

wrong	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
right	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	
score	100	98.6	97.2	95.8	94.4	93.1	91.7	90.3	88.9	87.5	86.1	84.7	83.3	81.9	80.6	79.2	77.8	76.4	75	

# Observing Organisms

Name \_\_\_\_\_

We have defined *biology* as the study (-logy) of life (*bio-*), so it follows that a biologist would be a person who studies life. This begs the definition of the word, *life*, which is more difficult. The properties of life include: cellular structure, homeostasis, growth, reproduction, acclimation, and evolution. Our semester is focused upon the organism which is the unit of a species. As a living organism, it must demonstrate all of these properties. For our course, then, we must look at how different organisms have solved the problems of life. Today we are afforded the opportunity to observe some organisms in their natural environment. We will visit the ECSU arboretum RAIN OR SHINE! So wear suitable clothing, sunscreen, and shoes to keep you warm and dry. Be prepared for mud and thorn snags. If you are sensitive or allergic to insect bites, bring an insect repellent and/or an emergency antihistamine or adrenaline kit.

Biologists use an artificial system to classify organisms into “kingdoms” (sorry ladies!). Many biology textbooks and biologists maintain that there are six kingdoms: Bacteria, Archaea, Protista, Fungi, Plantae, Animalia. We will probably use an eight kingdom system in our course as Protista becomes refined from an “unnatural mixed bag” into better-defined natural kingdoms. The following key will help you assign organisms to the six commonly-recognized kingdoms based upon their characteristics.

## Key to the Kingdoms

- 1. Microscopic, largely unicellular, visible only *en masse* ..... 2
  - 2. Cells very small, lacking a nucleus or membrane-bound organelles ..... 3
    - 3. Cell walls peptidoglycan..... Bacteria 4
      - 4. Cells and colonies bluish-green, likely autotrophic.....Cyanobacteria
      - 4. Cells and colonies not bluish-green, likely heterotrophic .....Other Eubacteria
    - 3. Cell walls not peptidoglycan ..... Archaea
  - 2. Cells large, with nucleus and membrane-bound organelles ..... 5
    - 5. Cells green (possibly brown or red) and likely autotrophic.....Protista: Algae
    - 5. Cells not green and likely heterotrophic ..... Protista: Aquatic Fungi, Protozoan
- 1. Macroscopic, likely multicellular, complex form..... 6
  - 6. Body attached to a substrate, not free-moving..... 7
    - 7. Thallus aboveground yielding dust-like spores, underground mycelium, likely heterotrophic ..... Fungi
    - 7. Green leaf and stem aboveground, underground roots, likely autotrophic..... Plantae
  - 6. Body free-moving, not attached to substrate, likely heterotrophic ..... 8
    - 8. Body lacking backbone, maybe with hard external shell.....Animalia: Invertebrate
    - 8. Body with backbone, usually with soft external surface ..... Animalia: Vertebrate

## The Environment

The ECSU arboretum has a rich assemblage of habitats for organisms thanks to glacial carving and human intervention. Keep notes of the characteristics of the various areas. Pay attention to the introductions and explanations of your instructor as you visit:

- old field
- upland forest
- canopy gaps
- pond
- leaf litter
- disturbed fill
- lowland forest
- stream

Check off each area above as you visit it.

### **Kingdom Bacteria**

The bacteria are unicellular to colonial, but the tiny cells lack nuclei and membrane-bound organelles. Cyanobacteria are usually autotrophic while other eubacteria are usually heterotrophic. Since they lack much structure to assist in identification, we rely upon mode of nutrition and colony morphology (appearance) to distinguish the bacteria. The bacteria are found abundantly almost everywhere but are difficult to observe due to their size. Masses of cyanobacteria appear in the field as a blue-green, brown, or black slime on rock, soil, or tree bark. Masses of eubacteria are more difficult to observe except *en masse* in bacterial “rot.” These observation difficulties lead us to more cultural observations.

### **Kingdom Archaea**

The archaea are no different in macroscopic views than bacteria. And while both are only possibly visible *en masse*, the bacteria are unlikely to be observed even if we took samples and tried to culture them. These organisms have a metabolism evolved for extreme temperatures, salinity, or oxygen deprivation. Being aerobic organisms, we cannot easily go where Archaea thrive.

### **Kingdom Protista**

Protists come in many forms, but most are unicellular and all are microscopic. The cells have a nucleus and membrane-bound organelles.

- ❶ Algae are green, yellow-green, brown, or red in color and are usually autotrophic; there are many different types of algae classified as protists which may not be closely related!
- ❷ Aquatic fungi usually have non-motile, colorless, heterotrophic, vegetative cells, but sometimes a reproductive cell is pigmented or motile.
- ❸ Protozoans are generally lightly colored, flexible, motile, heterotrophic cells.

Because of their size, protists are difficult to observe in the field. To find these we would need to make a wet mount of some of the “crud” in a pond water sample, or at least fill a transparent container with some pond water to view the more-macroscopic types or colonial forms *en masse*. However, some protists are quite large; good examples are some of the slime molds and some algae. With luck we may find some of these in the stream or on stumps or in the leaf litter.

### **Kingdom Fungi**

Fungi are also a diverse assemblage of organisms: jelly, coral, disc, sponge and gilled fungi. Each come in a bewildering array of forms. While we may observe many non-poisonous kinds, DO NOT EAT any mushrooms! Most fungi have an underground web-like network of cells called mycelium. The mycelium is the vegetative body of a fungus. Occasionally a mycelium sends up a reproductive structure: the mushroom. When we do eat mushrooms, we are consuming fungal gonads! All cells of fungi have cell walls made of a polymer called chitin. Fungi are heterotrophic, but some form associations with autotrophs. Lichens are an association between a fungus and an alga. Mycorrhizae are an association between a fungus and the roots of a higher plant. Many fungi are saprobic (use dead organic material for energy) but many others are parasitic (use living organic material). Yeast fungi produce alcohol as grape juice is converted to wine, and carbon dioxide as dough is converted to bread. As decay organisms, fungi are important decomposers in the environment.

Make some sketches of the fungi observed in the field. If the organism is parasitic or saprobic, you need to label the host or substrate tissue and the fungus tissue to distinguish them. Be sure to note the color and form of what is under the caps of mushrooms!


### Kingdom Plantae

Plants are the dominant land organisms. They conspicuously outnumber all other organisms above ground. This is as it should be since they are the autotrophic producers in the environment. Their green leaves produce energy-rich chemicals to feed the animals and fungi. The leaves have a particular shape which is useful in identifying species of plants. Leaves may be simple (one blade per petiole) or compound (more than one blade per petiole). The leaves are attached at nodes along a stem. This arrangement can be alternate (one leaf per node), opposite (two leaves per node), or whorled (more than two leaves per node). The stem can be herbaceous (green and soft) or woody (brown and brittle) and can branch profusely at the base (making a shrub) or can grow tall without much branching at the base (making a tree). Plants are divided into several major divisions: mosses, club mosses, horsetails, ferns, conifers, and flowering plants.

A plant with simple leaves \_\_\_\_\_

A plant with compound leaves \_\_\_\_\_

A plant with lobed leaves \_\_\_\_\_

A plant with alternate leaves \_\_\_\_\_

A plant with opposite leaves \_\_\_\_\_

What type of plants are colonizing the old field? \_\_\_\_\_

For the upland forest, name two...trees in the canopy \_\_\_\_\_

...shrubs in the understory \_\_\_\_\_

...forbs in the herb layer \_\_\_\_\_

For the lowland forest, name two...trees in the canopy \_\_\_\_\_

...shrubs in the understory \_\_\_\_\_

...forbs in the herb layer \_\_\_\_\_

What plant dominates on the steeply-sloping creek banks? \_\_\_\_\_

Name two herbs at the edge of the pond \_\_\_\_\_

Name two emergent plants rooted in the pond \_\_\_\_\_

Based on mass and thinking of the whole arboretum, what is the dominant plant? \_\_\_\_\_

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Make some sketches of the plants observed in the field. Be sure to label your diagrams.

**Maple Leaf**

**Oak Leaf**

**Poison Ivy Leaf**

**Fern Leaf**

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**4 Shapes of Sassafras Leaf**

/4

**A Key to some fall Flowering Plants  
from the ECSU Arboretum**

- Leaves opposite..... *Eupatorium rugosum*
- Leaves alternate
  - Flowers Yellow/Orange
    - Leaf Petiolate..... *Impatiens capensis*
    - Leaf Sessile
      - Flower Axillary/Solitary..... *Oenothera biennis*
      - Flower in Inflorescence
        - Inflorescence 3-4 cm in length..... *Solidago odora*
        - Inflorescence 1 cm in length..... *Solidago graminifolia*
  - Flowers White
    - Leaf margin dentate..... *Aster divaricatus*
    - Leaf margin entire..... *Polygonum cuspidatum*
  - Flowers Blue/Purple
    - Leaf simple..... *Centaurea maculosa*
    - Leaf compound
      - Leaf pinnate..... *Coronilla varia*
      - Leaf palmate/trifoliate..... *Trifolium pratense*
  - Flowers Pink
    - Leaf compound..... *Trifolium pratense*
    - Leaf simple
      - Leaf lanceolate
        - Flower 4 mm long..... *Polygonum pennsylvanicum*
        - Flower 2 mm long
          - Inflorescence longer than 5 cm..... *Polygonum coccineum*
          - Inflorescence shorter than 5 cm..... *Polygonum persicaria*
      - Leaf sagittate
        - Flowers Axillary/Solitary..... *Convolvulus sepium*
        - Flowers in Inflorescence..... *Polygonum sagittatum*

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