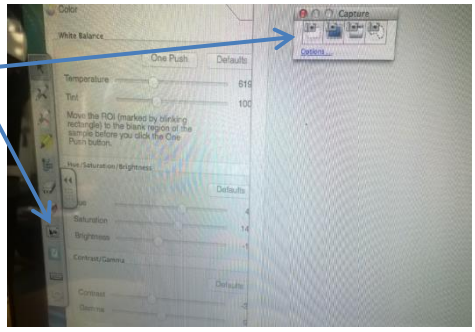


3. Scale down to **1792 X 1374** and **50%** at the top of the screen.

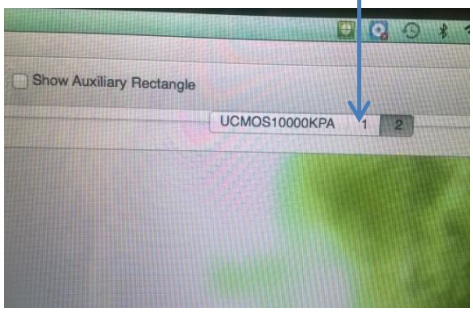


Taking a Picture

1. Click the camera snapshot icon on the left of the screen
2. Capture option box will come up



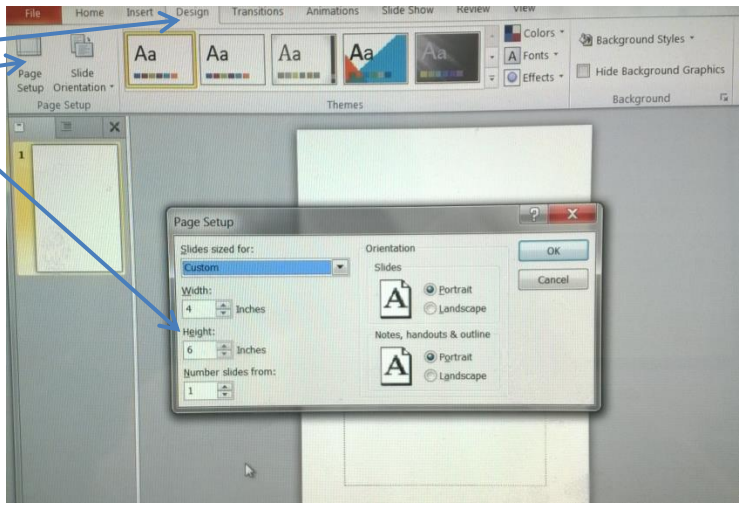
3. Chose to capture an area or full screen
4. View your picture by clicking the number of the picture displayed at the top of the screen. Then save the picture as a tiff image.



5. Saving the image as a tiff
    a. Select file on the image then select export file and save as an image then select tiff.

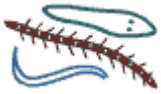
Printing the Picture

1. Open PowerPoint
2. Import the picture in PowerPoint setting the slide design to 4 X 6
3. Setting the slide size on PowerPoint
    a. Click Design
    b. Page Setup
    c. Customize width and height
4. Print the picture by selecting file, then print, and selecting the hp photosmart 140 series printer.



~ Pond Life Identification Kit ~

A simple guide to small and microscopic pond life
with links to Micscape resources

Group		Key features
Bacteria		single celled, dots or strands, just visible with strongest magnification, cyanobacteria are larger
Protozoa		single celled, with tiny hairs or pseudopodia
Algae		single celled, mostly green, sometimes yellow-brown
Rotifers		wheel-like, hairy appendages, transparent, free swimming or attached 0.2 - 1 mm
Gastrotrichs		two tails, hairy, round mouth opening 0.1 - 0.5 mm
Worms		long thin body, many non related forms
Bryozoa		plant-like or jelly-like colony, crown of tentacles individuals: 0.25 - 5 mm
Hydra		green brown or colourless, body and tentacles contract and stretch extended: 20 mm
Water bears (Tardigrades)		8 stumpy legs, slow moving <1 mm See gallery links on the right for some of the finest video clips on the Web of these cute critters!
Arthropods		jointed limbs; many groups e.g. crustaceans ('water fleas'), mites
other Arthropods: Insect stages		wide variety of forms

Protozoa~ Some common freshwater types with links to Micscape resources

Protozoa are a very diverse group of organisms that vary widely in size, shape, features and habit. This page gives an overview of some commonly found freshwater protozoa.

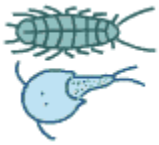
The protozoa have been grouped by their major features. Some of these are artificial groups (i.e. not necessarily related to their taxonomy) but are convenient ones for the pond dipper. More about the classification of algae and protozoa.

Group		Key features
Flagellates (those that photosynthesise are often classed as algae)		one or more flagella (whip-like cilia), phytoflagellates are green/ photosynthesise, zooflagellates are not green <0.4 mm
Amoeba		move with pseudopods 0.02 - 5 mm
Shelled amoeba		amoeba with a shell e.g. of sand grains 0.1 - 0.4 mm
Heliozoans 'Sun animalcules'		immobile, spherical with radiating hair-like pseudopods 0.01 - 1 mm
Ciliates - Peritrichs		cylindrical or bell-shaped bodies, undulating membrane of cilia, some stalked, often colonial and attached to animals or plants bell: <0.25mm
Ciliates - Suctoria		on water plants and other animals, adult ciliates have lost cilia, sticky tentacles capture prey <0.7 mm
Other ciliates	 *Coleps*  *Lacrymaria*  *Paramecium*  *Stentor*  *Spirostomum*	various, mostly free living forms cell usually of a fixed shape but can be contractile, or extending neck, cilia of various forms, fixed mouth 0.01 - 4 mm

Arthropods~ Some smaller freshwater types with links to Micscape resources

Arthropods are characterised by jointed limbs and include major groups like the crustacea, insects, spiders and mites. They have many segments, a tough outer skeleton and many modified limbs. There are many microscopic and macroscopic types that occur in freshwater.

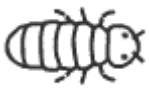
Notes:
There are several other groups with limb-like structures that aren't arthropods. Check rotifers and hydra on the first page.

Group		key features
Crustacea - Ostracods		bean-like shell <2 mm
Crustacea - Copepods		long antennae, tiny eyespot: 0.5 - 3 mm
Crustacea - Water fleas 'Cladocera'		antennae, large compound eye 0.3 - several mm
Water bears (Tardigrades)		8 stumpy legs body <1 mm See gallery links on the right for some of the finest video clips on the Web of these cute critters!
Water mites		8 legs, round body 0.5 - 5 mm
Mosquito larvae (e.g. fly)		long body, often moves in S-shaped curves 1 - 20 mm
Other Insect stages		wide variety of forms >1 mm
Some larger freshwater crustacea - where Micscape has resources		Water louse (isopod) 10 mmFairy shrimp 10 cm and tadpole shrimp (branchiopods) 10 mm
Freshwater shrimps (not true shrimps but amphipods)		curved, compressed body centimeter 25 mm

Insect stages ~ Some larvae, nymphs and adult insects that live in freshwater

In pond water you will come across many insects, often perfectly adapted to the aquatic environment. Some species are entirely aquatic, whereas other insects only live in the water during their larval stages or as nymphs. When insects undergo a metamorphosis we call the immature form larva. When they gradually transform via moults into the adult form the young stages are called nymphs. This pages gives a simple overview of these stages and some of the adult forms. There are no Micscape links yet, articles welcomed!

Note on size: Many aquatic insects and their immature stages can vary in size from a few mm to 3cm or more depending on e.g. maturity and species, so sizes have been omitted for most groups. The shape and general features are a more reliable guide to a group than size.

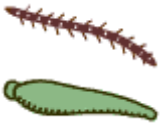
Group		key features
Alderfly nymph		one tail, long filaments along the abdomen
Caddisfly larva		most species build a cylindrical case for protection, each species makes a distinct case from different material
Stonefly nymph		two jointed tails
Mayfly nymph		three jointed tails, leaf-like (or other shaped) 'gills' on its sides
Damselfly nymph		three leaf-like tail appendages (gills), bizarre extendable jaws
Dragonfly nymph		robust, no tail appendages, bizarre extendable jaws
Water bug nymph/adult		no jaws, like all water bugs they possess a tube-like beak, the nymphs don't have wings, Some common forms: Backswimmer, water boatman. On the water surface: Pond skater
Water-beetle larva		strong jaws, long segmented body, short legs
Water beetle adult		strong jaws, tough shield, many water beetles are fierce predators
Springtail		the grey spring-tail (the most primitive insect group) *Podura aquatica* lives on the surface of the water, often in large numbers, 0.5-2.5mm Visit the Postal Microscopical Society (UK) Springtail Group site for overview and projects

Mosquito larva		with a long slender body, often moves in S-shaped curves,
Dronefly larva		this so called rat-tailed maggot has a long tubed tail for breathing
Other Arthropods that are not insects		Go to arthropods overview: e.g. ostracods, copepods, water fleas, mites etc.

Worms ~ Some common freshwater types with links to Micscape resources

There are a number of groups of worms that occur in freshwater. Many aren't microscopic but are shown here to give an overview of these groups. Some common organisms that may be confused for a worm are also included.

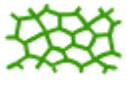
Note: this table isn't comprehensive, there are several other freshwater groups like ribbonworms and horsehair worms.

Group		Key features
Flatworms (Platyhelminthes)		flattened, 2 or more eye spots, move in gliding fashion 1 - 15+ mm
Segmented worms (Annelids)		oligochaetes: 1.5 mm. to >2cm long, hair bundles, (includes earthworm and *Tubifex*) leeches: characteristic 'leech-like' motion, suckers each end >1 cm
Roundworms (Nematodes)		move very frantically, often in 'S' curves, 0.2 - 10 mm
not to be mistaken for worms:		*Hydra*, has tentacles extended: 2 cm
		larger ciliated protozoa like *Spirostomum* (has very fast contraction)
		insect stages like mosquito larva, these have a more distinct head than the worms above, also antennae/legs

Algae ~ Some common freshwater types with links to Micscape resources

Algae are a very diverse group of organisms that vary widely in size, shape, colour and habit. Ten or so phyla are represented in freshwater. This page gives an overview of some commonly found freshwater algae.

The algae have been grouped by their major features. Some of these are artificial groups (i.e. not necessarily related to their taxonomy) but are convenient ones for the pond dipper. More about the classification of algae and protozoa.

Group		Key features
Flagellated forms (some are also often classed as protozoa) note: These flagella are hardly visible, only with strong magnification.		
Euglenoids		green, flagella (whip-like cilia), free-swimming, red eye spot, body is flexible <0.4 mm
Dinoflagellates		brown, 2 flagella, (1 in girdle), free-swimming, tough armour <0.4 mm
Green algae (Chlorophyta)		spherical colonies, cells with 2 flagella Volvox: 0.5 - 2mm
not all green algae are green		tiny, green/red, often in bird baths <0.05 mm
Non-flagellated forms		
Blue-green algae (cyanobacteria)		blue-green, often slow locomotion, used to be considered algae but more related to bacteria cells<0.05 mm colonies can be many mm
Diatoms		usually brownish, silica cell wall in two parts, solitary or colonial, some have a slow gliding motion <0.5 mm
Desmids (Gamophyta: conjugating green algae)		green, no flagella, mainly solitary, some colonial, various shapes, two semi-cells which are mirror images <0.5 mm
Green algae (Chlorophyta)		green, don't move, no flagella, not attached to a surface starshaped colony: Pediastrum <0.3 mm bottom right: Scenedesmus <0.03 mm
Other algae of various growth forms		
Water net		a sock-like colony, green algae (related to Pediastrum) up to 20 centimeters

Filamentous forms		
Pond scum (Gamophyta: conjugating green algae)		non-branching, green, chains of cells with distinctly shaped cell contents cell with <0.1 mm. length: centimeters
Other non-branching forms		several non related groups
Branching forms		mostly green algae
Red algae (Rhodophyta)		mainly marine, but some freshwater forms, not always red