HL Paper 1

Which functions are carried out by all unicellular organisms?

A.	growth	homeostasis	photosynthesis	response
B.	growth	homeostasis	metabolism	response
C.	metabolism	photosynthesis	reproduction	response
D.	growth	nutrition	reproduction	ventilation

What is an example of the therapeutic use of stem cells?

A. Sequencing the human genome
B. Forensic investigations of paternity
C. Production of genetically modified crops
D. Restoration of insulation tissue in neurons

What distinguishes prokaryotic cells from eukaryotic cells?

	Prokaryotic cells	Eukaryotic cells
A.	no plasma membrane	plasma membrane
B.	80S ribosomes	70S ribosomes
C.	Golgi apparatus	mitochondria
D.	no internal membrane compartments	internal membrane compartments

Which substance is used for structure in plants?

A. Amylopectin
B. Cellulose
C. Collagen
D. Starch

An unknown cell is observed using a microscope. A cell wall, ribosomes and DNA are identified. What can be concluded from these observations?

A. It can only be a prokaryotic cell.
B. It can only be a eukaryotic cell.
C. It could be a prokaryotic or eukaryotic cell.
D. It can only be a plant cell.

A red blood cell is 8 μm in diameter. If drawn 100 times larger than its actual size, what diameter will the drawing be in mm?

A. 0.08 mm
B. 0.8 mm
C. 8 mm
D. 80 mm

What is proportional to a cell's surface area?

A. Rate of exchange of materials
B. Rate of heat production
C. Rate of waste production
D. Rate of oxygen consumption

What are stem cells?

A. Specialized cells that can be used therapeutically
B. Surplus cells taken from an embryo
C. Cells that retain their ability to divide and differentiate
D. Cells in the xylem and phloem tissues that support a plant

---

Which are functions of membrane proteins?

A. Hormone binding sites and DNA replication

B. Cell adhesion and translation

C. Cell to cell communication and protein pumps

D. Passive transport and glycosis

Where are proteins synthesized by free ribosomes used?

A. Outside the cell after secretion
B. Within the nucleus
C. Within the lysosomes
D. Within the cytoplasm

What describes nuclear division in stem cells?

A. Clonal selection

B. Mitosis

C. Cytokinesis

D. Meiosis

Which evidence falsifies the Davson–Danielli model?

I. The presence of globular proteins within the phospholipid bilayer

II. Non-polar amino acids cause proteins to remain embedded in membranes

III. Membrane proteins remain in a fixed position inside a membrane

A. I only

B. I and II only

C. II and III only

D. I, II and III

Which property makes stem cells suitable for therapeutic use?

A. They can divide by meiosis to form gametes.
B. They contain chemicals that can kill bacteria.
C. Their chromosomes are suitable for gene transfer and cloning.
D. They can differentiate into specialized cells.

What is a function of the plant cell wall?

A. Formation of vesicles for transport of large molecules
B. Prevention of excessive water uptake
C. Communication with other cells by means of glycoproteins
D. Active transport of ions

What features of a cell favour efficient removal of waste products?

	Surface area	Volume
A.	high	high
B.	high	low
C.	low	high
D.	low	low

Which is a difference between prokaryote and eukaryote cells?

	Prokaryote cell	Eukaryote cell
A.	no ribosomes	ribosomes
B.	no region containing DNA	nucleus containing DNA
C.	no flagella	flagella
D.	no mitochondria	mitochondria

What happens to the cell surface area to volume ratio as a cell grows?

A. It decreases, so production of waste material is reduced.
B. It increases, so mineral ion absorption is increased.
C. It increases, so osmosis is reduced.
D. It decreases, so rate of gas exchange is too low.

What is an example of binary fission?

A. Cell division in prokaryotes
B. Production of haploid gametes
C. Separation of chromatids in prokaryotic cells
D. Replication of prokaryotic DNA occurring simultaneously in two directions

---

Which of the following is **not** a function performed by a membrane protein?

A. Hormone binding sites
B. Cell adhesion
C. Enzyme synthesis
D. Pumps for active transport

Which process is possible due to the fluidity of cell membranes?

A. Endocytosis
B. Osmosis
C. ATP production
D. Cell recognition

Animal cells often secrete glycoproteins as extracellular components. What is a role of these glycoproteins?

A. Adhesion

B. Additional energy reserve

C. Membrane fluidity

D. Water uptake

How do prokaryotic cells divide?

A. By mitosis
B. By meiosis
C. By budding
D. By binary fission

What is the approximate thickness of the plasma membrane of a cell?

A. 10 nm

B. 50 nm

C. 10 µm

D. 50 µm

The following events occur in mitosis.

X: Attachment of spindle microtubules to centromeres
Y: Movement of sister chromatids to opposite poles
Z: Supercoiling of chromosomes

What is the correct sequence of events?

A. X → Z → Y
B. X → Y → Z
C. Z → X → Y
D. Z → Y → X

What causes cells to differentiate?

A. Sufficient nutrition
B. Full expression of all genes
C. Specialized functions at different stages of embryo development
D. Expression of some genes with suppression of other genes

During which phase of the cell cycle do chromosomes duplicate?

A. G1
B. S
C. G2
D. Mitosis

What is a difference between a cell in the G_1 phase and a cell in the G_2 phase of the cell cycle?

A. A cell in the G_2 phase would be smaller than a cell in the G_1 phase.
B. A cell in the G_2 phase would have more mitochondria than a cell in the G_1 phase.
C. A cell in the G_1 phase would have more DNA in its chromosomes than a cell in the G_2 phase.
D. DNA replication occurs in the G_1 phase but not in the G_2 phase.

What actions occur during interphase?

A. DNA replication and RNA synthesis
B. Spindle formation and DNA replication
C. Chromosome alignment at the metaphase plate
D. Growth and separation of sister chromatids

During which stage does the cell surface area to volume ratio decrease?

A. Interphase

B. Metaphase

C. Telophase

D. Cytokinesis

Which of the following processes take place during interphase in animal cells?

I. Spindle formation
II. Transcription and translation
III. Increase in numbers of mitochondria

A. I only
B. I and II only
C. II and III only
D. I, II and III

How do cells in multicellular organisms differentiate?

A. Some cell types divide by mitosis more often than others.
B. They express some of their genes but not others.
C. Some of their proteins denature but not others.
D. Their DNA content changes with time.

What can be deduced about a striated muscle fibre from both of these statements?

"A eukaryotic cell has one nucleus."
"A striated muscle fibre has many nuclei."

A. It is prokaryotic.
B. It is an exception to cell theory.
C. It consists of aseptate hyphae.
D. It is preparing to divide.

Which features are present in prokaryotic cells?

A. DNA, plasma membrane and mitochondria
B. DNA, cell wall and pili
C. ribosomes, chloroplasts and cell wall
D. cytoplasm, ribosomes and rough endoplasmic reticulum

Which functions of life are carried out by **all** unicellular organisms?

A.	photosynthesis	nutrition	homeostasis
B.	nutrition	reproduction	response
C.	metabolism	photosynthesis	growth
D.	growth	reproduction	photosynthesis

The giant marine alga *Halicystis ovalis* is able to move sodium ions from vacuoles to the surrounding seawater through active transport. Which condition or feature is required for this mode of transport?

A. Movement from a region of higher sodium concentration to a region of lower sodium concentration
B. A partially permeable surface
C. Membrane fluidity
D. Transmembrane proteins

What structures are part of an *Escherichia coli* cell?

A. Ribosomes, nucleoid and Golgi apparatus

B. Ribosomes, mitochondria and pili

C. Cell wall, plasma membrane and nuclear membrane

D. Pili, flagella and cytoplasm

What is evidence for the endosymbiotic theory?

A. RNA can catalyse metabolic reactions.

B. Meteorites contain organic molecules.

C. Amino acids can be synthesized from inorganic compounds.

D. Mitochondria possess their own DNA.

Which of the following take(s) place during interphase and mitosis in animal cells?

I. Re-formation of nuclear membranes
II. Pairing of homologous chromosomes
III. DNA replication

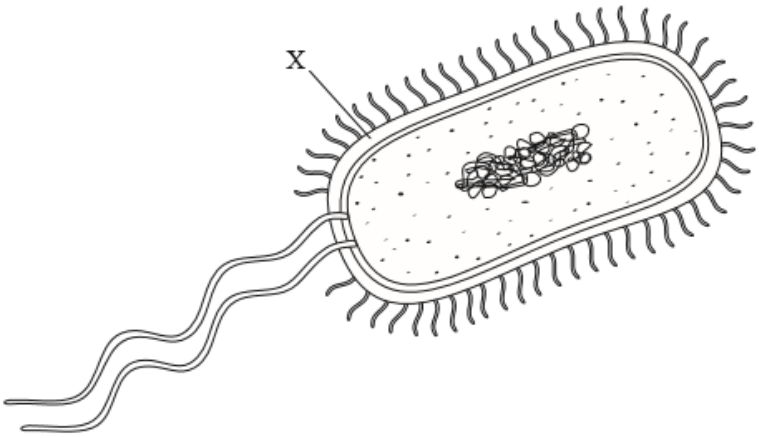
A. I only
B. I and II only
C. II and III only
D. I and III only

Which pair of features is correct for both diffusion and osmosis?

	Diffusion	Osmosis
A.	net movement of particles from high to low concentration	active transport of water across a partially permeable membrane
B.	net movement of particles from low to high concentration	active transport of water across a partially permeable membrane
C.	net movement of particles from low to high concentration	passive movement of water across a partially permeable membrane
D.	net movement of particles from high to low concentration	passive movement of water across a partially permeable membrane

---

The diagram shows the structure of a bacterium.



What is the structure labelled X?

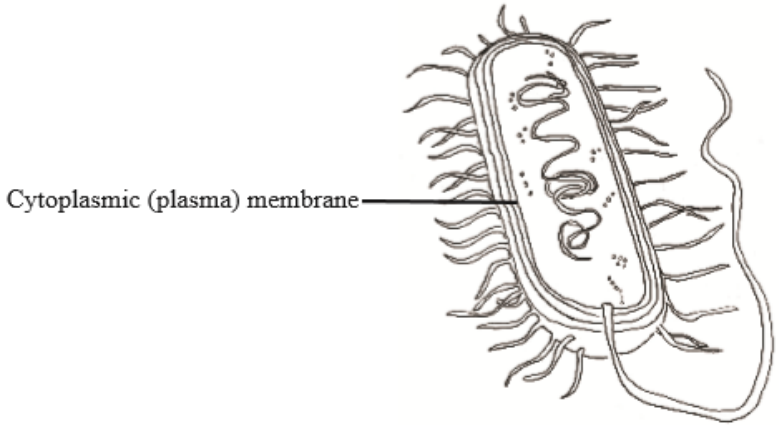
A. Pilus
B. Cell wall
C. Cytoplasm
D. Cell membrane

What is the process shown in this image?

[Source: http://www.slideshare.net/sciencepowerpointcom/bacterial-reproduction-biology-lesson-powerpoint-binary-fission]

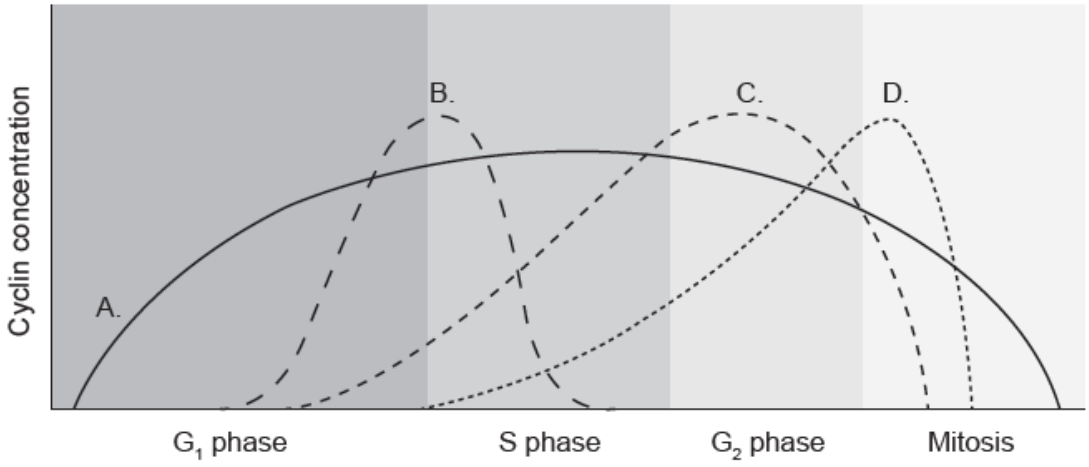
A. Binary fission of a prokaryotic cell
B. Telophase II in a eukaryotic cell
C. End of mitosis in a prokaryotic cell
D. Cytokinesis of a eukaryotic cell

What is the function of the cytoplasmic (plasma) membrane of this bacterium?



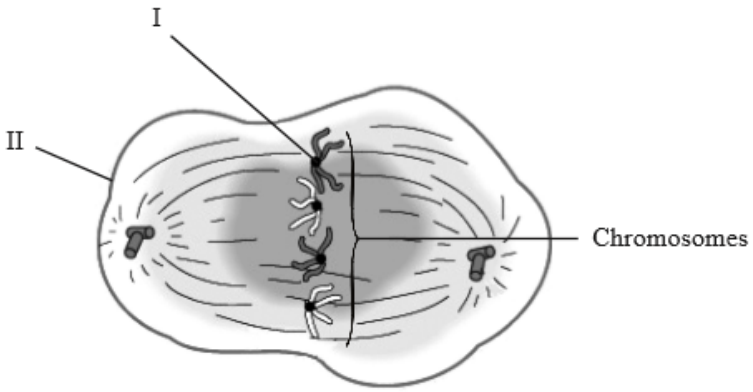
A. To produce ADP
B. To form the only protective layer preventing damage from outside
C. To control entry and exit of substances
D. To synthesize proteins

The diagram shows the concentration of four cyclins during the cell cycle. Which curve represents the cyclin that promotes the assembly of the mitotic spindle?



[Source: http://upload.wikimedia.org/wikipedia/commons/thumb/c/ce/Cyclin_Expression.svg/400px-Cyclin_Expression.svg.png]

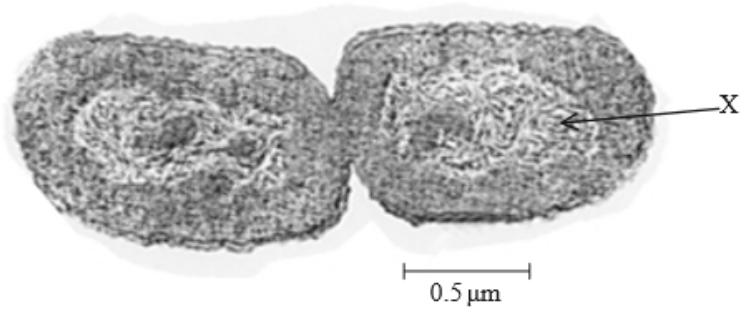
The diagram below shows a cell during mitosis.



What are the structures and stage of mitosis?

	Stage of mitosis	Structure I	Structure II
A.	metaphase	chromatid	nuclear membrane
B.	anaphase	centromere	plasma membrane
C.	anaphase	chromatid	nuclear membrane
D.	metaphase	centromere	plasma membrane

Questions 3 and 4 refer to the following micrograph of an E.coli bacterium undergoing reproduction.

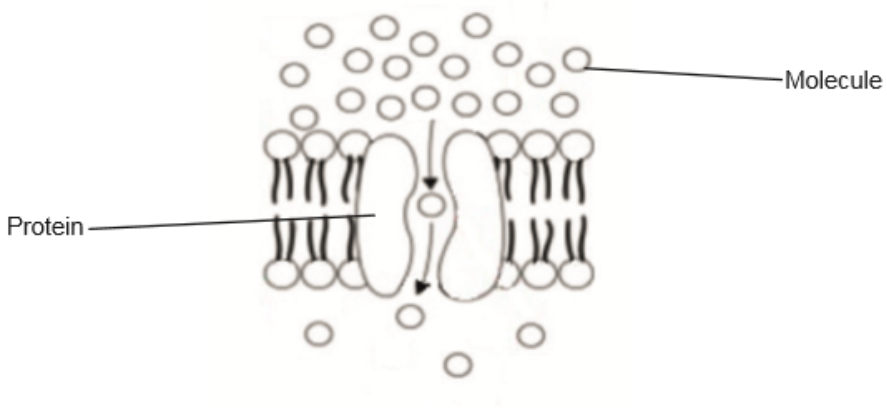


[Source: www.bio.mtu.edu/campbell/prokaryo.htm]

In the diagram what does label X identify?

A. Nucleoid region
B. Chromatin
C. Histones
D. Endoplasmic reticulum

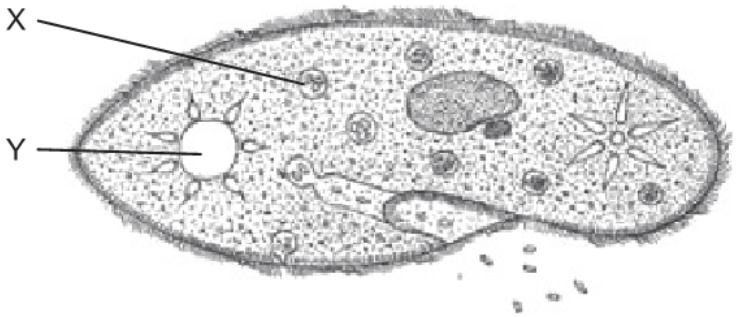
The diagram is a model of one type of movement across a membrane.



[Source: CAMPBELL, NEIL A.; REECE, JANE B., *BIOLOGY*, 7th, ©2005, p. 134.
Reprinted by permission of Pearson Education, Inc., New York, New York.]

What is this type of movement?

A. Simple diffusion
B. Facilitated diffusion
C. Osmosis
D. Active transport

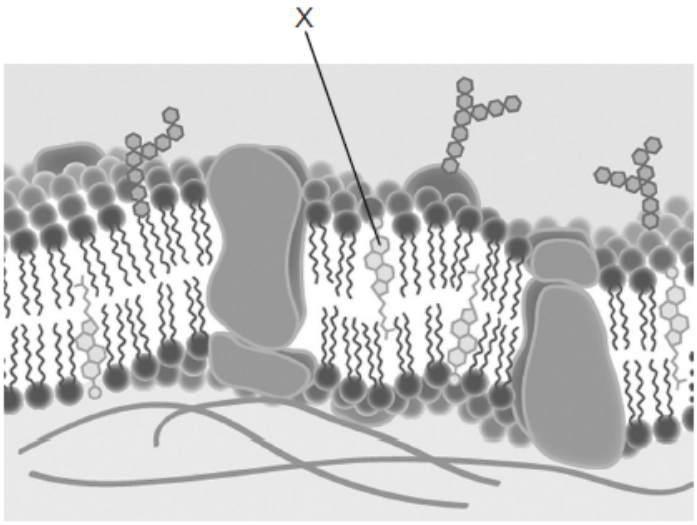


[Source: Adapted from www.biology-resources.com. Copyright 2004–2017 D G Mackean & Ian Mackean. All rights reserved.]

Which function is accomplished by structures X and Y in the *Paramecium*?

	X	Y
A.	digestion	homeostasis
B.	feeding	metabolism
C.	food storage	movement
D.	DNA replication	respiration

The diagram shows a plasma membrane.



[Source: adapted from http://shmoop.com]

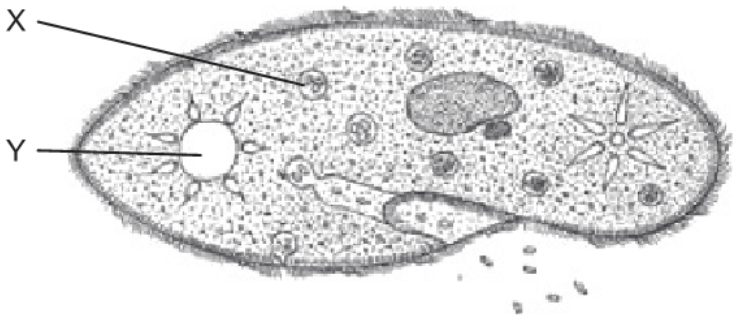
Which molecule is labelled X?

A. Cholesterol

B. Glycoprotein

C. Phospholipid

D. Amylase



[Source: Adapted from www.biology-resources.com. Copyright 2004–2017 D G Mackean & Ian Mackean. All rights reserved.]

The salt concentration inside the *Paramecium* is 1.8 %. The salt concentration in the surrounding medium suddenly drops to 0.2 %. What will be the likely response?

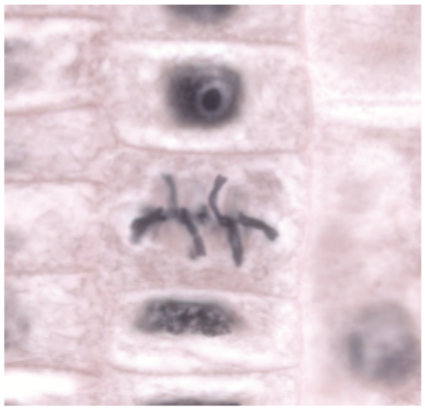
A. The cell will lose salt to the medium.

B. The contractile vacuole will expel more water.

C. The cell will swell and eventually burst.

D. The membrane will become more permeable to salt.

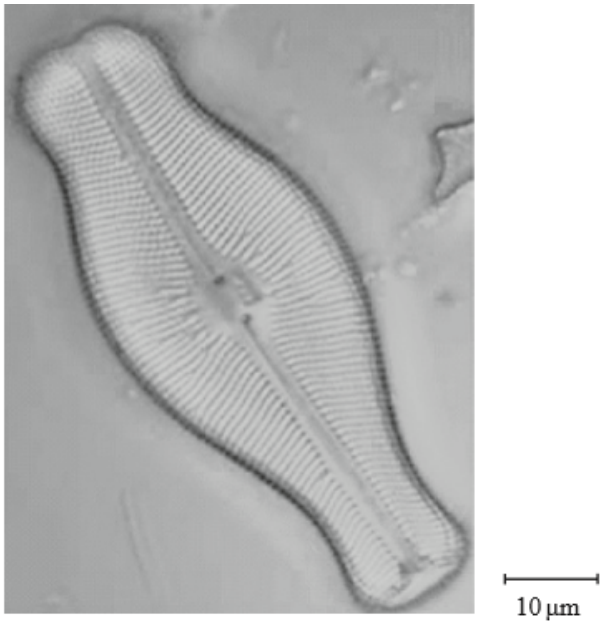
Which phase of mitosis is shown in the photomicrograph?



[Source: http://commons.wikimedia.org/wiki/File:Allium-Mitose03-DM100x_BL28.jpg]

A. Anaphase
B. Metaphase
C. Prophase
D. Telophase

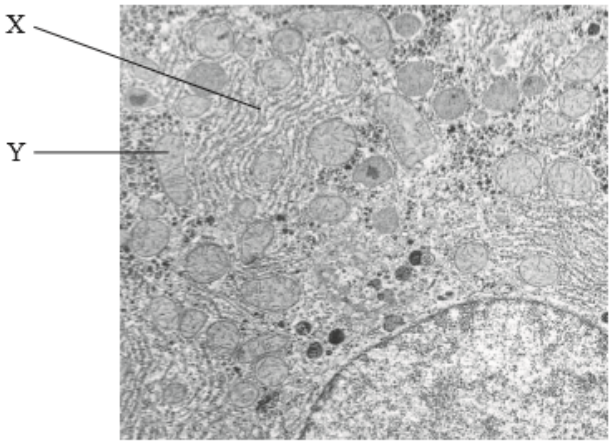
The diatom *Didymosphenia geminata* is a species of single-celled alga that lives in warm, shallow water. In the light microscope image below, the scale bar is equal to 10 micrometres (10 μm). What is the actual length of the cell?



[Source: United States Environmental Protection Agency
http://www.epa.gov/region8/water/didymosphenia/White%20Paper%20Jan%202007.pdf
EPA white paper]

A. 0.007 mm
B. 0.07 mm
C. 0.7 mm
D. 7.0 mm

In the electron micrograph of a rat liver cell below, what are the structures labelled X and Y?

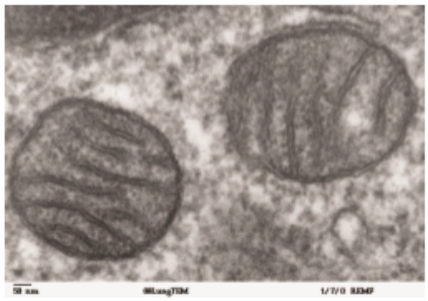


[Source: ©Principia Cybernetica. Used with permission.]

	X	Y
A.	rough endoplasmic reticulum	mitochondrion
B.	smooth endoplasmic reticulum	nucleus
C.	Golgi apparatus	vesicle
D.	chromosome	vacuole

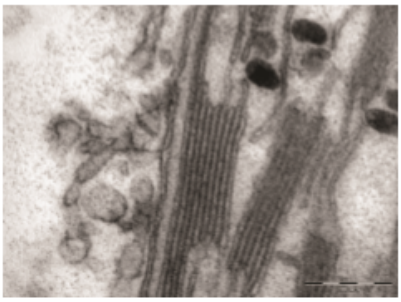
In the electron photomicrographs which organelle is involved in vesicle formation?

A.



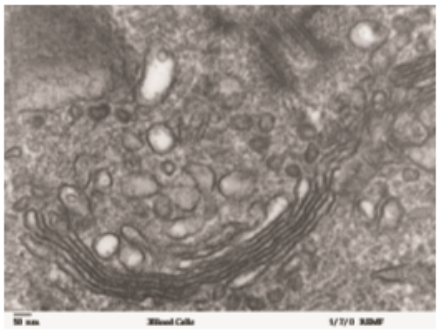
http://en.wikipedia.org/wiki/File:Mitochondria,_mammalian_lung_-_TEM.jpg

B.



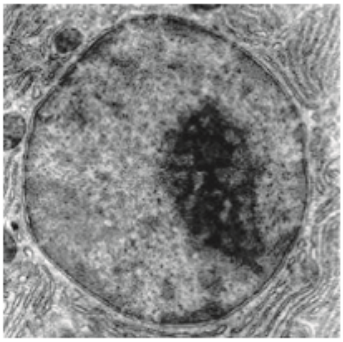
http://en.wikipedia.org/wiki/File:Chloroplast_in_leaf_of_Anemone_sp_TEM_85000x.png

C.



http://en.wikipedia.org/wiki/File:Human_leukocyte,_showing_golgi_-_TEM.jpg

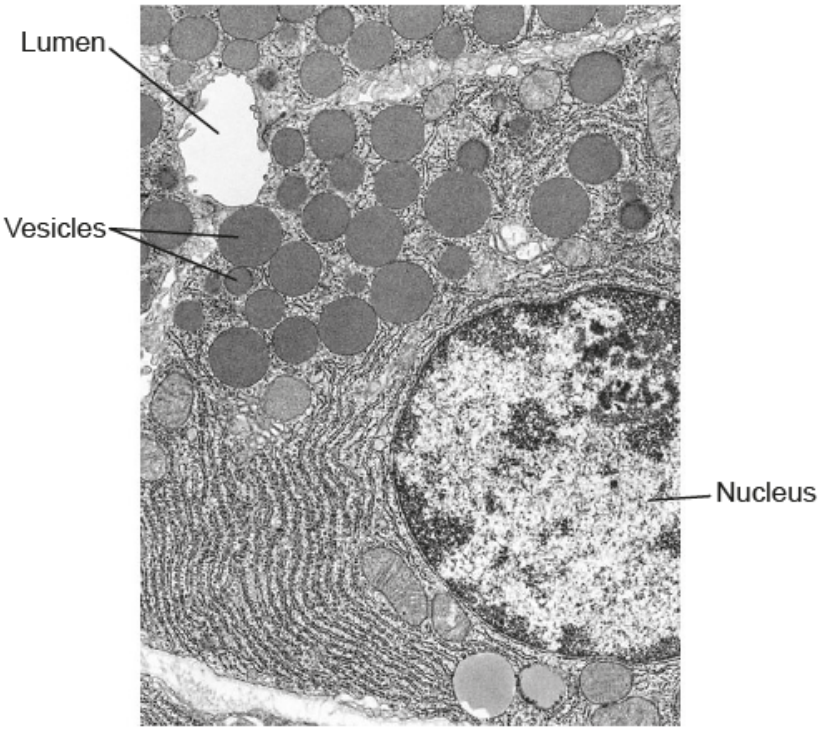
D.



http://en.wikipedia.org/wiki/File:Micrograph_of_a_cell_nucleus.png

---

The image shows an electron micrograph of pancreatic exocrine cells.



[Source: Meschner AL, *Junqueira's Basic Histology: Text and Atlas*, 12th edition. Copyright McGrawHill Education.]

What is the role of the vesicles shown in the micrograph?

A. To transport hormones between the rough endoplasmic reticulum and the Golgi apparatus

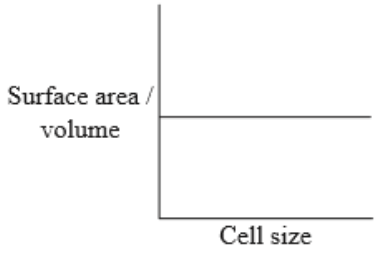
B. To store glycogen when blood glucose levels are high

C. To move enzymes out of the cell by exocytosis

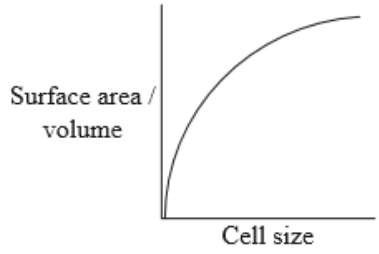
D. To digest cellulose

How does the surface area to volume ratio change with an increase in cell size?

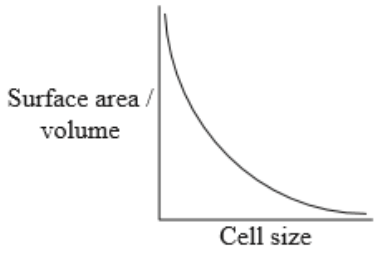
A.



B.



C.



D.