

Basic Biological Principles

Module A Anchor 1

Key Concepts:

- Living things are made of units called cells, are based on a universal genetic code, obtain and use materials and energy, grow and develop, reproduce, respond to their environment, maintain a stable internal environment, and change over time.
- Prokaryotic cells do not separate their genetic material within a nucleus. In eukaryotic cells, the nucleus separates the genetic material from the rest of the cell.
- The cells of multicellular organisms become specialized for particular tasks and communicate with one another.

Vocabulary:

Homeostasis	Evolution	Asexual reproduction
Eukaryote	Nucleus	Sexual reproduction
Cell membrane	DNA	Membrane-bound organelles
Cell	Prokaryote	Cell specialization

Characteristics of Life:

1. List the characteristics of life common to all living things.
2. If an organism lacks any of these characteristics, is it considered living? Why or why not?
3. Which of the following characteristics of living things explains why birds fly south for the winter?
 - A. Living things respond to their environment
 - B. Living things maintain homeostasis
 - C. Living things are made of cells
 - D. Living things are based on a universal genetic code
4. Which characteristic(s) of living things is more important to the survival of the species as a whole, rather than the individual organism? Why?

Prokaryotes vs. Eukaryotes:

1. Compare and contrast prokaryotes and eukaryotes in terms of structures; list specific organelles which are present in each, as well as other structural similarities and differences.
2. Compare and contrast prokaryotes and eukaryotes in terms of genetic material.
3. How are the similarities and differences between prokaryotic and eukaryotic cells dependent on their size?
4. How do the structures of prokaryotic and eukaryotic cells influence their functions?
5. Not all cells are alike. Which of the following is NOT a true statement about differences between cells?
 - A. Cells come in many different shapes
 - B. Different kinds of cells are different sizes
 - C. Some cells have a nucleus and others do not
 - D. Most cells have a membrane, but some do not

Levels of Organization:

1. Describe the relationship between organelles, cells, tissues, organs, and organ systems.
2. Cells in multicellular organisms have many sizes and shapes. These differences are referred to as cell specialization. Cell specialization allows cells to:
 - A. Reproduce
 - B. Perform different functions
 - C. Respond to their environment
 - D. Be less complex

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Characteristics of Life:

1. List the characteristics of life common to all living things.

Living things are made of cells, are based on a universal genetic code, obtain and use materials and energy, grow and develop, reproduce, respond to their environment, maintain a stable internal environment, and change over time.

2. If an organism lacks any of these characteristics, is it considered living? Why or why not?

No – nonliving things can contain some of the characteristics of life. For example, a chemical can react to the environment.

3. Which of the following characteristics of living things explains why birds fly south for the winter?

A. *Living things respond to their environment*

4. Which characteristic(s) of living things is more important to the survival of the species as a whole, rather than the individual organism? Why?

*Reproduction – ensures the continuation of the species, but has no direct benefit to the organism
Change over time – refers to evolution, which occurs to species and not to individual organisms.
Individual organisms survive or do not survive, altering the species as a whole and allowing it to continue existing.*

Prokaryotes vs. Eukaryotes:

1. Compare and contrast prokaryotes and eukaryotes in terms of structures; list specific organelles which are present in each, as well as other structural similarities and differences.

Prokaryotes – No nucleus, no membrane-bound organelles, unicellular

Eukaryotes – contain genetic material within nucleus, contain membrane-bound organelles, can be unicellular or multicellular

Both – contain cell-membrane, cell wall, ribosomes, contain genetic material

2. Compare and contrast prokaryotes and eukaryotes in terms of genetic material.

Prokaryotes do not contain their genetic material within a nucleus. Contain circular pieces of DNA concentrated within a nucleoid. Some contain plasmids, which can be shared with other prokaryotes.

Eukaryotes contain their genetic material in chromosomes within a nucleus.

3. How are the similarities and differences between prokaryotic and eukaryotic cells dependent on their size?

Prokaryotic cells are smaller, therefore have a more favorable surface-area to volume ratio. This makes transport of materials into and out of the cell much easier. Prokaryotes are therefore able to lack membrane-bound organelles and have less complex internal structure. Eukaryotes are generally larger than prokaryotes, and have a less favorable surface-area to

volume ratio. This makes transport more complicated, requiring them to contain a larger variety of organelles.

4. How do the structures of prokaryotic and eukaryotic cells influence their functions?

Prokaryotes contain everything necessary to carry out life processes; however, they do lack the complex internal structure of eukaryotes. The more complex internal structure of eukaryotes allows them to perform a larger array of functions, including those requiring multicellularity.

5. Not all cells are alike. Which of the following is NOT a true statement about differences between cells?

D. Most cells have a membrane, but some do not

Levels of Organization:

1. Describe the relationship between organelles, cells, tissues, organs, and organ systems.

Groups of a variety of organelles make up cells. Groups of the same cell type make up tissues. Groups of multiple tissues make up organs. Groups of organs with the same overall purpose working together make up organ systems.

2. Cells in multicellular organisms have many sizes and shapes. These differences are referred to as cell specialization. Cell specialization allows cells to:

B. Perform different functions

3. The cells of unicellular organisms are:

C. Able to perform all the functions necessary for life

4. Give an example of changes that take place as cells in a multicellular organism differentiate.

Organisms originally begin as undifferentiated stem cells. These stem cells are capable of differentiating into any cell type. A number of factors influence the type of cell into which a stem cell differentiates. These factors are not all fully understood. Once a cell reaches its final differentiated state, it can no longer naturally change.

5. Explain the relationship between cell specialization, multicellular organisms, and homeostasis.

Multicellular organisms are large and complex; therefore, they require more complicated systems in order to maintain homeostasis. Multicellular organisms accomplish this by designating particular functions to particular cells. This allows different cells to work together to maintain homeostasis within a larger organism.

6. How are unicellular and multicellular organisms alike? How are they different?

Alike – both are able to perform all of the functions necessary for life. Both can perform a large array of functions.

Different – the cell of a unicellular organism is capable of performing all its necessary functions. A multicellular organism, due to its large size and complex structure, differentiates different cells for different functions.