Notes

Biology 101
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Topic: The Diversity of Life

Reading: Chapters 19, 20, 21, 22, 23

Main concepts:

- Prokaryotic organisms, like all living organisms, have DNA and have cell membranes. However, they lack internal membranes, and thus no nucleus.
- Members of Domain Bacteria and Domain Archaea have several fundamental differences. One significant difference is that the cell wall of Bacteria contain a substance called peptidoglycan, which the Archaea lack.
- Most prokaryotes are much smaller than eukaryotic cells. Three common shapes are coccus (spherical), bacillus (rod-shaped), and spirillus (spiral-shaped).
- Kingdom Protista was originally intended to contain all the one-celled Eukaryotes. However, several hard-to-place multicellular groups have been added to this kingdom. Because it is a polyphyletic group (represents multiple evolutionary lineages), this kingdom may be broken up in the future.
- Among the organisms currently classified as protists, we can see a wide range of nutrition (autotrophs, heterotrophs, decomposers), and a wide range of reproductive methods (sexual and asexual). Reproduction and “sex” (gene exchange) are not necessarily the same process in protists.
- Plants are a diverse group that includes all multicellular, non-motile autotrophs which have cell walls made of cellulose.
- Key features of plants:
  - Life cycle that includes the alternation of generations, with haploid gametophyte and diploid sporophtye phases.
  - Multicellular embryos that are dependent on the parent organism.
  - Capture sunlight to use as an energy source to synthesize organic molecules. These molecules are metabolized for energy or are used to build cell structures.
- Green algaes also have cell walls made of cellulose and have the same photosynthetic pigments as plants. Ancient green algaes probably gave rise to modern plants. Some taxonomic systems put green algaes in the Plant Kingdom.
- Fungi include both unicellular and multicellular non-motile heterotrophs. Most fungi are decomposers: they obtain their nutrients and energy by chemically breaking down and absorbing dead material (external digestion). Some parasitize living organisms.
- The main fungal organism is a mass of individual cells called hyphae. This mass is called mycelium. A familiar “mushroom” is the reproductive structure of a larger fungal organism in the soil.
- Fungal cells are often very long, multinucleated, and have a cell wall made of chitin (a carbohydrate).
- Fungi reproduce both sexually and asexually. Hyphae can fuse and exchange genes, forming a zygote. Fungi can also produce asexual spores.
- The key features of organisms in Kingdom Animalia:
  - Multicelluar
  - Heterotrophic (must consume other organisms for energy and materials)
  - Reproduce mostly by sexual reproduction.
  - No cell walls (all living things have cell membranes; only some have cell walls).
  - Most are motile at some stage in their lives.
- Evolutionary trends in animals:
  - Development of organized tissues: this separated sponges from other animals (some taxonomists question whether sponges should be grouped with animals at all).
  - Development of bilateral symmetry: the development of a definite “head” end later led the way to a brain and specialized sense organs.
  - Development of organs: tissues organized into organs allowed for specialization of various life functions within certain organs.
  - Development of lined body cavities: this allows compartmentalization of the body cavity.

Common misconceptions:

- Many students lump one-celled organisms together, and make little distinction between bacteria, viruses, “germs,” molds, various protists, and even molecules. Bear in mind that bacteria, molds (a division of fungi),

and protista are all distinct organisms. Viruses are non-living entities. Molecules are structures that living things are made of.

- Many people believe that all bacteria are harmful. In fact, very few cause disease. Most are essential to the ecosystem, and a few have been harnessed by humans to produce foods such as cheese, yogurt, and tofu.
- Some students, especially younger children, fail to recognize the connection between bacteria and the process of decay, thinking that decay is just a natural process that organic material goes through.
- When people think of "plants," they often think first of herbaceous flowering plants. "Folk taxonomy" places "plants," "shrubs," and "trees" in separate categories, which are often functional categories if you're discussing what to plant in your garden. Scientific classification places all multicellular non-motile autotrophs with cellulose cell walls into Kingdom Plantae.
- Many people believe that moss is a kind of fungus and can grow in the dark. The green color of moss tells us that it is photosynthetic and needs light. Moss has all the features that place it in the plant kingdom rather than among the fungi.
- Many students confuse fungus, mold, moss, algae, and "slime" in general. Fungus is a kingdom. Molds and mildews are specific groups of fungi. Moss is a plant, and algaes are photosynthetic protists.
- Students often list fungi as producers, perhaps thinking of mushrooms as "vegetables." Fungi are heterotrphic, not autotrophic, so they are not producers in an ecological sense.
- Many people have a limited concept of "animal," thinking only of mammals. The Animal Kingdom includes a wide range of multicellular motile heterotrophs. Some are large and visible; some are microscopic.

Reading notes:

- Describe the features that all prokaryotic organisms have in common. Describe the differences between Domain Bacteria and Domain Archaea.
- Describe the different modes of nutrition seen among the protists.
- Describe various means of reproduction seen in the protists.
- Biologists say that sex and reproduction are uncoupled in most protists. What does this mean?
- Describe the major features that place organisms in the Plant Kingdom.
- Sketch the alternation of generation in plants. Look up the terms "haploid" and "diploid" and define them in your notes.
- List the key features of fungi that define the kingdom.
- Describe the ways in which fungi reproduce.
- List the characteristics that all members of the animal kingdom share.
- Examine figure 23-1 showing the phylogeny of animals. List the features that mark branch points on the tree, and describe why these features are important.

Useful websites:

- "Introduction to the Bacteria" http://www.ucmp.berkeley.edu/bacteria/bacteria.html is a site that includes both modern and fossil bacteria. Some parts are under construction.
- "Microbe World" http://www.microbeworld.org/findex.aspx has information and good photos of bacteria and archaea. Click on "Meet the Microbes" in the navigation bar.
- "Cells Alive!" http://www.cellsalive.com/index.htm is a good site for reviewing basic cell structures.
- "Protista Movies" http://biog-101-104.bio.cornell.edu/BioG101_104/tutorials/protista.html has small QuickTime movies of live protists.
- "Protist Movie Database" http://protist.i.hosei.ac.jp/Movies/htmls/indexE.html also has lots of QuickTime movies of protists.