EXPLORING LIFE

EXERCISE 1:
THE FIVE KINGDOMS
Exercise 1: The Five Kingdoms of Life

Workbook Contents

Vocabulary

Key Concepts

Introduction
  Introduction to the Series
  Introduction to the Exercise

Diversity of Organisms
  The Five Kingdoms
  Prokaryotes and Eukaryotes

Relationships Among Eukaryotes
  Structure, Life Cycle and Multicellularity
  Evolution
  Classification of Organisms

Understanding Eukaryotes
  Structure and Function
  Reproduction and Development

Summary

Summary & Review

I. Introduction
  IA. Introduction to the Series
  IB. Introduction to Exercises

II. Diversity of Organisms
  IIA. The Five Kingdoms
  IIB. Prokaryotes & Eukaryotes

III. Relationships Among Organisms
  IIIA. Structure
  IIIB. Life Cycle
  IIIC. Multicellularity
  IIID. Evolution
  IIE. Classification

IV. Understanding Eukaryotes
  IVA. Structure & Function
  IVB. Reproduction & Development

V. Summary
Vocabulary

Animalia - The kingdom of organisms containing multicellular eukaryotes that typically ingest food, have specialized tissues and are motile; the animals
Cell Theory - The well established theory that organisms consist of cells and that all cells come only from pre-existing cells
Eukaryote - An organism whose cells contain their genetic material within a nucleus
Evolution - Descent of organisms from common ancestors with the development of genetic and phenotypic changes over time that make them more suited to the environment
Fungi - The kingdom of organisms containing multicellular eukaryotes that have absorptive nutrition, form spores, and lack flagella throughout their life cycle
Genus - In taxonomy, a group of similar, related species; related genera comprise a family
Monera - The kingdom of organisms that contains the bacteria including both eubacteria and archaeabacteria
Organism - Any living creature
Photosynthesis - A metabolic process by which plants and algae capture visible light and use the energy to produce oxygen and reduce carbon dioxide to carbohydrate
Phylum - In taxonomy, a subdivision of a kingdom; a group of similar, related classes comprise a phylum and a group of related phyla comprise a kingdom
Plantae - The kingdom of organisms containing multicellular eukaryotes that protect the zygote internally and produce their own food by photosynthesis; the plants
Prokaryote - An organism whose genetic material is not contained within a nucleus; a bacterium
Protista - The kingdom of organisms that contains unicellular or undifferentiated multicellular eukaryotes; the protozoa, algae, slime molds, and water molds
Sexual Reproduction - Reproduction involving meiosis, gamete formation, and fertilization; produces offspring with chromosomes inherited from each parent but a unique combination of genes
Species - Taxonomic category whose members are characterized by anatomy and can only breed successfully with each other
Key Concepts

Introduction

Introduction to the Series

1. a) Which group of organisms will you learn about in this series - prokaryotes or eukaryotes?
   
   b) Circle the organisms that are not eukaryotes: animals bacteria fungi plants protists viruses

Introduction to the Exercise – Pause the movie to answer Question #2:

2. a) Where are the buttons located on the screen? ___________ b) Where are the tools? ___________
   
   c) Which button should you click if you have questions? _____ d) What is one of the tools? _______

3. What four concepts will the movies focus on? – Pause the movie when they are all listed on the screen:
   
   a) ____________________________
   
   b) ____________________________
   
   c) ____________________________
   
   d) ____________________________

4. Fill in the blanks, based on the questions that you will ask yourself as your progress through this study:
   
   a) How does each organism function to (list at least three functions): ____________________________
      ____________________________
      ____________________________

   b) How does each organism accomplish these functions within the constraints imposed by ___________

   c) How is a multicellular organism’s ___________ determined as it grows from __________ to adult

   d) How does the organism you are studying compare to: ____________________________

Diversity of Organisms

The Five Kingdoms

5. We group things together because they are different / similar, especially genetically / structurally.

6. Connect (draw a line between) each organisms and the kingdom in which it belongs:

   Organism: Bacteria Mushroom Paramecium Swan Water Lily
   Kingdom: Animal Fungi Monera Plant Protista

7. List one characteristic and one example organism (other than those listed above) for each kingdom:

   Characteristic: ____________________________
   Organism: ____________________________
The Five Kingdoms

Prokaryotes and Eukaryotes

8.  a) **True** or **False**: All organisms are composed of cells.
    b) **True** or **False**: Cells are the structural and functional units of **most**, but not all, organisms.
    c) **True** or **False**: Cells are **not** capable of self-reproduction.
    d) **True** or **False**: Cells come **only** from pre-existing cells.

9. Check all the boxes that apply to each group of organisms (as shown by the example organism) below:

<table>
<thead>
<tr>
<th>Characteristics (check all that apply)</th>
<th>prokaryotes</th>
<th>eukaryotes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>E. coli</em></td>
<td><em>Paramecium</em></td>
</tr>
<tr>
<td>cell wall</td>
<td></td>
<td>DNA organized in chromosomes</td>
</tr>
<tr>
<td>cell membrane</td>
<td></td>
<td>DNA in single circular loop</td>
</tr>
<tr>
<td>cytoplasm</td>
<td></td>
<td>organelles</td>
</tr>
<tr>
<td>nucleus</td>
<td></td>
<td>larger ribosomes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>smaller ribosomes</td>
</tr>
</tbody>
</table>

What structure primarily distinguishes eukaryotes from prokaryotes? __________________________

Relationships Among Eukaryotes

Structure, Life Cycle and Multicellularity

10. Check all the boxes that apply to each kingdom in the chart below:

<table>
<thead>
<tr>
<th>Characteristics (check all that apply)</th>
<th>FUNGI</th>
<th>PLANTS</th>
<th>ANIMALS</th>
<th>PROTISTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Structure</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cell wall</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>capable of movement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plastids</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life Cycle (see Question #11)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cells bound in place; organism grows larger</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cells can migrate; development complex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diploid through most of life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>haploid through most of life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>alternation of generations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cellularity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>multicellular (generally)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>unicellular (generally)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11. Draw a line to connect each diagram below with the correct kingdom:

- Diploid zygote → Diploid adult → Haploid spores → Diploid adult → Haploid gamete
- Diploid zygote → Diploid adult → Haploid gamete
- Diploid zygote → Haploid adult → Haploid gamete

Kingdom
Animalia
Fungi
Plantae

12. True or False (circle one): The classification of organisms is always clear and distinct.

Evolution

13. Organisms are thought to be similar because: _______________________________________________________________________

14. Fill in the diagram below. Use the terms monera, protist, fungi, plant, animal, prokaryote, eukaryote, unicellular, multicellular.

15. Match the events to the timeline:

- 3.5 bya: Birds and mammals appeared
- 2 bya: Multicellular eukaryotes arose
- 600 mya: Reptiles evolved from amphibians
- 350 mya: First eukaryotes originated; cells capable of photosynthesis appeared
- 225 mya: Ozone layer; plants, arthropods and amphibians move onto dry land
- 150 mya: First humans appeared
- 6 mya: Original (anaerobic) prokaryotes lived in oceans; no oxygen in atmosphere
The Five Kingdoms

Classification of Organisms

16. a) Put the following in order: class, family, genus, kingdom, order, phylum, species

b) The following exercise is not in the movie. Pause the movie and take a moment to complete this section:

Often, when learning to remember a list of items, it helps to develop a mnemonic or memory tool. Take the first letter of each of the groups above and make a sentence with words that start with the first letters. Example: King Phillip came over for good soup.

Yours: _____________________________________________

17. Label each of the groups humans are classified in with the appropriate level of taxonomy (kingdom, etc.):

Animalia  Chordata  Hominidae  Homo  Mammalia  Primates  sapiens  Vertebrata

18. If a species is “a group of organisms that can reproduce sexually in their natural habitat,”

a) what types of reproduction can make species difficult to determine?

b) why are some animals, like horses and donkeys or lions and tigers, not the same species?

__________________________________________

Understanding Eukaryotes

Structure and Function

19. a) True or False: Structural traits and similarities may indicate relatedness.

b) True or False: Structure has no influence on function.

c) Match the kingdom with its organisms’ usual mode of acquiring nutrients:

<table>
<thead>
<tr>
<th>Kingdom:</th>
<th>Animal</th>
<th>Fungi</th>
<th>Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient Acquisition Mode:</td>
<td>secrete digestive enzymes</td>
<td>self-nourishing</td>
<td>ingest food</td>
</tr>
</tbody>
</table>

d) Describe one way in which structure and function are related:

__________________________________________

e) Give an example of a structure adapted to a particular function:

__________________________________________

f) Can an organism live as successfully outside of the environment (niche) to which it is adapted? _______
Key Concepts

Reproduction and Development

20. a) Which increases genetic variability – asexual or sexual (circle one) reproduction?

b) True or False: Asexual reproduction and selection are among the driving forces of evolution.

c) Animals have motile / non-motile gametes; fungi have motile / non-motile gametes.

d) Development = the process by which differentiated cells in a multicellular / unicellular organism arise from a multi-celled / single-celled zygote.

e) Plants and fungi exhibit determinate / indeterminate growth, meaning that they can / cannot grow throughout their lives; animals exhibit determinate / indeterminate growth.

Summary

21. a) What functions of eukaryotic organisms will you examine in this series (list at least three)?

b) What constrains these functions for each organism?

c) What changes in the development of multicellular organisms?

d) How will you determine the classification of the organisms you study?

Summary/Review

1. Explain why it might be important to study and understand:

a) the cellular basis for life: ____________________________

b) the differences between prokaryotes and eukaryotes: ____________________________

c) the taxonomy of organisms: ____________________________

d) the nature of evolution: ____________________________

2. List the five kingdoms and give an example organism and characteristic for each. Which one is prokaryotic?

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Organism</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. According to the cell theory, what do ALL organisms have in common?

4. What structure primarily distinguishes eukaryotes from prokaryotes?
The Five Kingdoms

5. What types of characteristics do we look at to determine relatedness and differences among organisms?

6. Why is the classification of organisms not always clear and distinct?

7. List, in order, the levels of taxonomy. Then, using an example organism other than the ones provided by the movie, list the groups into which that organism is classified. Your example organism: ______________

   Level of Taxonomy: ____________
   Group Classified in: ____________

8. Describe a way in which structure and function are related. How does this help us to classify organisms?

9. In what ways do reproduction and development affect relatedness?

10. Define **evolution** and how it affects the relatedness of organisms: