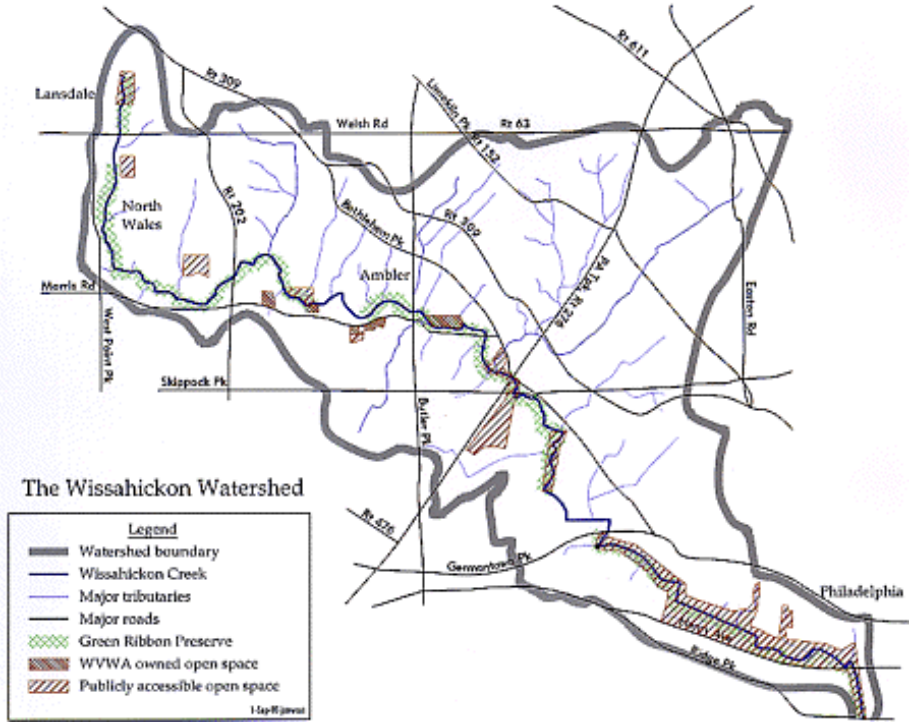
Scott Stein, Pennsylvania

Wissahickon Watershed Land Use WebQuest

You have just spent several days analyzing the health of the Wisahickon Creek by assessing a variety of biotic and abiotic factors, including a stream habitat analysis, riparian zone survey and biotic index. Let's take a step back and look at the factors in the Wissahickon Watershed that contribute to the staus of the creek. Remember, a watershed is all the land that drains to a specific body of water such as a creek. For the Wissahickon Creek, the watershed is 64 square miles which flow downhill to the Wissahickon or one of its tributaries. Because rainwater runs downhill to the Wissahickon, whatever happens on the land will affect the Creek. Thus protecting the Wissahickon means treating land in the watershed sensitively.

Part or all of the following communities lie within the watershed of the Wissahickon Creek: Montgomery Township, Lansdale Borough, North Whales Borough, Upper Gwynedd Township, Lower Gwynedd Township, Whitpain Township, Ambler Borough, Upper Dublin Township, Whitemarsh Township, Abington Township, Springfield Township and Philadelphia.

Here is the outline of the Wissahickon Watershed:



(http://wissahickoncreek.blogspot.com/2009_05_01_archive.html)

So, what is wrong with the water in the Wissahickon?

At the Friends of the Wissahickon website, http://www.fow.org/, select: About The Park, then Water Quality / Flow.

1. Why is hot, dry weather especially problematic for water quality in the Wissahickon?

2. What 2 measures need to be taken to preserve the water quality of the stream?

Now, take a look at the bigger picture from the EPA. Use the Environmental Justice Assessment Tool at http://www.epa.gov/enviro/ej/ to obtain the following information about your zip codes.

It's time to look more directly at factors impacting the health of the watershed. You will first look at point sources of pollution.
****Point sources of pollution** = industry (chemical and pharmaceutical companies), wastewater treatment plants, hazardous waste sites, etc**.**
****Non-point sources of pollution** = runoff from farms, urban / suburban paved surfaces and lawns.

Under Map Features, select +Regulated Sites and +Water Features
Put a check in the box for all regulated sites
Put a check in the box for all water features (will now be drawn in red)

Select Redraw. Be sure to select Legend on the bottom of the map once it is redrawn.

	Wissahickon/Springside	**Your Zip Code**
How many sites / businesses discharge materials into the water? (# red squares)		
# businesses handling hazardous waste in area? (# green squares)		
# businesses releasing toxic wastes (#light blue squares)		
# businesses having air emissions monitored (#dark blue squares)		
Which streams / bodies of water are impaired? (look for shaded red areas or heavy red line)		

What is the population density and distribution like in your zip code?

Select the  icon in the toolbar across the top and select persons per sq. mile from the values pull-down bar. Click OK at the bottom to get information about the population density of your watershed.

	Wissahickon/Springside	**Your Zip Code**
What is the range of population density in your zip code?		
Is it evenly distributed? clumped? etc. Describe the pattern.		
Approximately what % of the zip code is made up of the highest population density?		

Use the Environmental Justice Assessment Tool at http://www.epa.gov/enviro/ej/ to obtain the following land use information about your zip codes:

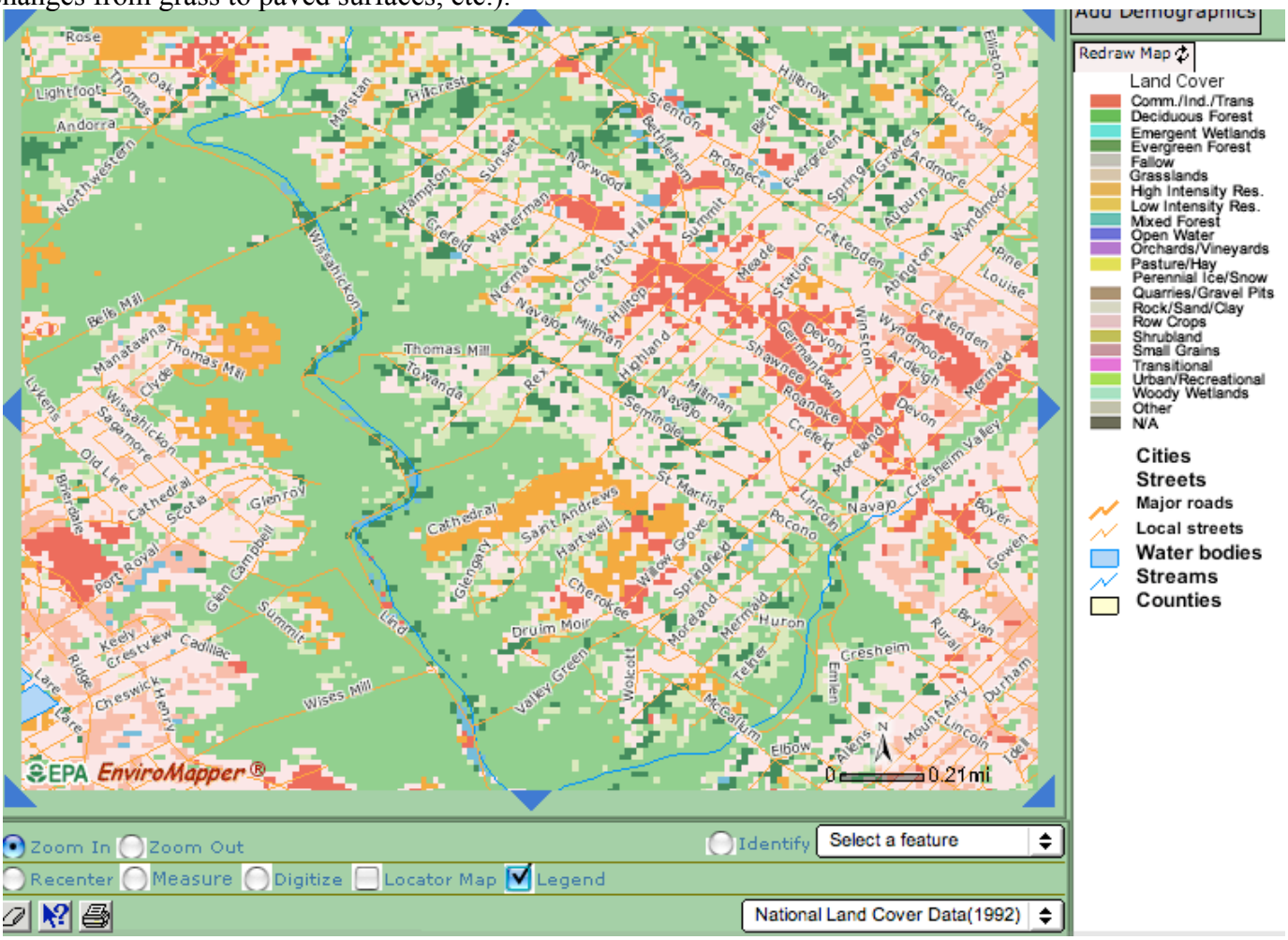
Type in the school zip code. (then repeat for your home zip code)

On the bottom right of the map, select the Remote Imagery Services pull-down menu and select National Land Cover Data (1992). Select Redraw Map. Once the map is redrawn, select Legend on the top right of the map.

For each type of land use displayed on the map, estimate the % of the total area that is used for that type of land use. NOTE: some colors may be slightly off due to the fact that satellite interpretation of what is reflected back up to the satellite from Earth is not a perfect process. **On your map, heavy to light residential and/or commercial use should be interpreted either by shades of dark to light pink or by orange/mustard shades**. Use your knowledge of this area and/or Google Earth, aerial photos, and topographic maps to help you.

Land Use	**% Wissahickon/Springside**	**% Your Zip Code**

Copy/screen capture and paste your zip code's land use map below. Make it the same size as the one below and then delete the one below. Based on this image, what you previously observed in **your** zip code, and what you know about the land use in your area, modify the color coded patches below in order to describe what your zip code will look like in 25 years and explain why (ex. More development leading to land use changes from grass to paved surfaces, etc.).



How might the information that you obtained from the maps, photos and EPA website help explain the chemical factors, biotic index, and overall health of the Wissahickon Creek that you actually observed? **Give one specific example.** Ex. Higher population density means more paved surfaces causing more runoff causing more erosion and sediment resulting in a low….. or…. more places that discharge water into the creek mean more nutrients meaning more nitrates causing …..

Make **2 specific** recommendations as to how the quality of the Wissahickon Watershed **and** your local watershed can be maintained and improved. Use all of the information available to you from your maps, readings, websites, etc. in order to **explain why** these recommendations will have their effects.

Wissahickon:

1.

2.

Your zip code _____:

1.

2.

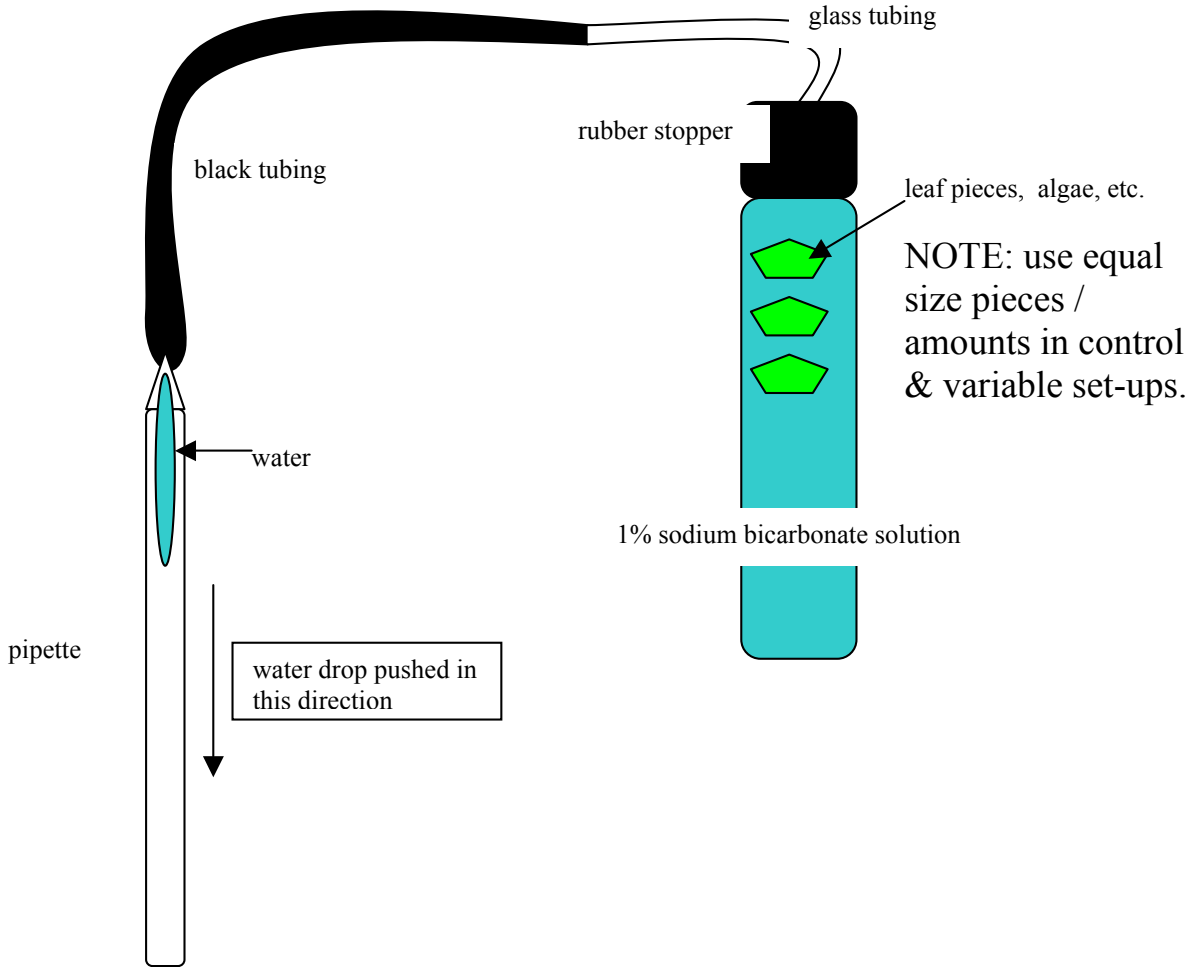
FACTORS AFFECTING THE RATE OF PHOTOSYNTHESIS

Design an experiment to test the effects of one of the following factors on the rate of photosynthesis, by measuring the amount of oxygen produced by a photosynthetic organism [plants: duckweed, elodea, any houseplant (geranium, ivy, etc), any tree / shrub (holly, oak, pine, rhododendron, azalea, etc.); protists (algae)]

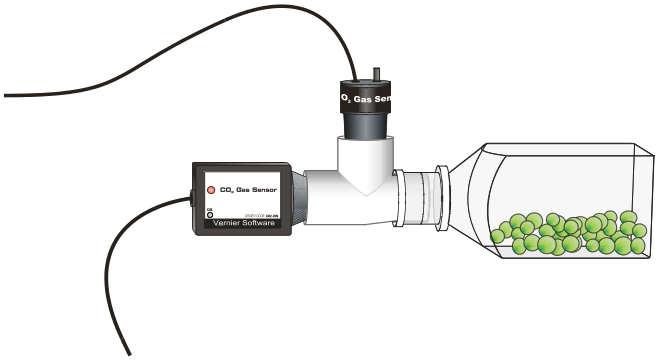
Variables: type of plant
young vs. old leaf
color of light
strength of light
temperature (be sure to keep the entire set up at the same temp.)
amount of carbon dioxide available
pigmentation of leaf (ex. red vs. green cabbage)
deciduous vs. evergreen
C3 vs. C4 vs. CAM

How can you measure the rate of photosynthesis?

1. Set up a volumeter like the one diagrammed below. The oxygen gas produced by photosynthesis will push the water along the pipette. The volume of the water displaced (final - initial readings) is equal to the volume of oxygen gas produced.



2. Use the Vernier carbon dioxide or oxygen probes and the Biochambers.



Requirements:

Complete lab report, including title, purpose, hypothesis, procedure, materials, results, graphs, and conclusion.

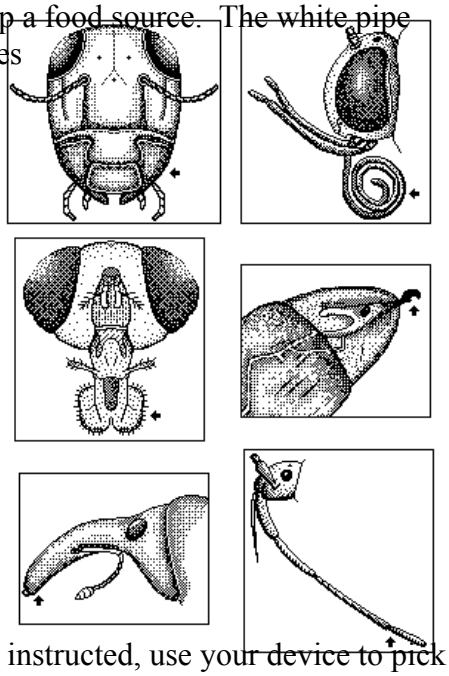
Helpful Hints:
1. Measure the level of the water drop each 2-3 min. for 15 min. Record your data in a data table that you design.
2. Be sure to use equal size pieces in your control and variable (2) groups. Be sure that everything else is the same except for what you are testing.
3. Place a piece of white paper under the pipette to help you read it.
4. To get water into the pipette, fill a 10 ml graduate with water, put the pipette in tip down, put your finger over the top of the pipette and lift the pipette out and turn it on its side.
5. Place the volumeters a set distance away from your light source, with the test tube facing the light.

Resources:
1. http://www.marietta.edu/~spilatrs/biol103/photolab/physfacs.html

THE EVOLUTION OF PIPE CLEANER FEEDING DEVICES

Many animals have specialized feeding structures that are adaptations to their specific environment and food supply (insect vs. fruit eating bird beaks, herbivore vs. carnivore mammalian teeth, etc.). Each of you represents an organism that is part of a larger population.

Obtain a white pipe cleaner and a colored pipe cleaner. These represent 2 sections of an animal mouthpart/feeding device, coded for by 2 different sets of genes. These genes are "master" genes, turning on other genes related to mouth part location, structure and size. Your job is to modify them into a single unit so that it can serve as a feeding device that will be able to pick up a food source. The white pipe cleaner is coded for in a way so that it must remain straight at all times



Sketch your finished structure here and on the board.

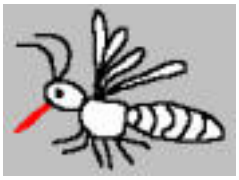
How does it compare to the others? (variation, alleles, gene pool)

EVOLUTION BY NATURAL SELECTION:

The main food source on island Biologica is _____. When instructed, use your device to pick up as much food as possible in 1 minute. Use only one hand to hold your device, pick up one food sample at a time, and place it in your stomach (cup). Hold your stomach (cup) up at the level of your head when placing the food in it, not down at floor level.

How much food did you gather?
How did this compare to the top 3?

Only the 3 most successful variations survive and reproduce – these are adaptations selected for by the environment.



Sketch these 3 most successful structures:

What causes variation?
1. genetic recombination - crossing over & independent assortment during meiosis, random fertilization
2. mutation - base sequence point mutation, chromosomal non-disjunction / translocation

**The 3 most successful designs survive and reproduce sexually. (keep these on the board)

Redesign your pipe cleaner feeding structure based on one of the 3 main variants of the population. You now represent offspring of the successful organisms. Note: some of you will have your genotype affected by one of the mutations described below. You must redesign your feeding structure based on that variation but still similar to the top 3.

Possible sources of mutations:
1. point mutation → white pipe cleaner can now bend
2.point mutation → white pipe cleaner must remain coiled
3. non-disjunction→ larger stomach
4. non-disjunction → 2 of each pipe cleaner
5. tranlocation → extra white pipe cleaner
6. translocation → extra colored pipe cleaner

Sketch your new food gathering device.

Look at the structures that several of your classmates have designed. Are they exactly the same as the original 3 designs? How do offspring become different from their parents?

SPECIATION:

The class will now represent a small portion of the original population (live in a valley) that was blown over to the other side of the mountain overlooking the valley during a storm, and has become geographically isolated. (How else does geographical isolation occur?) The food source in this area is different (global warming will also cause changes in climate in the future so that the plants that some animals feed on might have an altered life cycle that is not in synch with the animal's life cycle)

When instructed, gather as much of the new food source as possible, in the same manner as before.

How much food did you gather?

Sketch the 3 most effective structures from the entire class.

How does this population compare to the 3 most successful from the original population?

After many generations and the accumulation of many mutations due to different environmental pressures (stomach size and location; # of chromosomes, mating call because of different shaped mouthpart, etc.) this population and the original population may not be able to interbreed. They might have become reproductively isolated and would now be 2 different species. What are some other ways by which populations become reproductively isolated?

Conclusion:

Use the following terms in explaining the activity that you completed with the pipe cleaners:
alleles, variation, gene pool, adaptation, natural selection, geographical isolation, reproductive isolation, divergence, species, allopatric speciation.