AP® BIOLOGY
2013 SCORING GUIDELINES

Question 6

The following data were collected by observing subcellular structures of three different types of eukaryotic cells.

RELATIVE AMOUNTS OF ORGANELLES IN THREE CELL TYPES

Cell Type	Smooth ER	Rough ER	Mitochondria	Cilia	Golgi Bodies
X	Small amount	Small amount	Large number	Present	Small amount
Y	Large amount	Large amount	Moderate number	Absent	Large amount
Z	Absent	Absent	Absent	Absent	Absent

Based on an analysis of the data, **identify** a likely primary function of each cell type and **explain** how the data support the identification. (**3 points maximum**)

Cell Type	**Identify function**		**Explain how data support identification (1 point each correct pair). NOTE: No points for identification without explanation.**		
X	• Locomotion • Movement / surface transport	**AND**	Has cilia for movement and large amounts of mitochondria to provide energy for locomotion of cell itself (ciliated protist) or movement of particles (mucus /oocyte) along cell surface		
Y	• Secretion / exocytosis • Protein synthesis	**AND**	Has large amounts of rough ER and Golgi to produce and package proteins		
	• Lipid/hormone synthesis • Detoxification	**AND**	Has large amounts of smooth ER to produce lipids / hormones		
Z	• Transport	**OR**	• Oxygen transport in animal cells • Water transport in plant cells	**AND**	Does not require these organelles
	• Protection	**OR**	• Epidermal cells (stratum corneum, cork, nails)	**AND**	
	• Support	**OR**	• Ground tissue (schlerenchyma) • Vascular tissue (xylem)	**AND**	
	• Storage	**OR**	• Maximizes volume / space available (hemoglobin, oxygen)	**AND**	
	• No function	**OR**	• Is a dead cell/is undergoing apoptosis	**AND**	

6A,

6. The following data were collected by observing subcellular structures of three different types of eukaryotic cells.

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Based on an analysis of the data, **identify** a likely primary function of each cell type and **explain** how the data support the identification.

ANSWER PAGE FOR QUESTION 6

Cell X likely functions in locomotion because it has a large number of mitochondria, which perform cellular repiration and synthesize ATP, which provides the energy needed for movement. Cell X also has cilia, which are used for movement.

Cell Y likely functions to synthesize and excrete proteins and compounds needed elsewhere in the organism, because it has a large amount of smooth and rough ER, which function in protein synthesis and processing (and rough ER has ribosomes, which actually perform protein synthesis), and a large number of Golgi bodies, which package and ship out proteins.

Cell Z may be a surface or epithelial cell that serves no function except for protection or insulation, since it lacks many organelles used for other functions.

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6B1

6. The following data were collected by observing subcellular structures of three different types of eukaryotic cells.

RELATIVE AMOUNTS OF ORGANELLES IN THREE CELL TYPES

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X	Small amount	Small amount	Large number	Present	Small amount
Y	Large amount	Large amount	Moderate number	Absent	Large amount
Z	Absent	Absent	Absent	Absent	Absent

Based on an analysis of the data, **identify** a likely primary function of each cell type and **explain** how the data support the identification.

ANSWER PAGE FOR QUESTION 6

Cell x B a cell focused one movement There are few golgi bodies and little ER (rough or smooth) so protein production is not a priority, but there is a lot of mitochondria to produce ATP and cilia would facilitate movement.

Cell y B focused on protein synthesis. It has no cilia for movement and has an average number of mitochondria, but the large number of golgi bodies and the abundance of ER (especially rough, which contains ribosomes) means it is about proteins.

Cell z might be a cyanobacteria or other photosynthetic prokaryot. It would gain energy from the ATP left over from the light reactions in photosynthesis and use loose ribosomes to create proteins.

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6C,

6. The following data were collected by observing subcellular structures of three different types of eukaryotic cells.

RELATIVE AMOUNTS OF ORGANELLES IN THREE CELL TYPES

Cell Type	Smooth ER	Rough ER	Mitochondria	Cilia	Golgi Bodies
X	Small amount	Small amount	Large number	Present	Small amount
Y	Large amount	Large amount	Moderate number	Absent	Large amount
Z	Absent	Absent	Absent	Absent	Absent

ATP

Protein synthesis

neuron

Based on an analysis of the data, **identify** a likely primary function of each cell type and **explain** how the data support the identification.

ANSWER PAGE FOR QUESTION 6

The primary function of cell type X is for the creation of ATP in cellular respiration. This is because there are large amounts of mitochondria, which are "the powerhouse of the cell" and this is where ~~the~~ the krebs cycle, ETC, and chemiosmosis takes place to create energy in the form of ATP.

The primary function of cell Y is the synthesis of proteins. This is because there are large amt of Rough ER where protein production takes place, large amt. of smooth ER to detoxify, and large amt. of golgi bodies to package proteins.

The primary function of cell Z is a neuron to send impulses throughout the nervous system. This is because the cell has no Rough ER, Smooth ER, mitochondria, cilia, or Golgi bodies. A neuron is made up of dendrites, axon, terminal branches to help send impulses to the brain.

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AP® BIOLOGY
2013 SCORING COMMENTARY

Question 6

Question 6 was written to the following Learning Objectives in the AP Biology Curriculum Framework: 2.5 and 4.6

Overview

Question 6 asks students to work with data about the contribution of cellular structures to specialized cellular functions. Students were presented with experimental observations about the relative amounts of specific organelles in three different cell types and asked to identify a likely function of each cell type. Students were then asked to explain how the experimental observations support their conclusions about why each cell type is likely to have the primary function that they identified in their response.

Sample: 6A
Score: 3

The response earned 1 point for identifying locomotion as a likely function of Cell X and explaining that mitochondria synthesize ATP, which is used by the cilia for movement

The response earned 1 point for identifying synthesis and packaging of proteins as a likely function of Cell Y and explaining that the large amount of rough ER and Golgi bodies indicates that the cells synthesize, package, and ship out proteins needed elsewhere in the organism.

The response earned 1 point for identifying Cell Z as serving no function except for protection and explaining that the cells lack the organelles used for other functions.

Sample: 6B
Score: 2

The response earned 1 point for identifying movement as a likely function of Cell X and explaining that there are a lot of mitochondria to synthesize ATP and cilia to facilitate movement.

The response earned 1 point for identifying protein synthesis as a likely function of Cell Y and explaining that there is an abundance of rough ER and a large number of Golgi bodies.

Sample: 6C
Score: 1

The response earned 1 point for identifying the synthesis of proteins as a likely primary function of Cell Y and explaining that there are large amounts of rough ER where protein production takes place and large amounts of Golgi bodies to package proteins.