

# CHAPTER 1

NOTE: All of these activities are optional. Choose the ones that are most appropriate for your student(s).

## ACTIVITY 1.1: Make a Paramecium puzzle

This activity is very flexible. It can be art-intensive with a lot of drawing and coloring, or you can use a pre-printed picture that requires no coloring at all. (A pre-printed design is available in the CONSUMABLE section at the back of this book. You also have the option of going online and downloading an image. In this book we are under copyright restrictions when it comes to providing images, but for you to download an image for personal use is fine.)

Ideally, your puzzle design should be glued to cardboard to make the pieces thick and durable, but if that is not an option you could just use heavy card stock. (If you are really ambitious and have the right equipment, you can make the puzzle out of wood and paint it with acrylic paints.) You can cut the pieces as squiggly shapes or you can cut the picture into squares (which would actually be harder to put together).

If making the puzzle from scratch won't work for you and you'd prefer using pre-cut blank puzzles, see the note at the bottom of the next page.

NOTE: If you are working with older kids who like to do crafts but are a little too old for puzzles, you could suggest that they make the puzzle as a gift for a younger sibling, cousin, or neighbor. Perhaps they could also write a little card to go with it, explaining what the picture is. Writing assignments that have a practical purpose are often met with more enthusiasm than regular "school writing assignments" are.

### You will need:

- A copy of one of the following pattern pages printed onto heavy card stock
- Art supplies for coloring and/or painting the picture (Colored pencils would work well, especially if they are the "Berol Prismacolor" brand.)
- Cardboard: Ideally mat board, the material they use for framing pictures, but you can substitute a cereal box or the cardboard back of an art tablet (which is thicker than cereal box cardboard)
- A waterproof black marker if you will be drawing your own picture
- Scissors (possibly an X-acto craft knife if you are cutting mat board into square pieces)
- White glue (or spray adhesive, especially if you have to print the design on regular paper which will wrinkle if white glue is applied to it)
- A rolling pin and a piece of plastic wrap or foil to cover the puzzle while rolling
- OPTIONAL: A large paintbrush for applying white glue
- OPTIONAL: A sheet of sticky-back plastic laminate to put on the top to protect the image from dirt and water

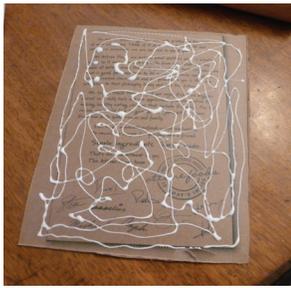
**STEP 1:** Choose whether you want to use the "designed-for-you" pattern or the "do-it-yourself pattern." Copy the pattern onto heavy card stock paper, if possible. If only regular paper is available, so ahead and use it. (TIP: If you use regular paper, you can avoid wrinkle issues when gluing it to the cardboard if you use spray adhesive instead of white glue.)

NOTE: You also have the option of using a photographic image downloaded from the Internet. This would be a good option if you have student(s) who don't like to draw and color or you have very limited class time. Just use Google image search and keywords "paramecium, micrograph."

**STEP 2:** Do all your drawing and coloring. You can use a creative color scheme—you don't have to be realistic. OPTIONAL finishing touch: Put a piece of sticky-back plastic laminate over the finished image to protect it.

**STEP 3:** Glue your picture to a piece of cardboard. Mat board is ideal if you want the pieces to be similar to a real puzzle. (TIP: You can often get page-sized scraps for free at frame shops. They discard "centers" that have been cut out of mats.) However, you can also use the side of a cereal box or similar non-corrugated cardboard. Corrugated cardboard is not recommended.

If you are using white glue, spread the glue on the cardboard and use a large brush, if possible, to spread it around very evenly. (TIP: Small brushes will be useless. You need a large one because you have to get the glue spread around very quickly before it starts to dry.) Make sure there are no blobs or bare spots. Lay the paramecium picture on the cardboard, covering it with a piece of foil or plastic wrap (something that will not stick). Roll with a rolling pin for several minutes to prevent wrinkles. If a rolling pin is not available, you could use a piece of PVC pipe, a wooden cylinder from a building block set, or any other smooth cylindrical object. Even rubbing it with a flat ruler or with the palm of your hand would be better than nothing.



Put glue on cardboard.



Spread glue evenly.



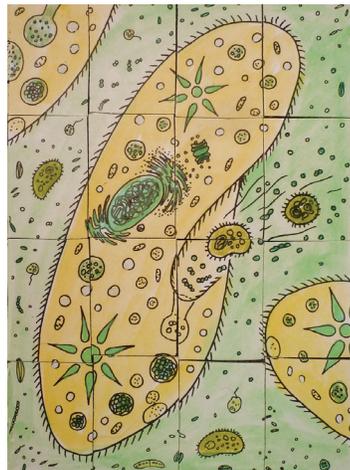
Put on picture.



Put a piece of plastic or foil on top and roll firmly for several minutes.

If you are using spray adhesive, follow direction on can. (Probably you'll spray both sides lightly, let it sit a minute, then stick them together and press firmly. Do not breathe the vapor from the spray adhesive!

**STEP 4:** Allow the puzzle for dry for at least 10-15 minutes (longer if possible), then use scissors to cut the puzzle into pieces. If you make about a dozen pieces the puzzle will be easy to reassemble. Making about 15-18 pieces will be medium difficulty and 20-25 pieces will be challenging.

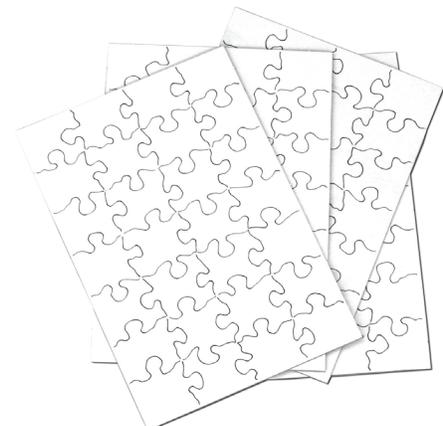


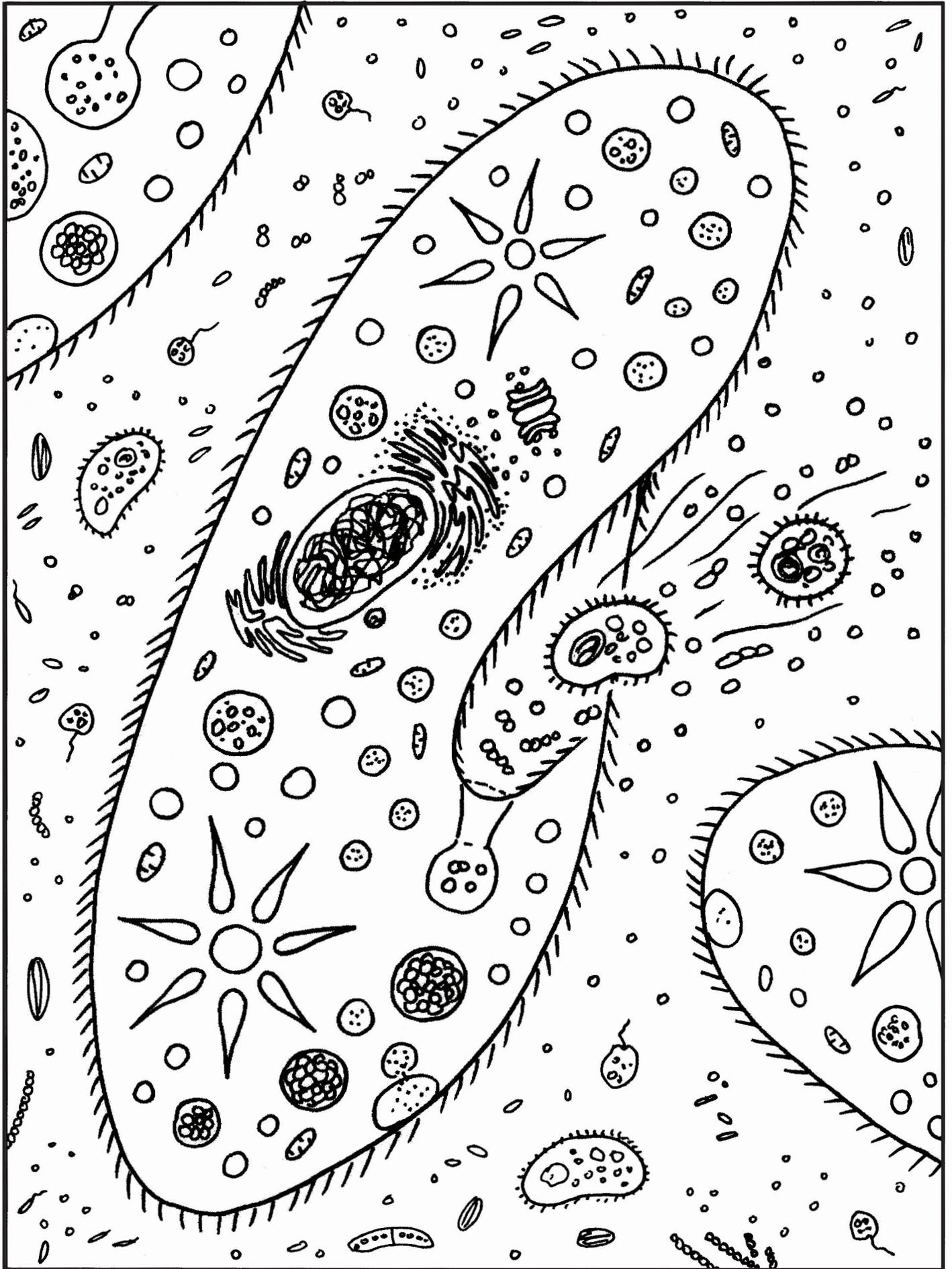
TIP: If you have really good colored pencils (such as Berol Prismacolor) you can lay down a background "wash" of watercolor paint, then apply the pencils after the paint is dry. High quality colored pencils are fairly opaque and even light colors will cover over the paint. This technique was used on the samples in the center and on the right.

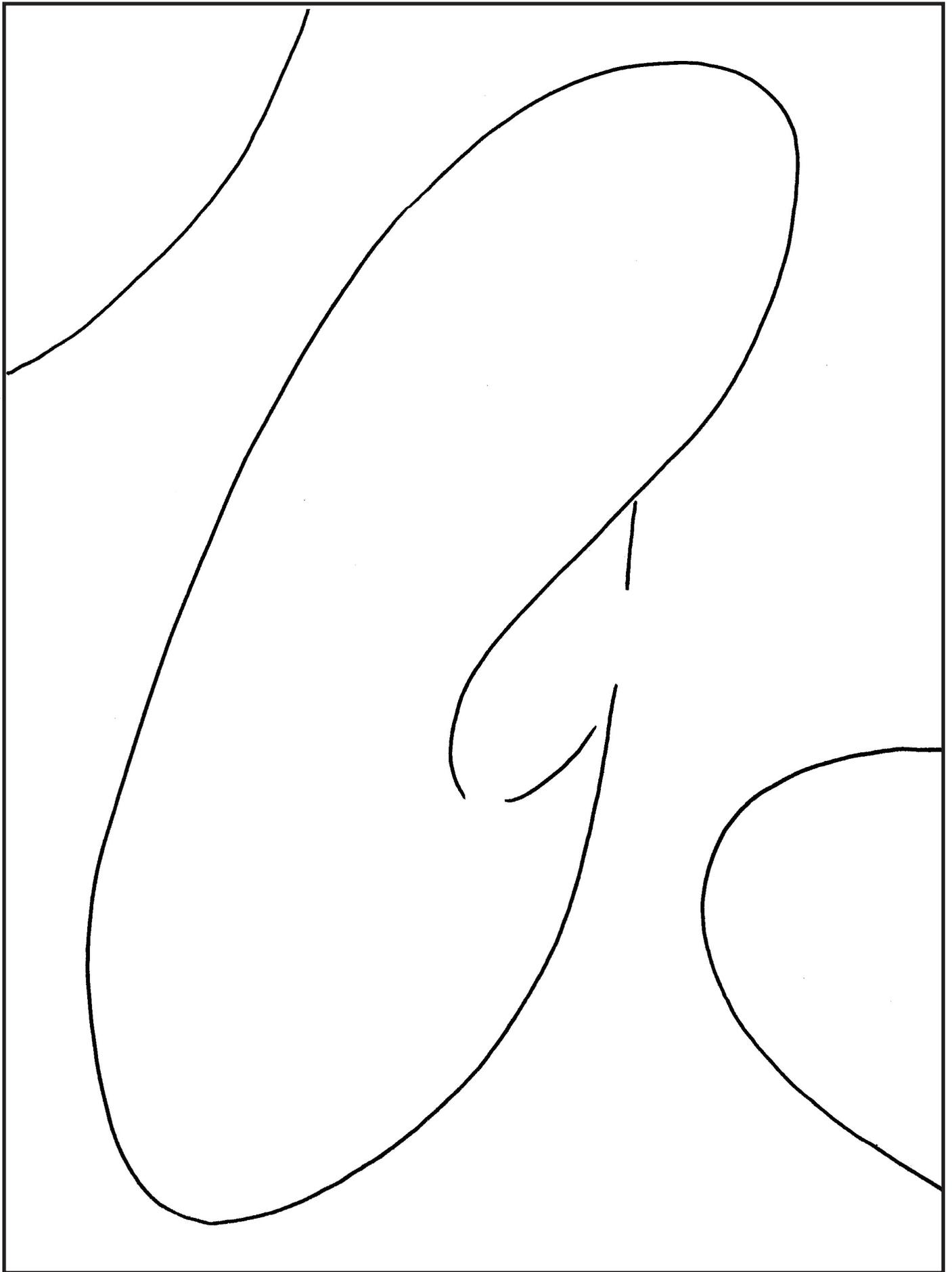
Making the pieces square or rectangular (as in center) will make the puzzle slightly more difficult to put together.

**ANOTHER OPTION:** You can purchase blank puzzles on Amazon.com. They come in bulk packages of 12 or 24 puzzles. The cost per puzzle ranges from 50 cents to one dollar (USD). There is a range of difficulty, from 12 to 64 pieces. The 28-piece puzzle is shown here. (You can find other purchasing options [other than Amazon] by using Google search or a similar search engine.)

For this option, you would want to draw your own picture using acrylic paints or permanent markers. Don't try to glue paper to it.







This is a "dot-it-yourself" pattern with just a few guidelines to get you started.

## ACTIVITY 1.2: Make a Paramecium pillow

This is not necessarily a “girl” activity. The middle school boys in my class were just as enthusiastic about making a pillow as the girls were!

**SUGGESTION:** If you are working with a group, you might want to consider having a few “designated sewers” (even some adult help pulled in for the day) who can stitch quickly and efficiently. If you are taking more than one day to do the project, you could send them home with an adult sewer so that in the following session the students would only need to stuff them and stitch them shut by hand.

**NOTE ABOUT SIZE OF PILLOW:** If you would like to make a pillow that is larger than the pattern provided here, this is very easy to do. Simply print this pattern, then cut it into three pieces and enlarge each piece (by the same percentage) using a photocopier or scanner. If you are using trim, measure around the outside of your new, larger pattern to find the length of the fringe. (HINT: Using the furry fabric is easier.)

### You will need:

- A copy of each pattern page (on regular paper)
- Sharp sewing scissors (for cutting fabric)
- Pins
- Sewing machine, if possible (threaded with white thread)
- Two pieces of white cotton fabric (or cotton/poly blend) each measuring about 11” x 17” (30 x 45 cm)

**NOTE:** Do not use stretchy fabric. If you can find specialty fabric that looks shaggy (like cilia) you could make the reverse side of the pillow hairy—the real texture of a paramecium’s exterior.

- White fringe trim for cilia around edge (unless you are using specially fur on the back) 40” (100 cm)
- Fabric markers
- Iron, if needed for the fabric markers (read the instructions on the marker box)
- Polyfill (stuffing) for pillow
- Needle and thread for hand stitching the pillow shut after filling it

**STEP 1:** Cut out pattern pieces and tape them together.

**STEP 2:** Pin pattern to fabric and cut out paramecium pieces. (NOTE: If you are using fabric that has right/wrong sides, make sure your pieces are cut appropriately so that you have the right sides facing out.)

**STEP 3:** Use fabric markers to draw the cell parts. You can do this freehand, or you can place the pattern under the fabric and trace over the parts. If you have trouble seeing the pattern through the fabric, you could place them on a window so light comes through. The cell parts don’t have to look exactly like the pattern, so don’t be overly concerned about getting things “exact.” The color of the parts is up to the artist, as in real paramecia the parts aren’t colored at all. This is a piece of art so the artists are free to express themselves as long as the parts remain identifiable. If your markers require ironing, do this before proceeding to the next step.

If you want to label the cell parts (not necessary but nice to do if you want something to help you remember what all those things are) use a fine point black permanent marker. Sharpie No-Bleeds work very well for tiny letters. Fine point Sharpies work well for medium-sized lettering. Don’t use the standard size Sharpie—the tip is too large.

**STEP 4:** If you are using two pieces of flat fabric (no furry texture on the back piece) then you will be adding the fringe trim around the edge to represent cilia. Pin the fringe to the inside of one of the pieces of fabric so that the fringe is on the inside of the seam. You can tack it down with masking tape if you have trouble making it stay in place. Make sure the seam of the fringe goes all the way to the edge. Use a basting stitch and sew around the edge to secure the fringe to the fabric, then remove tape.

**STEP 5:** Place the two sides together (right sides together, wrong sides facing out) and pin in place. Carefully stitch a seam around the edge. The dashed line on the pattern shows approximately where the seam should be sewn. Leave a gap somewhere along the seam. This gap will be the hole through which you stuff the pillow in step 6.



STEP 4: You can use masking tape to help secure the fringe. You will also need to pin it around the edges.

**STEP 6:** Turn the pillow right side out. Use “polyfill” or your choice of stuffing to stuff the pillow. TIP: Don’t over-stuff it. It will look better if you let the pillow be slightly flat, not totally round.

**STEP 7:** Use needle and thread to hand stitch the gap through which you stuffed the pillow.

A pillow with two flat sides should have fringe around the edges.

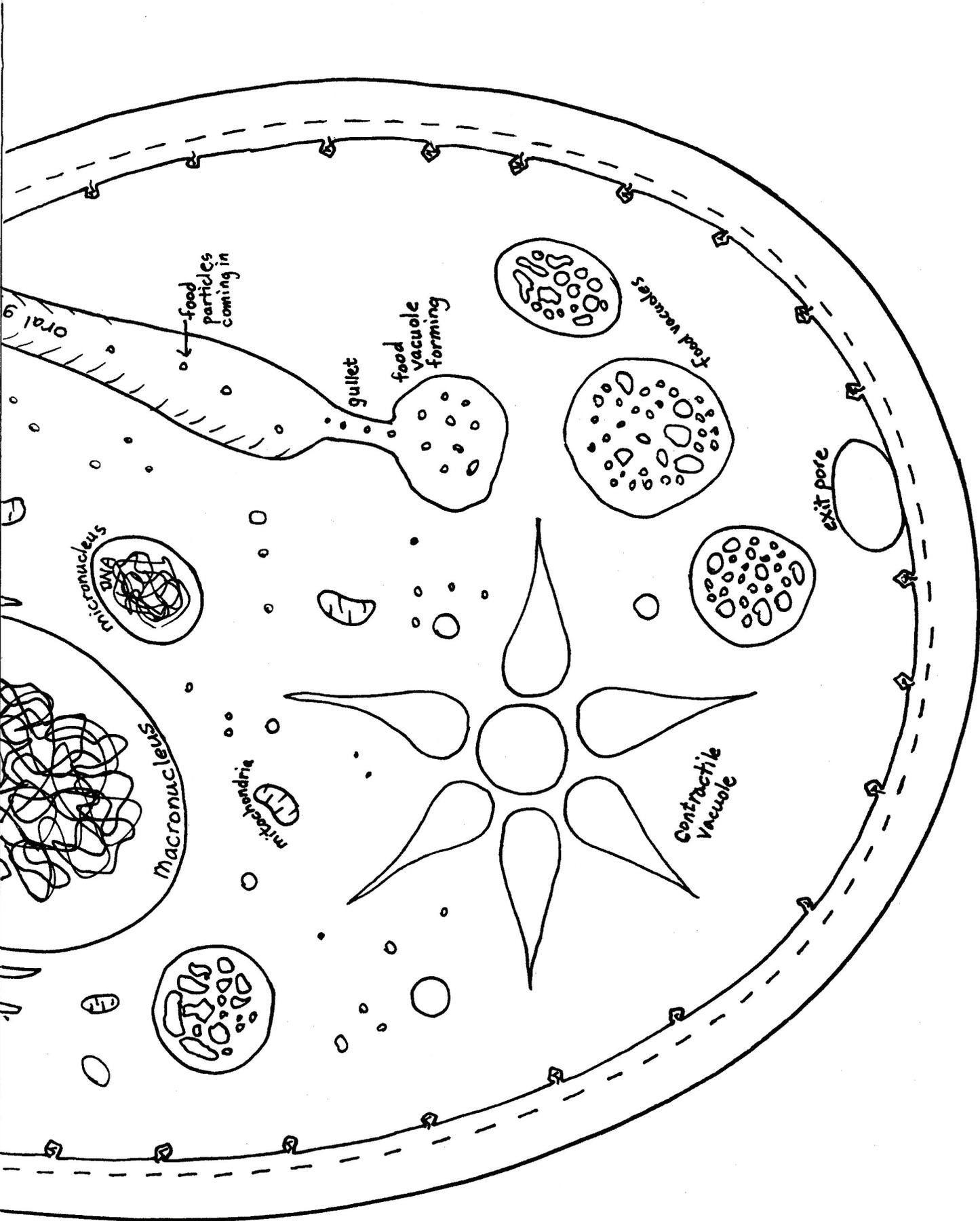


A pillow with a flat side and a furry side doesn't need fringe.

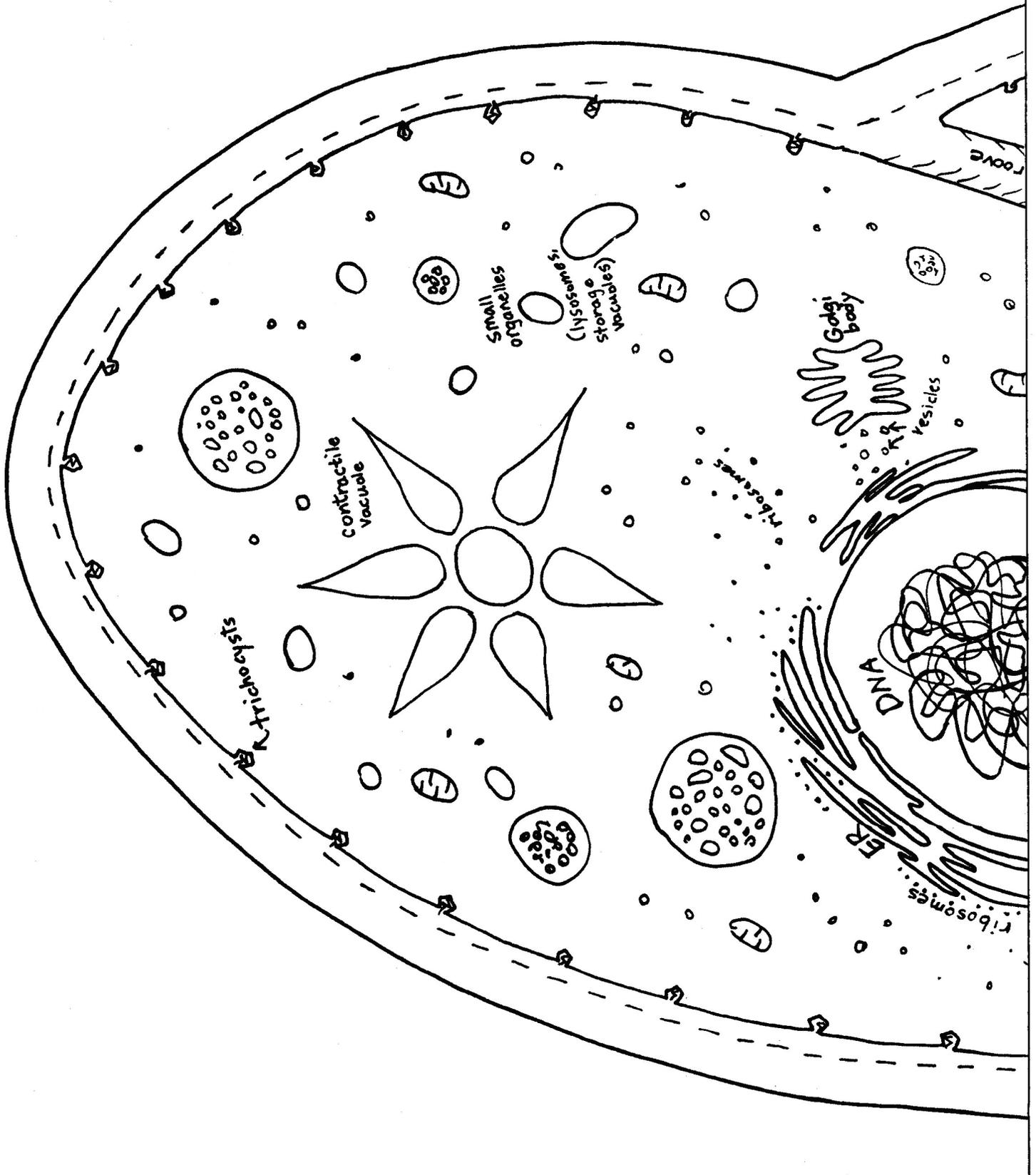


Remind students that the furry side represents the real texture of a paramecium, as seen in SEM images. The painted side represents what we see in TEM images and in compound (light) microscopes. Both are true, but unfortunately, it is impossible to see both at the same time.

PARAMECIUM PILLOW PATTERN -- bottom



PARAMECIUM PILLOW PATTERN -- top



### **ACTIVITY 1.3: DUCKWEED WORD ROOTS (Fun with Greek and Latin)**

In the introduction the students saw a duckweed leaf. Duckweed leaves float on the water with their roots dangling below them. It is an unusual plants, with the roots attached to the back of the leaf. Going with the theme of roots on the back of leaves, here is a game where we have not actual roots, but “word roots” on the back of leaves. The Greek and Latin word roots will be printed onto the backs of paper duckweed leaves.

#### **You will need:**

- A copy of each pattern page printed onto green card stock (or green paper if card stock is not available)
- Scissors

#### **Set up:**

Cut the cards apart on the lines, as rectangles. To make them oval like duckweed leaves, stack several cards (to make cutting faster) and round the corners so that the cards look more like ovals. You will end up with a bunch of green paper duckweed leaves with a word printed onto the back of each one. Now you are ready to play.

#### **How to play:**

Use standard “Memory Match” rules. Take turns turning over two cards. If they match, you keep the pair. If not, you turn them over again. It is up to you whether to allow players who get a match to take another turn. If one player ends up getting three or four matches in a row, it can be demoralizing for some players. Choose the rules that best suit your players.

#### **TIPS:**

- 1) If there seem to be too many cards, just choose a limited number of sets.
- 2) If it would help your students, feel free to make the English words one color and the Greek words another color. (If you have two shades of green, that is ideal. Copy centers usually have several shades of green.)

MIKROS	MAKROS	MULTUS
UNI	ANTE	POST
VACUUS	MILLE	CILIA
PROTO	EX	ENDO
FISSUS	SOMA	CON
ORA	SKOPOS	TRICHO
ZOION	KYTOS	NUCULA

SMALL	LARGE	MANY
ONE	BEFORE	AFTER
EMPTY	1,000	HAIR
FIRST	OUT	INSIDE
SPLIT	BODY	WITH
MOUTH	TO WATCH	HAIR
ANIMAL	CONTAINER	NUT

## ACTIVITY 1.4: Begin your microlife mural

This activity can be used as a review option, after completing all of the chapters. Or, you can work on it a little at a time, making a batch of the critters that were discussed in each chapter.

You have several size options:

Option (1) Make a mini-mural that is only two (or three) pages large. Each student will make their own.

Option (2) Make a small mural using some sheets of poster board as a background.

Option (3) Make a temporary mural by sticking pictures to a wall. Your mural can be as large as your wall.

### For option (1) you will need:

- Two pieces of paper (or card stock) for each student. One of them will have the small boat pattern copied onto it.
- Clear tape (the thin kind is fine)
- Pencils, pens, or colored pencils for drawing the microlife

### For option (2) you will need:

- 4-6 sheets of poster board (or more) depending on how large you want your mural to be
- Clear tape (wide for putting posterboards together, and thin for smaller chores)
- Paper and art supplies for making the creatures (including a black marker)
- A copy of each large boat pattern page (following)

### For option (3) you will need:

- Enlarged copies of the large boat pattern pages (Cut the pages in half and enlarge each of the four sections on a copier (or scan them and enlarge them digitally on your computer). Then assemble the 4 copies with clear tape. You can choose how large you want the creatures to be by controlling the size of the boat. Just remember that the length of the boat represents the size of the larger creatures. If you are filling a wall, the largest creatures could be several feet (half a meter) long, no problem.)
- Paper and art supplies for making the creatures (You could even use fabric or felt if you wanted a “collage” look.)
- Something to adhere the creatures to the wall, such as poster putty, masking tape, etc.

### Directions for option (1):

Put your two pages side by side and tape along the seam on the back. (You don't want tape on the front.) Add a third page if you think you'll need more space to draw. Use a pencil to sketch in your creatures. Don't forget to use the boat to measure! The playing cards at the end of each chapter are a convenient source to draw from, especially since they also give the size. You could also find info on the Internet. See page 140 for a sample of student work. (The sample is actually three pages taped together.)

### Directions for option (2):

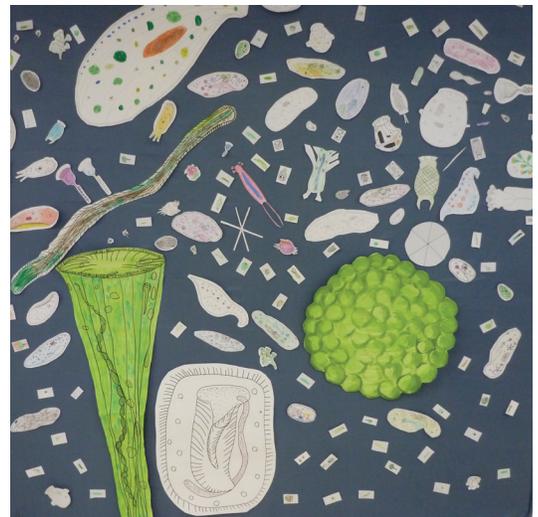
Tape the sheets of posterboard together on the back. If you will be drawing right on the posterboard, make the shiny side the back side. The less shiny side will be easier to draw on. If you will be taping or gluing your creatures on, then it does not matter as much which side you use as the front side.

Glue the picture of the boat to the top of your mural. (Use a black marker to extend the waves to the edges.) Also use your black marker to connect the middle of the boat and add the “500” mark.

Decide whether you will be drawing right on the poster or whether you will make the creatures individually, collecting them as you go along and then assembling all of them after the last chapter. The benefit of waiting until the end to assemble the mural is that you will then be able to plan how to arrange them before sticking them on.

### Directions for option (3):

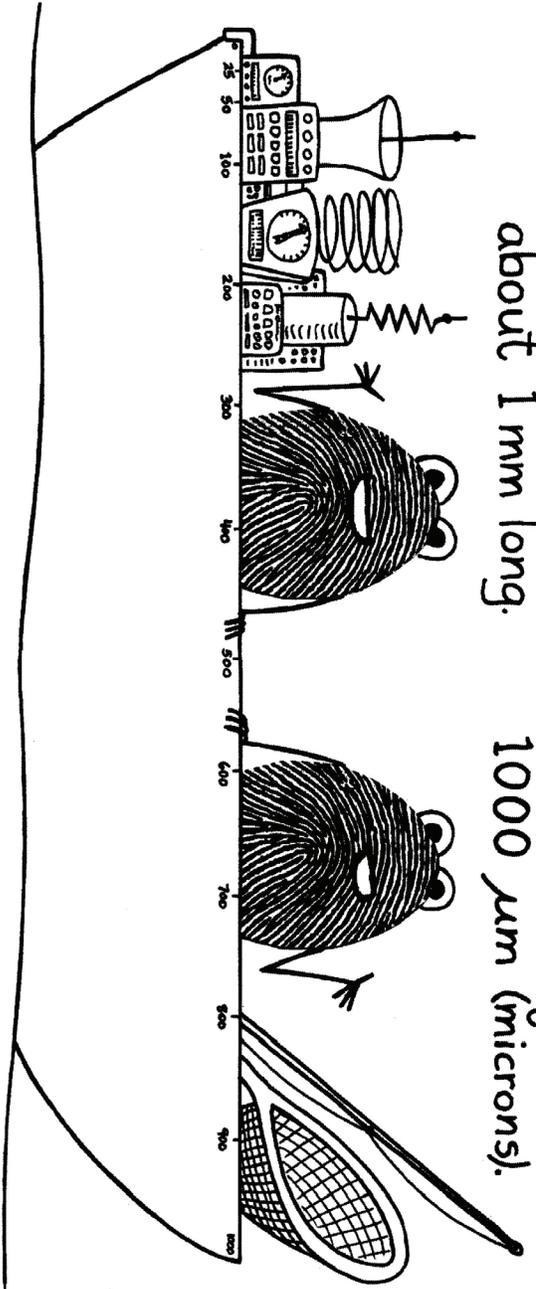
You are kind of on your own for this one. You will have to choose materials that are suitable for your students and your location. Try to get a class picture of your students with their mural.



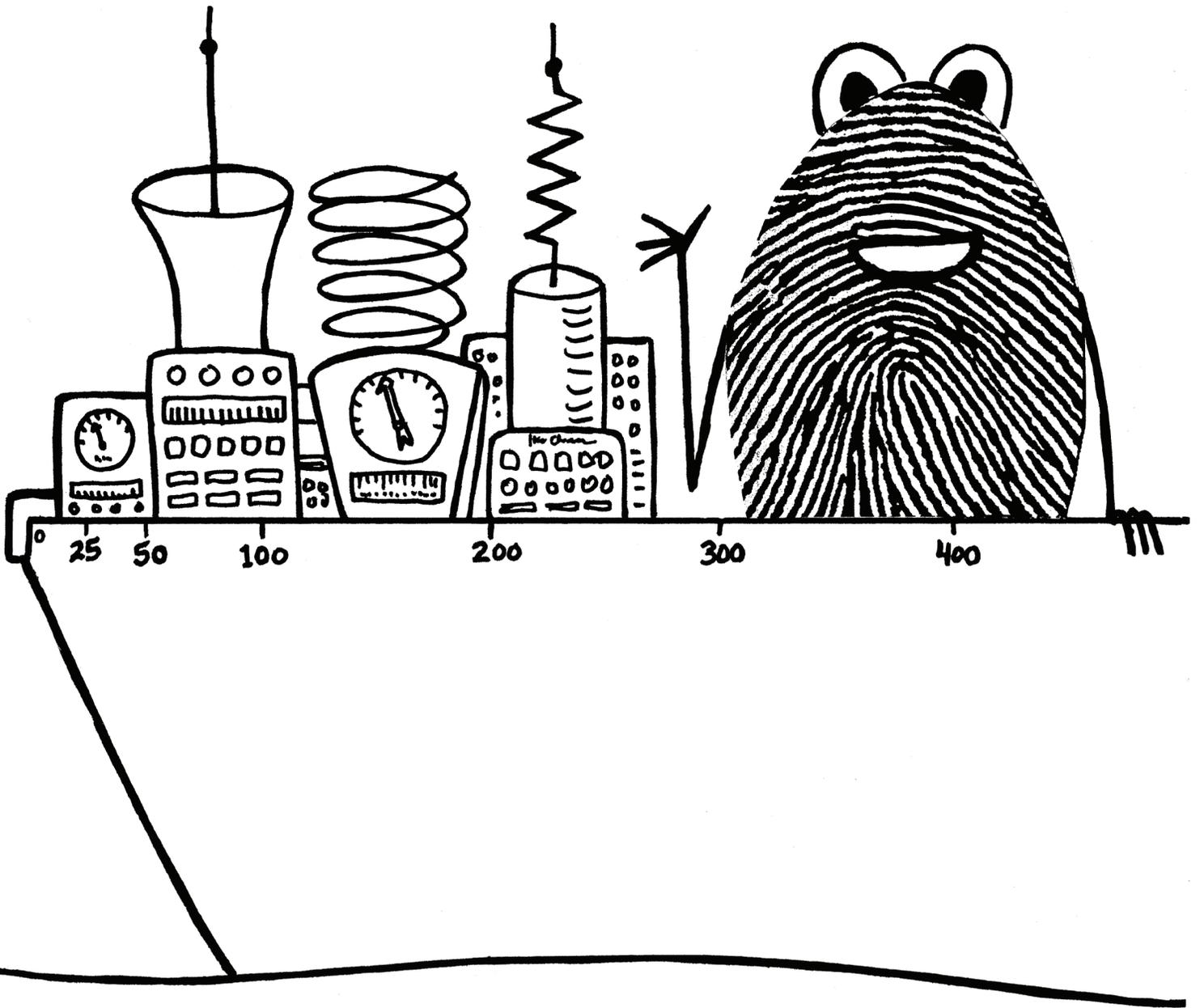
Wall mural done by students in Pennsylvania, fall 2015. (Paper drawings taped to blue sheet.)

Our boat is  
about 1 mm long.

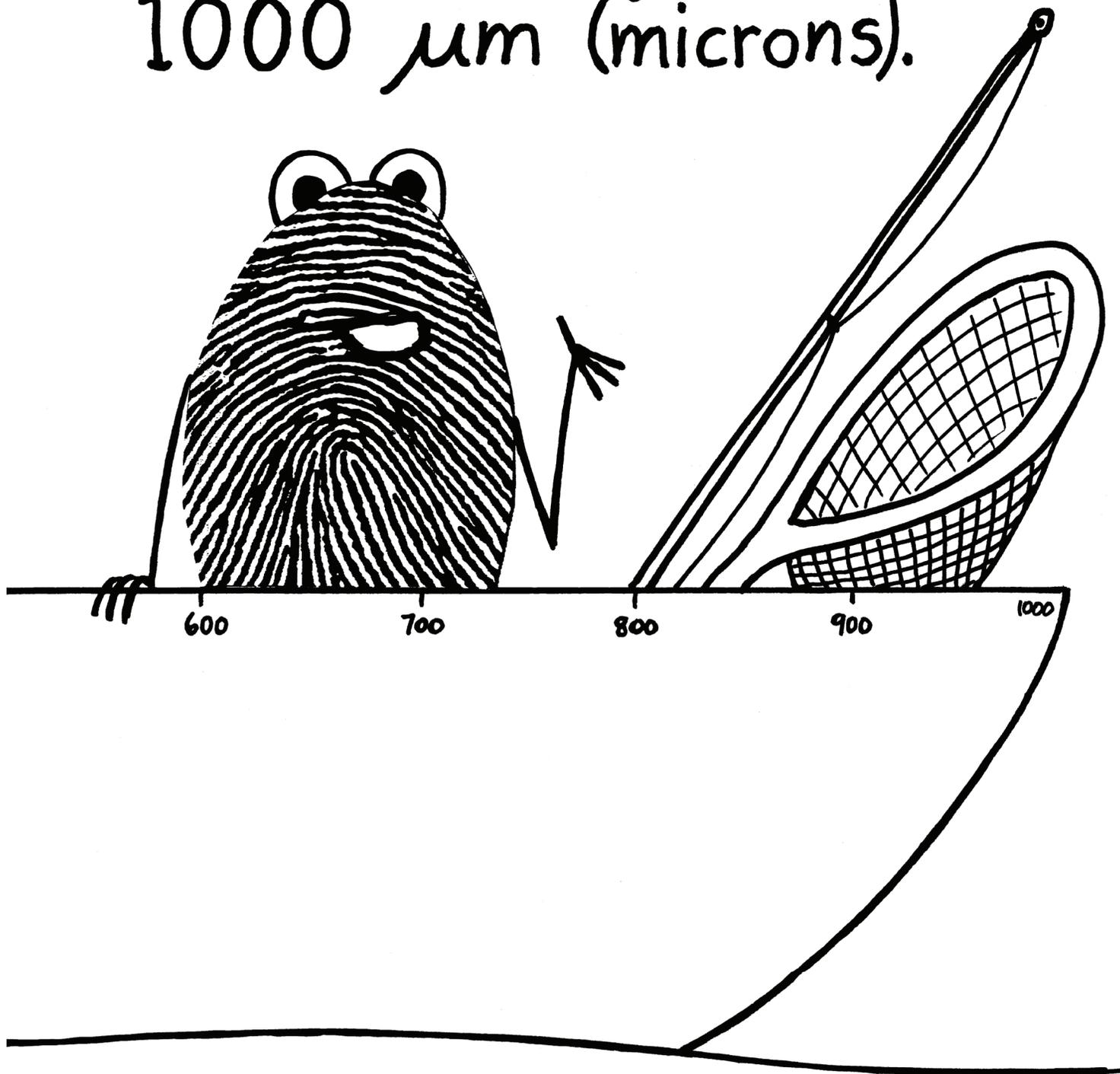
One mm equals  
1000  $\mu\text{m}$  (microns).



Our boat is  
about 1 mm long.



One mm equals  
1000  $\mu\text{m}$  (microns).



## CHAPTER 2

NOTE: All of these activities are optional. Choose the ones that are most appropriate for your student(s).

### ACTIVITY 2.1: Ciliate card games

#### You will need:

- Two copies of each of the following pattern pages printed on heavy card stock (so that the pictures do not show through on the back) NOTE: If you don't have card stock, but you do have colored paper, the colored paper might also prevent the pictures from showing through on the back.
- Scissors

These cards can be used to play a number of different games. You can choose which ideas suit your students best. You can also make up some games of your own! (And make sure to hang on to these cards, as you will be using them again in other chapters.)

#### IDEA #1: Standard "memory" game

Most people have played this game in many different forms. The downside is that it is very familiar. The upside is that it is very familiar. Everyone probably knows the format already. You don't have to spend time teaching everyone how to play.

Just take the two sets of cards and lay them out face down. (You can choose to play with less than all 18 of them. Select as many as your students can handle.) Line them up in a grid. Then take turns choosing two cards. If they match, you keep them. If not, you return them. The player with the most matches wins. It is up to you if you want to allow a player who finds a match to take another bonus turn. (If you want to try to prevent one player from "hogging" all the matches, don't use bonus turns.)

Extra idea: Separate the cards into the two sets. Lay out each set so the cards form the shape of a water drop. (Just do the best you can.) Then you choose a card from each droplet and see if they match.

#### IDEA #2: "Guess who?"

This idea is very straightforward and is also a common format that the players have probably played elsewhere. It is a variation on "20 Questions." One player will be the guesser and one will give the "Yes" or "No" answers. The purpose of the game is to review general information about the ciliates.

Lay all 18 cards out on the table, face up, so you can see all of them. The player who is going to give the answers secretly chooses one of the ciliates. The the guesser starts asking questions that can be answered with "Yes" or "No."

Examples of questions the guesser might ask:

- "Is your ciliate larger than 500 microns?"
- "Is your ciliate cup or cone shaped?"
- "Does your ciliate have any very long cilia?"
- "Is your cilia pear-shaped?"
- "Does your ciliate have stripes of cilia running lengthwise on its body?"
- "Does your ciliate have more than one contractile vacuole?"

The guesser gets ONE shot at guessing. If he is wrong, he "loses" and has to take another turn as the guesser. If he is right, they switch places and the other player becomes the guesser.

### IDEA #3: "Bigger is Better"

This idea is also very simple, but is usually well-received nonetheless. The purpose of this game is to notice relative sizes.

The cards are divided evenly between two players (9 cards each). Keep the half-decks face down. Each player turns over his top card. The smaller of the two ciliates is "out" and is removed from the game. The player with the larger ciliate puts his card onto the bottom of his pile. Then they both draw cards again. The stack of cards that are out of the game will grow with each turn. Eventually, one player will run out of cards. The player that still has cards wins that round.

NOTE: Whenever a range of size is given, use the larger number. For example, Coleps is 50 to 80 microns; use 80. So of Coleps (50- 80) comes up against Colpidium (50- 70), Coleps wins.

### IDEA #4: "Don't Get Nibbled by Coleps!"

This game will work with any number of players.

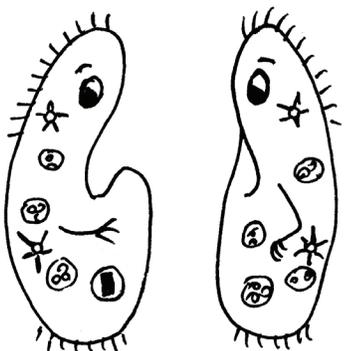
Lay all 18 cards out on the table, face down. Make sure they were well shuffled and no one knows the position of any of the cards. Players will take turns picking up cards, one by one. The object of the game is to NOT pick up Coleps. Coleps is a voracious eater. See those fang-things? Yes, Coleps will rip into anything and try to eat it. Yikes! Your finger could be in danger! Turn over a card and hope it's not Coleps. The player to turn over Coleps loses that round. Play multiple rounds.

OTHER OPTIONS: You could choose any of the cards to be "it." You could also make the scenario that you were looking for a lucky ciliate (Lucky Loxy?), and the player who happens to turn it over wins instead of loses.

### IDEA #5: Silly ciliates

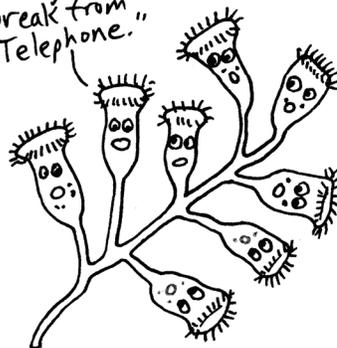
Have each student choose a card. Ask them to draw their ciliate as a funny cartoon character. They may take liberties such as making some cilia longer to look like they might be arms or hands, or adding eyes or mouths so they can see and talk. If you have enough time, make two ciliates (same species or different) talking or interacting with each other and add a caption.

If you need ideas, you can search Google for "cartoon protozoa."

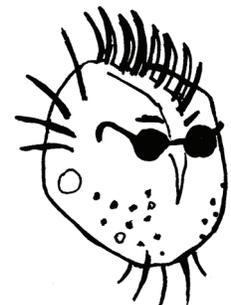


"Did I swallow my cell phone again?"

So what do you guys want to play- Hide + Seek? Tag? Monopoly? I just thought we could take a break from "Telephone."

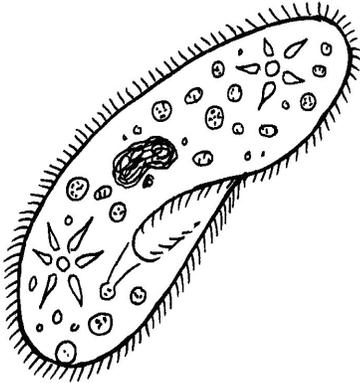


The Epistylis neighbors



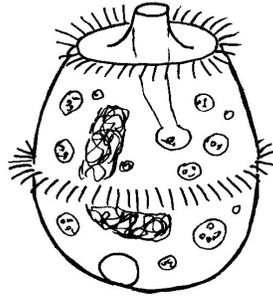
Yo! Ploteze  
A PUNK PROTO

**Paramecium**  
(species caudatum)



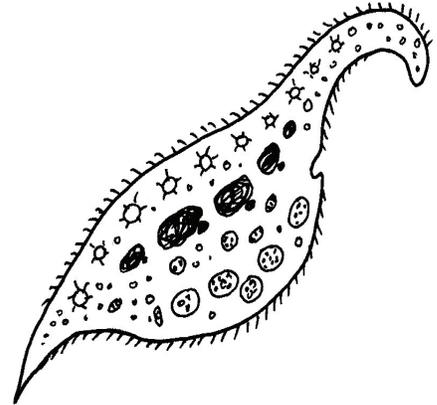
Size: 150-200 microns  
One of the most common ciliates.  
Has two very large contractile vacuoles.

**Didinium**  
(di-DIN-ee-um)



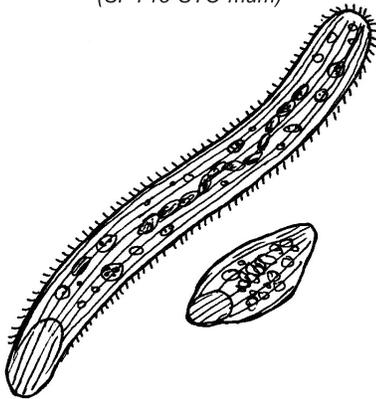
Size: 100-200 microns  
Loves to eat paramecia.  
Its cilia are arranged in two rows.

**Dileptus**  
(di-LEP-tus)



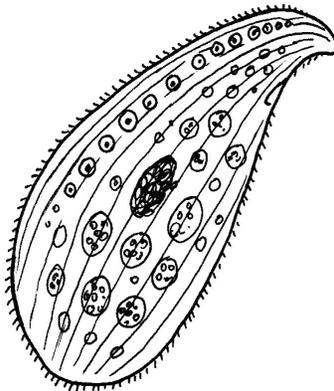
Size: 200-400 microns  
Smacks its prey with its proboscis.  
Has a "mouth" and a "tail."

**Spirostomum**  
(SPY-ro-STO-mum)



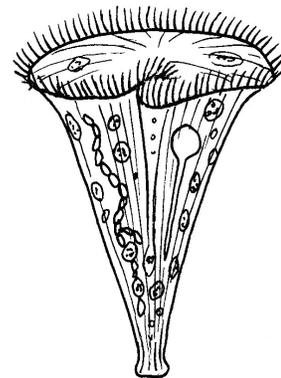
Size: about 1000 microns (1 millimeter)  
Can contract its body to 1/4 normal size in 6 milliseconds—the fastest cellular contraction in the world.

**Loxodes**  
(locks-O-dees)



Size: 700 microns  
Known for its ability to sense "up" and "down" using a structure similar to our inner ears. It also has a "beak."

**Stentor**  
(STEN-tor)



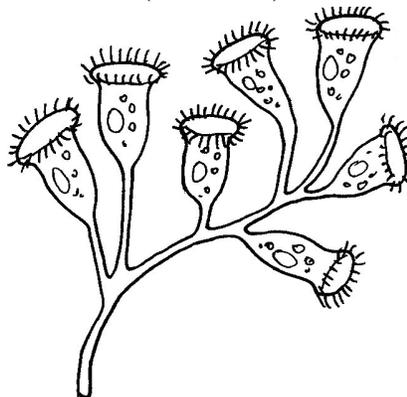
Size: 1000-2000 microns (1-2 mm)  
Though very large, it generally eats small things. The rim of cilia at the top create a current that brings in particles.

**Vorticella**  
(vort-i-SELL-uh)



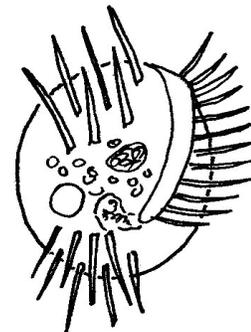
Size: 50-150 microns  
Can contract its stalk very quickly, making it look like a spring. They can attach to a surface or float freely.

**Epistylis**  
(eh-PIST-ul-is)



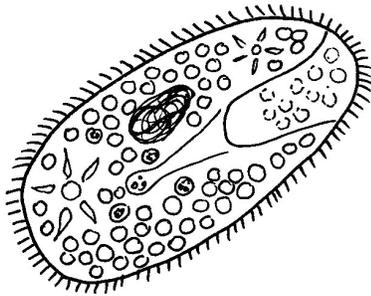
Size: individuals are 50-150 microns  
Colonies can be up to 5 millimeters.  
Though they look similar to Vorticella, they cannot contract like Vorticella can.

**Euplotes**  
(yu-PLO-tees)



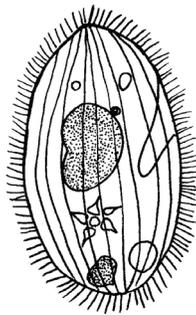
Size: 80-100 microns  
Often looks like it is walking or crawling across a surface.  
Also known for being a picky eater.

**Paramecium**  
(species bursaria)



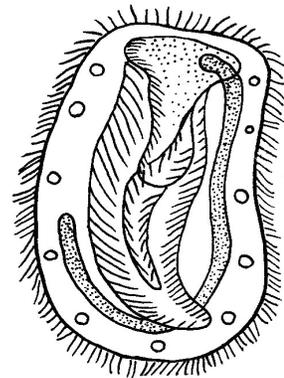
Size: 100-200 microns  
Known for its symbiotic relationship with algae. Green algae live inside P. bursaria.

**Colpidium**  
(cole-PID-ee-um)



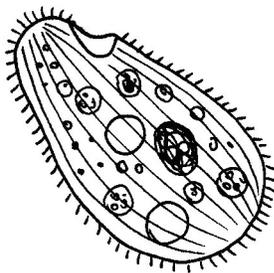
Size: 50-70 microns  
Feeds on bacteria  
Swims in slow, spiral motion.

**Bursaria**  
(bur-SARE-ee-uh)



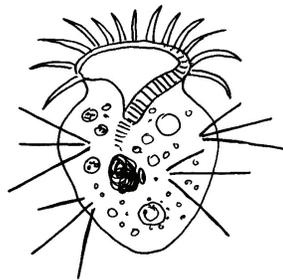
Size: 500-800 microns  
Don't confuse it with Paramecium bursaria.  
Has a large funnel-shaped "mouth" and will eat large things such as paramecia.

**Tetrahymena**  
(TET-ra-HI-men-uh)



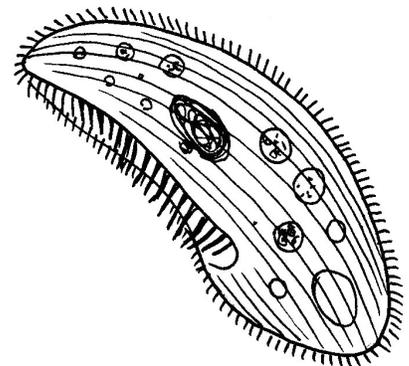
Size: 40-60 microns  
One of the most commonly used ciliates in science labs. Many major discoveries about cell biology were made using tetrahymena.

**Halteria**  
(hall-TEER-ee-uh)



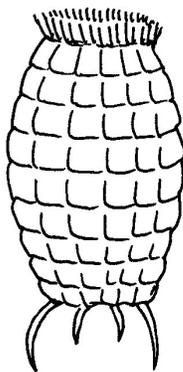
Size: 25-50 microns  
Can be identified by the bundles of three cilia at various points on the body. Is able to jump forward very quickly.

**Blepharisma**  
(BLEF-ar-IZ-mah)



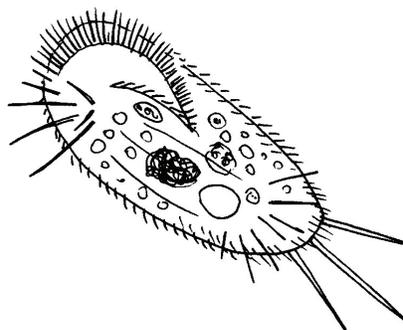
Size: 150-200 microns  
Has a pink or red color. Is light-sensitive.  
Eats bacteria and algae.

**Coleps**  
(COLE-eps)



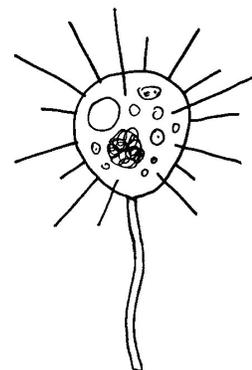
Size: 50-80 microns  
Barrel-shaped, covered with hard plates.  
Is a scavenger, and will aggressively eat almost anything.

**Stylonychia**  
(STY-lon-NICK-ee-ah)



Size: 150 microns  
Can be identified by the three long cilia protruding from the back end.  
Feeds on bacteria and algae.

**Podophyra**  
(PODE-oh-FIE-rah)



Size: 10-30 microns  
"Stands" on a stalk, and has sucking tentacles that it can push into prey and use like a drinking straw.

## ACTIVITY 2.2: Make a Vorticella “pencil topper”

### You will need:

- A copy of the following pattern page copied onto regular paper (card stock will be too heavy)
- Scissors
- White glue (glue sticks probably will not be sticky enough)
- A white chenille stem
- Clear tape
- A pencil (to be part of the craft)

**STEP 1:** Copy the pattern on to regular white paper. (Card stock will be too heavy.) If you are using the black and white pattern, finish drawing the design. Add a nucleus, a contractile vacuole, and many digestive vacuoles. You can add color if you wish. **If you have only a hard copy of this book and you need a digital pattern to print, go to [www.ellenjmchenry.com](http://www.ellenjmchenry.com) and click on FREE DOWNLOADS, then ANIMALS, then MICROBIOLOGY.**

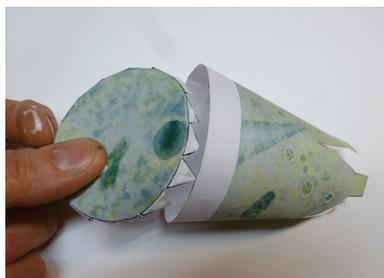
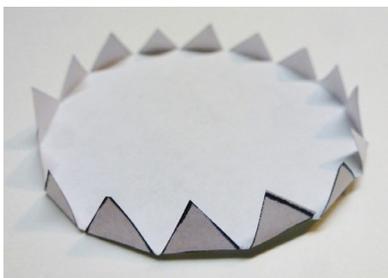
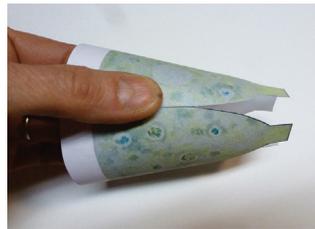
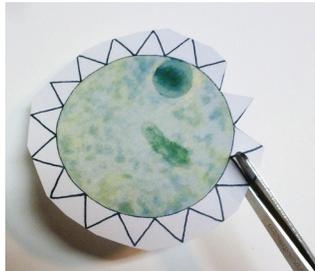
**STEP 2:** Cut out the two Vorticella body parts.

**TIP:** An easy way to cut around all those triangles is to cut a larger circle first, cutting along the tips of the triangles. Then just make snips into the triangles.

**STEP 3:** Put a small amount of white glue on the side tab, and press and hold in place for 10 to 15 seconds.

**TIP:** Don't use too much glue! A few tiny dots spread out over the area will be adequate. You know you are using too much glue if it seeps out when you press your seam together. White glue is very strong and using too much will give you a big soggy mess.

**STEP 4:** Fold all the triangles back. Put tiny dabs of glue on the outsides of each of the triangle flaps. Insert the top so that the mouth on the top approximately matches up with the gullet on the side. To press the tabs in place, insert your index and middle fingers into the cone from the bottom. Use your free hand to manipulate the top piece, pressing it down as needed. Press and hold the triangles until they stick in place.



**TIP:** White glue “grabs” very quickly and it usually only takes till the count of ten to have a tab stuck in place. If your glue is taking longer than this, consider trying a different bottle. If the glue feels slightly runny, it's bad glue. Glue can go bad if it freezes and thaws or if it sits too long. Make sure you don't use “school glue” as it won't grab quickly. When I started this project, I was using a bottle of Elmers Extra Strength white glue, which should have been excellent. However, it just was not holding. I switched to a different bottle of the same thing and the second bottle was fine. I'll never know what was wrong with that first bottle. Should have been fine, but wasn't. So if your glue is having issues, try a newer bottle of glue, or a different brand.

**STEP 5:** Glue two opposite bottom tabs. Then fold over a third and glue that in place. Let it dry for a few minutes. (While waiting for it to dry, you might want to start snipping the “fringe” at the top? See step 7.)



**STEP 6:** Poke a hole in the bottom (carefully use something sharp, like a nail), straight through those three glued tabs. (If they are still a little damp, you can blow a hair dryer on them for half a minute.) Stick the end of the chenille stem up through the hole. Bend the chenille stem to follow the contour of the inside of the cup, then tape it in place. Be sure to make this interior section of chenille stem long enough. You can even run it up the side of the cup. After the chenille is firmly taped to the inside, you can close up the last tab. It might be a little tricky, but you can stick something like a pencil point or scissor tip into the little gap in the paper, and use it to press from the inside.



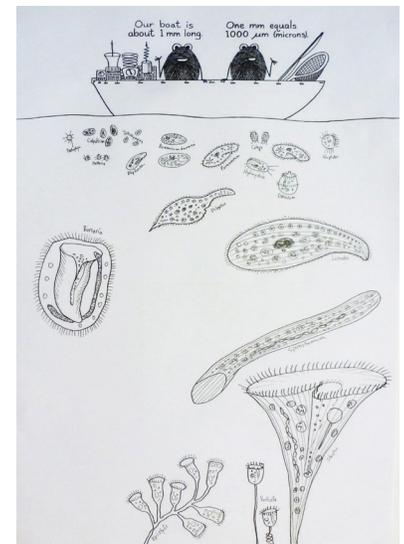
**STEP 7:** Snip the cilia fringe along the top. When finished snipping, fold them outward slightly. Then wrap the bottom of the chenille stem around the top of a pencil, and secure in place with clear tape. (NOTE: I found that the chenille stem holds the weight of the paper cup better when it is not coiled. If your vorticella gets “floppy,” try uncoiling the chenille stem a bit, and/or sliding it down further onto the pencil.)



### ACTIVITY 2.3: Work on your mural if you are doing it one chapter at a time

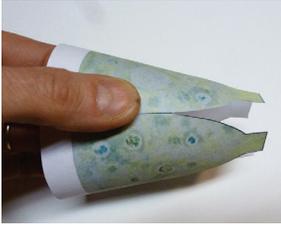
If you are waiting until the end to do the mural, just ignore this suggestion. If you are working on it chapter by chapter, now is the time to add all the ciliates. This sample shows how a mini-mural (two regular-sized pages taped together) might look at this point, with all the ciliates drawn in. You can add more than one of each if you think you will have space. Definitely draw groups of smaller ones, like Colpidium and Halteria. They are so small you might not see them!

If you are making a large mural, draw and cut out your ciliates. Tape them on if you are assembling them now, or store them away till the end of the unit.

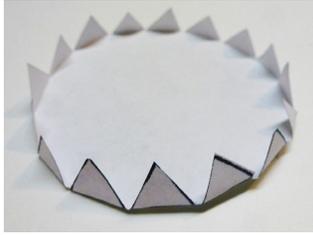


# VORTICELLA "PENCIL TOPPER"

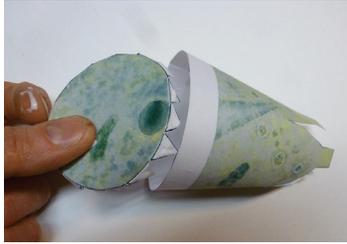
1) Glue side tab.



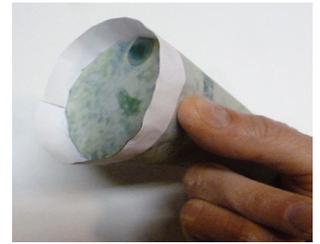
2) Snip triangles.



3) Glue top below white area.



TIP: Insert your first two fingers so that they can press on the inside while your thumb presses on the outside.



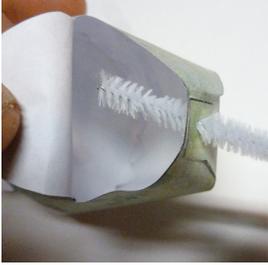
4) Glue two tabs.



5) Glue a third tab.



6) Insert chenille stem, bend and tape to inside.



7) Glue fourth tab.



8) Snip fringe.



9) Attach to pencil.

