

Chapter 1: CELLS: THE FUNDAMENTAL UNITS OF LIFE

Unity and Diversity of Cells

1-1 Living systems are incredibly diverse in size, shape, environment, and behavior. It is estimated that there are between 10 million and 100 million different species. Despite this wide variety of organisms, it remains difficult to define what it means to say something is alive. Which of the following can be described as the smallest living unit?

(a) DNA

(b) cell

(c) organelle

(d) protein

1-2 Indicate whether the following statements are true or false. If the statement is false, explain why it is false.

A. The Paramecium is a multicellular microorganism covered with hair-like cilia.

B. Cells of different types can have different chemical requirements.

C. The branchlike extensions that sprout from a single nerve cell in a mammalian brain can extend over several hundred micrometers.

1-3 For each of the following sentences, fill in the blanks with the best word or phrase selected from the list below. Not all words or phrases will be used; each word or phrase should be used only once.

Cells can be very diverse: superficially, they come in various sizes, ranging from bacterial cells such as *Lactobacillus*, which is a few ___ in length, to larger cells such as a frog's egg, which has a diameter of about one ___. Despite the diversity, cells resemble each other to an astonishing degree in their chemistry. For example, the same 20 ___ are used to make proteins.

Similarly, the genetic information of all cells is stored in their ___. Although

_____ contain the same types of molecules as cells, their inability to reproduce themselves by their own efforts means that they are not considered living matter.

amino acids micrometer(s) viruses

DNA millimeter(s) yeast

fatty acids plants

meter plasma membranes

1-4 How does cellular specialization serve multicellular organisms and how might a high

degree of specialization be detrimental?

1-5 The flow of genetic information is controlled by a series of biochemical reactions that

result in the production of proteins, each with its own specific order of amino acids.

Choose the correct series of biochemical reactions from the options presented here.

(a) replication, transcription, translation

(b) replication, translation, transcription

(c) translation, transcription, replication

(d) translation, replication, transcription

1-6 Proteins are important architectural and catalytic components within the cell, helping to

determine its chemistry, its shape, and its ability to respond to changes in the

environment. Remarkably, all of the different proteins in a cell are made from the same

20_____. By linking them in different sequences, the cell can make protein

molecules with different conformations and surface chemistries, and therefore different

functions.

(a) nucleotides.

(b) sugars.

(c) amino

acids.

(d) fatty acids.

1-7 Which statement is NOT true about mutations?

(a) A mutation is a change in the DNA that can generate offspring less fit for survival than their parents.

(b) A mutation can be a result of imperfect DNA duplication.

(c) A mutation is a result of sexual reproduction.

(d) A mutation is a change in the DNA that can generate offspring that are as fit for survival as their parents are.

1-8 Changes in DNA sequence from one generation to the next may result in offspring that are altered in fitness compared with their parents. The process of change and selection

over the course of many generations is the basis of_____.

(a) mutation.

(b) evolution.

(c) heredity.

(d) reproduction.

1-9 Select the option that best finishes the following statement: "Evolution is a process

_____."

(a) that can be understood based on the principles of mutation and selection.

(b) that results from repeated cycles of adaptation over billions of years.

(c) by which all present-day cells arose from 4–5 different ancestral cells.

(d) that requires hundreds of thousands of years.

1-10 Select the option that correctly finishes the following statement: "A cell's genome

_____."

(a) is defined as all the genes being used to make protein.

(b) contains all of a cell's DNA.