SL Paper 1

The cell membrane model proposed by Davson–Danielli was a phospholipid bilayer sandwiched between two layers of globular protein. Which evidence led to the acceptance of the Singer–Nicolson model?

A. The orientation of the hydrophilic phospholipid heads towards the proteins
B. The formation of a hydrophobic region on the surface of the membrane
C. The placement of integral and peripheral proteins in the membrane
D. The interactions due to amphipathic properties of phospholipids

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What is osmosis?

A. The movement of water through a membrane from a low to a high solute concentration

B. The movement of solutes through a membrane from a high to a low water concentration

C. The movement of water through a membrane from a high to a low solute concentration

D. The movement of solutes through a membrane from a low to a high water concentration

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What route is used to export proteins from the cell?

A. Golgi apparatus → rough endoplasmic reticulum → plasma membrane
B. Rough endoplasmic reticulum → Golgi apparatus → plasma membrane
C. Golgi apparatus → lysosome → rough endoplasmic reticulum
D. Rough endoplasmic reticulum → lysosome → Golgi apparatus

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.

Which process requires channel proteins?

A. Simple diffusion
B. Facilitated diffusion
C. Binding of hormones

D. Exocytosis

What feature do plant cells have but not animal cells?

A. Plasma membranes

B. Mitochondria

C. Cell walls

D. 80S ribosomes

Which movement occurs by osmosis?

A. Oxygen from alveoli into the blood
B. Water from a leaf into the atmosphere
C. Water from soil to root
D. Nitrate ions from soil to root

What provides evidence for the endosymbiotic theory?

A. Mitochondrial DNA in eukaryotic cells
B. 70S ribosomes in prokaryotic cells
C. Gene transfer from prokaryotic cells to eukaryotic cells using plasmids
D. Prokaryotic cells (*Escherichia coli*) in the large intestine digest proteins

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Which structure is found in *E. coli*, but **not** in a eukaryotic cell?

A. Cell wall
B. Endoplasmic reticulum
C. Cytoplasm
D. Pili

How can cells in a multicellular organism differentiate?

A. They express some of their genes but not others.
B. They all have a different genetic composition.
C. Different cells contain a different set of chromosomes.
D. Different cells do not have some of the genes.

If there are 16 chromosomes in a cell that is about to divide, what will be the number of chromosomes in a daughter cell after division by mitosis or meiosis?

	Mitosis	Meiosis
A.	16	16
B.	16	8
C.	8	16
D.	8	8

Which process contributes to growth of a multicellular body?

A. Exocytosis
B. Meiosis
C. Mitosis
D. Osmosis

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.

A botanist measures a leaf and finds it is 24 cm long and 8 cm wide. His drawing of the leaf is 4 cm wide. Which was the magnification and length of his drawing, assuming that the proportions of the drawing were correct?

	Scale	Length / cm
A.	×2	48
B.	×2	12
C.	×0.5	48
D.	×0.5	12

Why do crop plants dry out when a field is irrigated with water contaminated by sea water?

A. The plants lose water by active transport.
B. The plants gain salt by osmosis.
C. The plants gain salt by diffusion.
D. The plants lose water by osmosis.

Which of the following characteristics found in a structure necessarily indicates that it is alive?

A. The presence of genetic material
B. The presence of a lipid bilayer
C. Metabolism
D. Movement

Which structure is present in a prokaryotic cell?

A. Plasma membrane
B. 80S ribosome
C. Nucleus
D. Chloroplast

Which events occur during both mitosis and meiosis?

A. Production of haploid cells from diploid cells

B. Crossing over

C. Separation of the chromatids from each chromosome

D. Production of genetically different cells

Which of the following structures does *Escherichia coli* have?

I. Ribosomes
II. Pili
III. Nucleus

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

The statement relates to Pasteur's experiments.

> In his experiments, Louis Pasteur demonstrated that:
> - if broth was boiled to kill all organisms and was then kept in swan-necked flasks, preventing the entry of organisms, no organisms grew in the broth
> - if the swan-necked flask was broken, mold soon started to grow in the broth.

What did this statement suggest?

A. Mold evolved by endosymbiosis.
B. Oxygen is required for anaerobic respiration.
C. Cells can only be formed by division of pre-existing cells.
D. Nutrients are a requirement for mold growth.

Cells in the adrenal gland produce the hormone epinephrine and store it in vesicles. To release epinephrine these vesicles are carried to the plasma membrane and fuse with it. What process is occurring?

A. Expulsion

B. Exchange

C. Excretion

D. Exocytosis

What is a role of cholesterol in animal cells?

A. It increases body fat.

B. It controls membrane fluidity.

C. It lines the inner wall of capillaries.

D. It is a constituent of bile.

Which events occur during the G_1 phase and S phase of the cell cycle?

	G_1 phase	S phase
A.	DNA replicates	cell grows
B.	mitosis begins	cell divides
C.	cell divides	mitosis begins
D.	cell grows	DNA replicates

What are characteristics of eukaryotic cells?

	Nucleus	Mitochondria	Ribosomes
A.	present	present	80S
B.	present	absent	70S
C.	absent	present	80S
D.	absent	absent	70S

Which organism has DNA located in three organelles?

A. A sponge

B. A fern

C. A flatworm

D. A bacterium

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

Which of these processes require mitosis?

A. Embryological development
B. Reducing surface area to volume ratio
C. Maintaining cell size
D. Cell growth

What is the principal mode of division for the prokaryote *Escherichia coli*?

A. Endocytosis
B. Binary fission
C. Cytokinesis
D. Meiosis

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

A. Interphase

B. Metaphase

C. Telophase

D. Cytokinesis

Which of the following does **not** occur during interphase?

A. Replication
B. Translation
C. Cytokinesis
D. An increase in the number of mitochondria

The salt concentration inside an animal cell is 1.8 %. The salt concentration in the surrounding medium becomes 5 %. What will be the likely response?

A. The cell will gain water from the medium.

B. The cell will lose salt to the medium.

C. The cell will remain unchanged.

D. The cell will shrink from loss of water.

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

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

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

A. It decreases.
B. It increases.
C. It doubles.
D. It does not change.

Which characteristic of stem cells makes them useful for treating Stargardt's disease?

A. They can differentiate into retinal cells.
B. They are readily available from especially created embryos.
C. They transport white blood cells to the eyes.
D. They divide by binary fission so provide sufficient cells.

Why do multicellular organisms have emergent properties?

A. They have more genes than unicellular organisms.

B. Properties of unicellular organisms are enhanced by having many cells.

C. All of their genes are expressed whereas unicellular organisms express only some.

D. They show properties that can only result from the interaction of many cells.

Which of the following will contribute to the cell theory?

I. Living organisms are composed of cells.
II. All cells come from pre-existing cells by mitosis.
III. Cells are the smallest units of life.

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

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

A. Response, homeostasis, growth and photosynthesis

B. Metabolism, ventilation, reproduction and nutrition

C. Response, homeostasis, metabolism and growth

D. Reproduction, ventilation, response and nutrition

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 process is possible due to the fluidity of cell membranes?

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

A cell has cytoplasm, a cell wall, naked DNA and ribosomes. Based on this information, what type of cell could this be?

A. A cell from a pine tree
B. A grasshopper cell
C. A human red blood cell
D. A bacterium

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

Which statement is part of the cell theory?

A. Cells are composed of organic molecules.
B. Cells have DNA as their genetic material.
C. Cells have cytoplasm surrounded by a membrane.
D. Cells come from pre-existing cells

During which stage of the cell cycle are the numbers of mitochondria increased in a cell?

A. Cytokinesis

B. Interphase

C. Meiosis

D. Mitosis

Which organelle is involved in generating vesicles destined for the cell membrane?

A. Golgi apparatus

B. Smooth endoplasmic reticulum

C. Rough endoplasmic reticulum

D. Lysosome

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

A. 10 nm
B. 50 nm
C. 10 μm
D. 50 μm

Which of the following structures are found in all cells?

A. Mitochondria
B. Cell walls
C. Chloroplasts
D. Ribosomes

Where in the cell do condensation reactions involving amino acids occur?

A. Nucleus
B. Golgi apparatus
C. Ribosomes
D. Lysosome

What feature of cell membranes allows endocytosis to occur?

A. Fluidity of phospholipid bilayer
B. Presence of protein pumps
C. Presence of carrier proteins
D. Glycoprotein binding sites

What occurs during meiosis but not mitosis?

A. Spindles are formed from microtubules.

B. Chromosome number is conserved.

C. Homologous chromosomes pair up.

D. Centromeres split.

What happens during the G_2 stage of interphase?

A. Homologous chromosomes pair
B. Synthesis of proteins
C. Homologous chromosomes separate
D. Replication of DNA

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 do prokaryotic cells have that eukaryotic cells do not?

A. Mitochondria
B. 70S ribosomes
C. Histones
D. Internal membranes

Which structure found in eukaryotes has a single membrane?

A. Nucleus

B. Lysosome

C. Chloroplast

D. Mitochondrion

A number of different proteins are involved in nerve function. Which of the following does not require a membrane protein?

A. Active transport of sodium
B. Diffusion of K^+ into the cell
C. Diffusion of the neurotransmitter across the synapse
D. Binding of the neurotransmitter to the post-synaptic membrane

Which pair of features is correct for both a human liver cell and an *Escherichia coli* cell?

	Human liver cell	***Escherichia coli* cell**
A.	contains DNA associated with protein	contains naked DNA
B.	has 70S ribosomes	has 80S ribosomes
C.	contains mitochondria	contains mitochondria
D.	contains DNA enclosed by a membrane	contains DNA associated with protein

If a mitochondrion has a length of 5 μm and a student's drawing of the mitochondrion is 10 mm, what is the magnification of the drawing?

A. × 0.0005

B. × 0.5

C. × 200

D. × 2000

The giant alga *Acetabularia* has a feature that suggests it is an exception to the cell theory. What feature is this?

A. It lacks a nucleus.

B. It lacks a cell wall.

C. It has only one mitochondrion.

D. It lacks subdivision into separate cells.

Which sequence shows increasing relative size?

	Smallest → Largest		
A.	membrane thickness	virus	bacterium
B.	molecule	virus	membrane thickness
C.	bacterium	virus	eukaryotic cell
D.	bacterium	organelle	virus

Where can 70S ribosomes be found?

A. On membranes of the Golgi apparatus
B. In prokaryotic cells
C. On membranes of the rough endoplasmic reticulum
D. In nuclei

What do diffusion and osmosis have in common?

A. They only happen in living cells.
B. They require transport proteins in the membrane.
C. They are passive transport mechanisms.
D. Net movement of substances is against the concentration gradient.

What distinguishes prokaryotic cells and eukaryotic cells?

	Prokaryotic cells	Eukaryotic cells
A.	cell wall	plasma membrane
B.	cell structure not compartmentalized	cell structure compartmentalized
C.	smooth endoplasmic reticulum	rough endoplasmic reticulum
D.	no ribosomes	ribosomes present

Which functions of life are found in unicellular organisms?

A. growth, response and nutrition
B. differentiation, response and nutrition
C. metabolism, meiosis and homeostasis
D. growth, metabolism and differentiation

If a *Sequoia sempervirens* tree is 100 m tall and a drawing of it is 100 mm tall, what is the magnification of the drawing?

A. ×0.001

B. ×0.1

C. ×1.0

D. ×1000

What is the function of the Golgi apparatus?

A. Transport of lipids
B. Synthesis of polypeptides
C. Processing of proteins for secretion
D. Generation of most of the cell's supply of ATP

In a cell, what is the effect of a large surface area to volume ratio?

A. Slower rate of exchange of waste materials
B. Faster heat loss
C. Faster rate of mitosis
D. Slower intake of food

Which feature of striated muscle cells allows them to be considered as a possible exception to the cell theory?

A. They are found in multicellular organisms.
B. They contain more than one nucleus.
C. They are specialized for movement.
D. They do not carry out mitosis.

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

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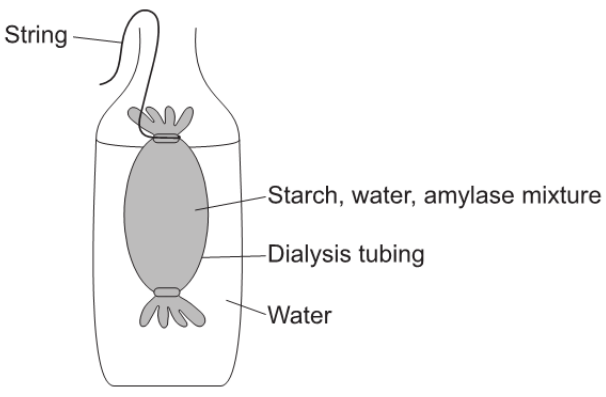
What is the difference between simple diffusion and facilitated diffusion?

	Simple diffusion	Facilitated diffusion
A.	Rate decreases with increasing concentration gradient	Rate increases with increasing concentration gradient
B.	Faster movement of molecules	Slower movement of molecules
C.	Always involves a membrane	Never involves a membrane
D.	Uses any part of a membrane	Uses channels in the membrane

Dialysis membrane was set up to model digestion and absorption in the small intestine.



What is a limitation of this model?

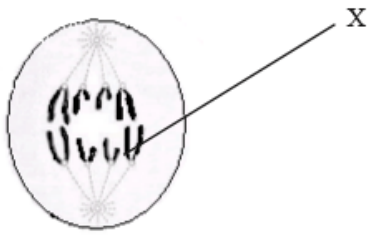
A. There can be no active transport.

B. Maltose will pass through the membrane.

C. Lipase should be present with protein.

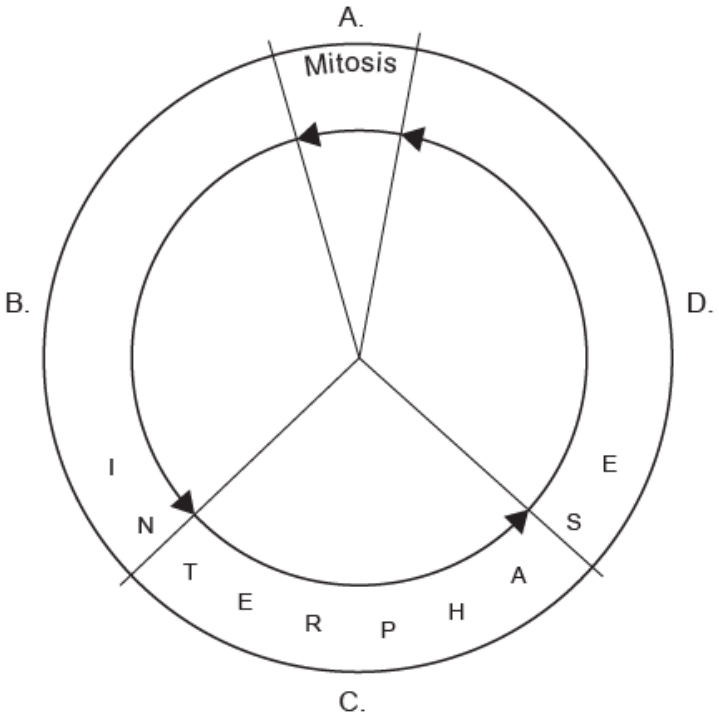
D. The membrane is not permeable to starch.

In which stage of mitosis is the cell labelled X?



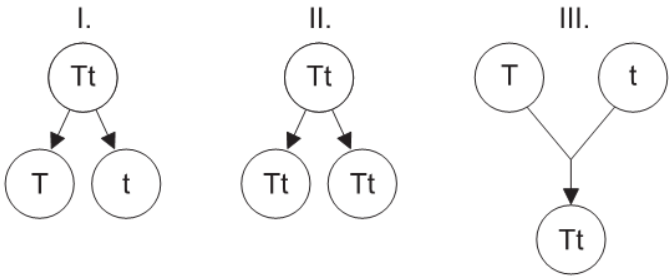
A. Anaphase
B. Interphase
C. Metaphase
D. Prophase

When during the cell cycle does DNA replication take place?



[Source: © International Baccalaureate Organization 2017]

Which diagram(s) represent(s) processes used in asexual reproduction?



A. I only

B. I and II only

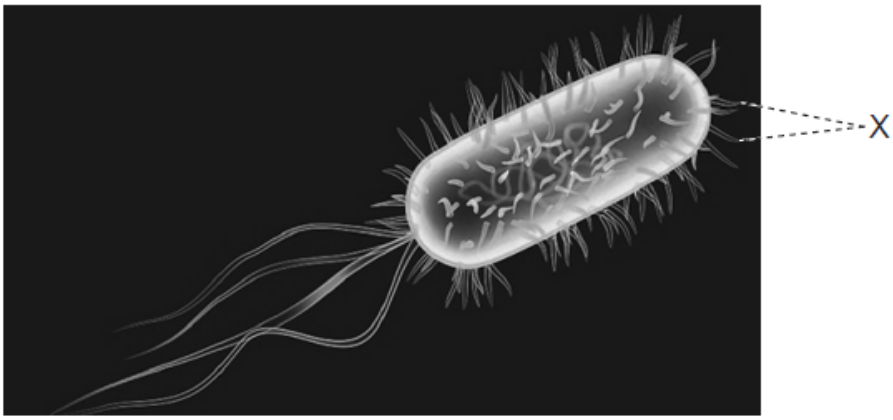
C. II only

D. I, II and III

Which of the following are features of prokaryotes and eukaryotes?

	70S ribosomes	80S ribosomes	Naked DNA	DNA associated with proteins
A.	prokaryote	eukaryote	prokaryote	eukaryote
B.	eukaryote	prokaryote	eukaryote	prokaryote
C.	eukaryote	prokaryote	prokaryote	eukaryote
D.	prokaryote	eukaryote	eukaryote	prokaryote

The image represents an *Escherichia coli*.



[Source: adapted from http://ishbytes.blogspot.co.uk]

What is the function of structure X?

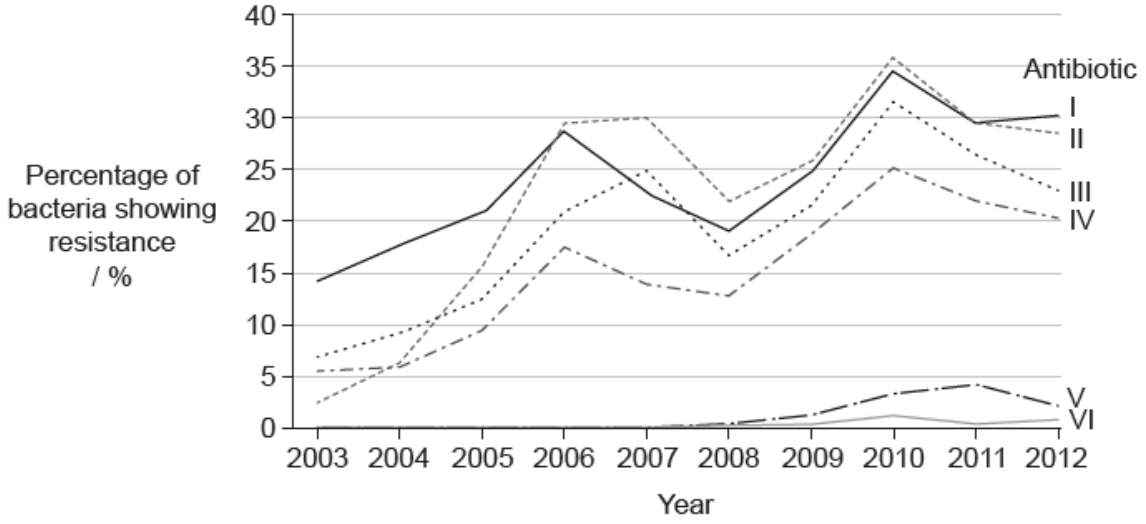
A. Active transport

B. Attachment

C. Binary fission

D. Cell respiration

The bacterium *Neisseria gonorrhoeae* causes infections related to the human reproductive system. The graph shows the percentage of samples in which this bacterium showed resistance to six antibiotics over a period of ten years.



[Source: © All rights reserved. National Surveillance of Antimicrobial Susceptibilities of *Neisseria gonorrhoeae* Annual Summary 2012. Public Health Agency of Canada, 2012. Translated, adapted and reproduced with permission from the Minister of Health, 2017.]

What is a possible explanation for the total percentage resistance being larger than 100% in 2010?

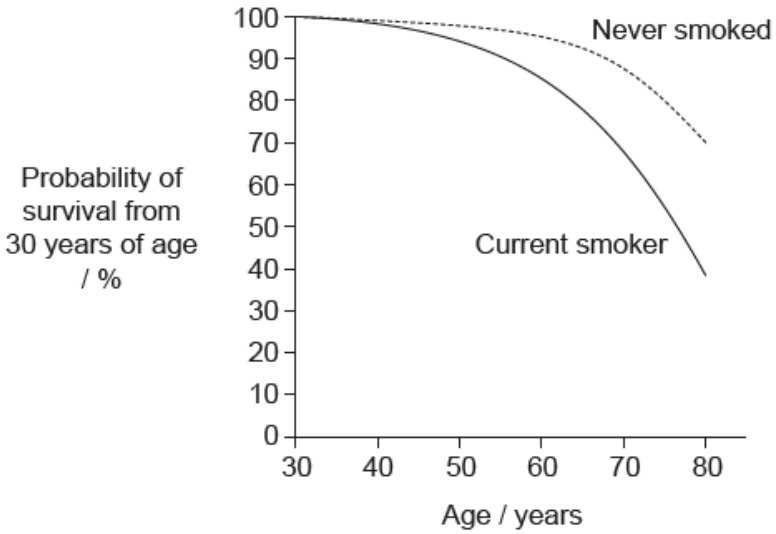
A. People do not take the antibiotics as prescribed.

B. More people have been sampled in that year.

C. There was an epidemic of *Neisseria gonorrhoeae* in that year.

D. Some bacteria are resistant to more than one antibiotic.

The graph shows the survival probabilities for current smokers and for those who never smoked among women 30 to 80 years of age.



[Source: adapted from J Prabhat *et al.* (2013) *The New England Journal of Medicine*, 368 (4), page 347. Copyright ©2013 Massachusetts Medical Society. Reprinted with permission]

What can be deduced from this graph?

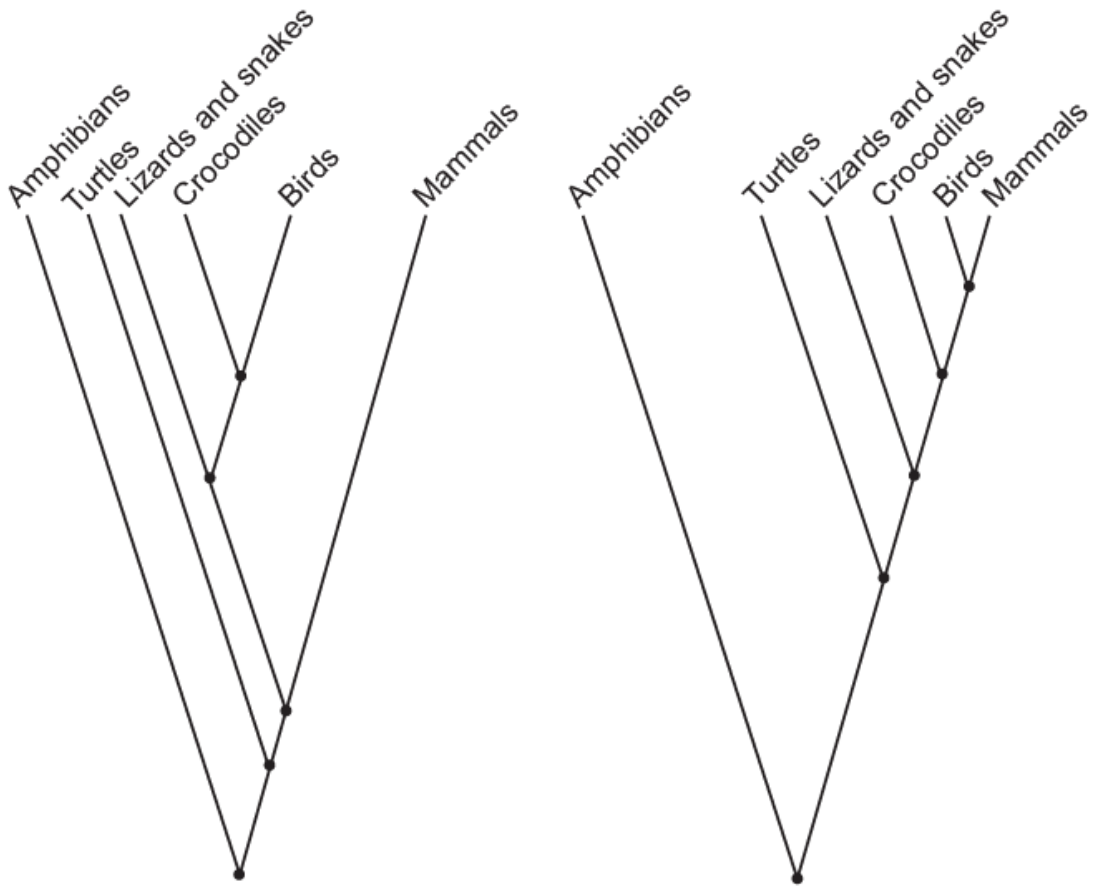
A. There is a correlation between smoking and cancer.

B. Smoking reduces life expectancy.

C. Smoking causes cancer.

D. 70 % of smokers survive to 80 years old.

Cladograms can be created by comparing DNA or protein sequences. The cladogram on the left is based on DNA sequences and the cladogram on the right is based on comparing protein sequences.



What is the reason that cladograms based on DNA sequences are more reliable predictors of the phylogenetic relationship of species than cladograms based on protein sequences?

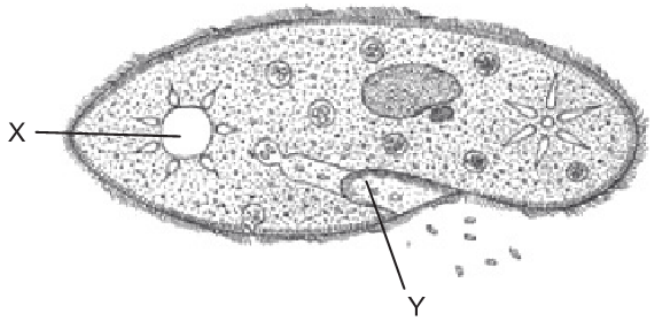
A. Amino acids are not as chemically stable as DNA nucleotides.

B. DNA mutates but amino acids do not.

C. Several different triplets of bases can code for the same amino acid.

D. There are 20 different amino acids but only 4 nucleotides.

The image is of a *Paramecium*



What evidence from the image of *Paramecium* indicates whether the organism is a prokaryote or a eukaryote?

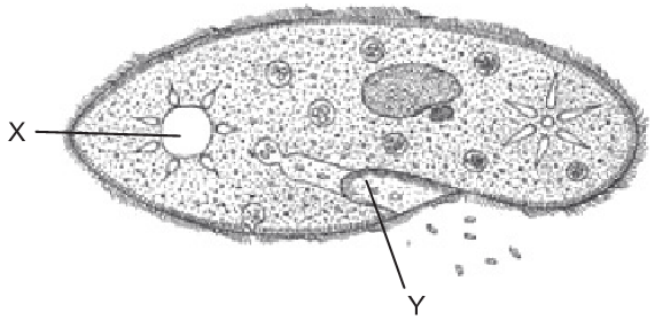
A. Compartments in the cell indicate that it is a eukaryote.

B. No nucleus indicates that the cell is a prokaryote.

C. Lack of a cell wall indicates that the cell is a eukaryote.

D. It is a unicellular organism, so it must be a prokaryote.

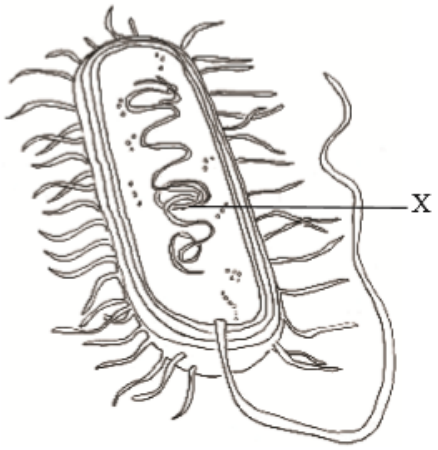
The image is of a *Paramecium*



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

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

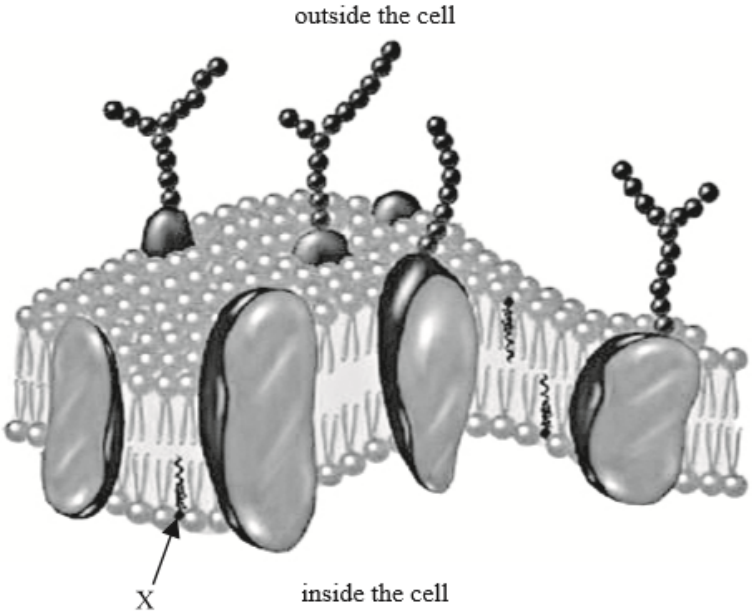
The diagram below shows a bacterium.



What structure does the part labelled X identify?

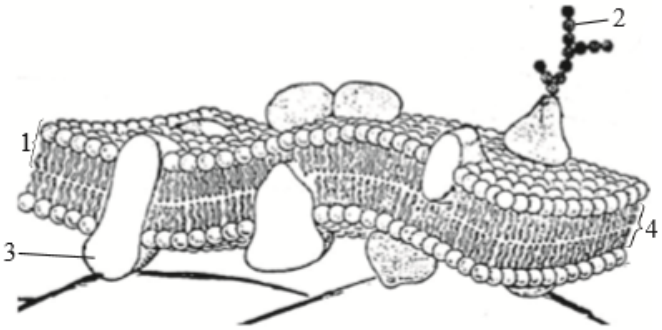
A. Nucleus
B. Nucleoid
C. Nucleolus
D. Nuclear membrane

The diagram below shows a plasma membrane. What is molecule X?



A. Cholesterol
B. Peripheral protein
C. Glycoprotein
D. Polar amino acid

What are the parts of the cell membrane indicated in the diagram?



	1	2	3	4
A.	phospholipid	glycoprotein	integral protein	hydrophobic layer
B.	hydrophilic layer	carbohydrate	cholesterol	phospholipid
C.	phospholipid	peripheral protein	glycoprotein	cholesterol
D.	hydrophobic layer	carbohydrate	integral protein	phospholipid

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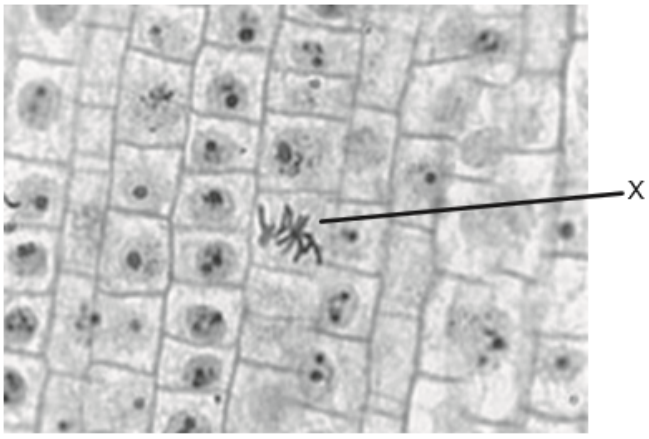
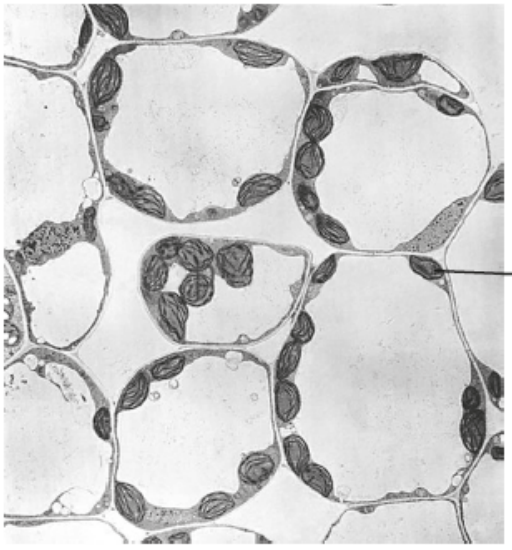
Which mitotic phase is labelled X in the micrograph of an onion (*Allium cepa*) root tip?



[Source: adapted from Microscope-microscope.org (www.microscope-microscope.org)]

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

The image shows an electron micrograph of mesophyll cells.



[Source: BIOPHOTO ASSOCIATES/SCIENCE PHOTO LIBRARY]

What is the name of the structure labelled X?

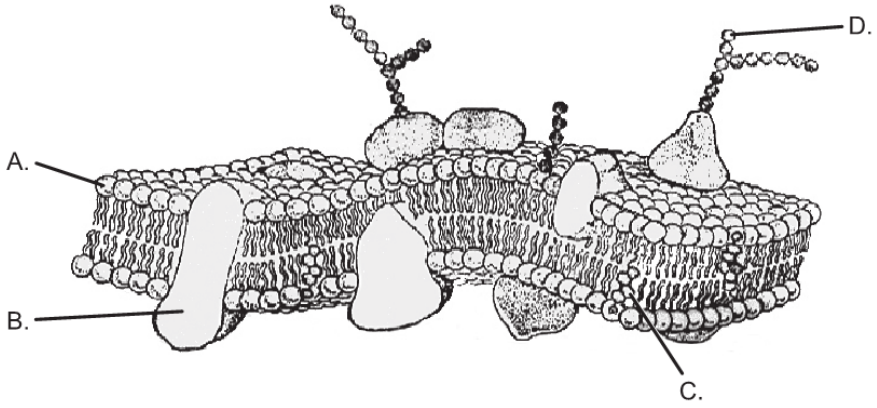
A. Cytoplasm

B. Mitochondrion

C. Nucleus

D. Chloroplast

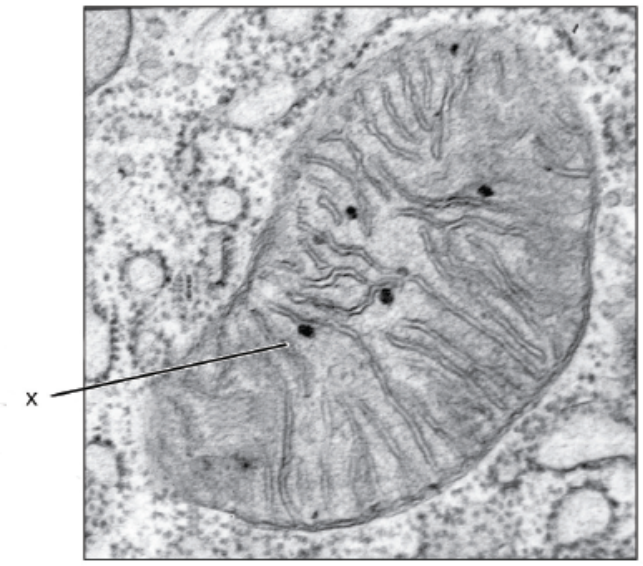
A diagram of a membrane



[Source: © International Baccalaureate Organization 2017]

In the diagram, which structure is an intrinsic or integral protein?

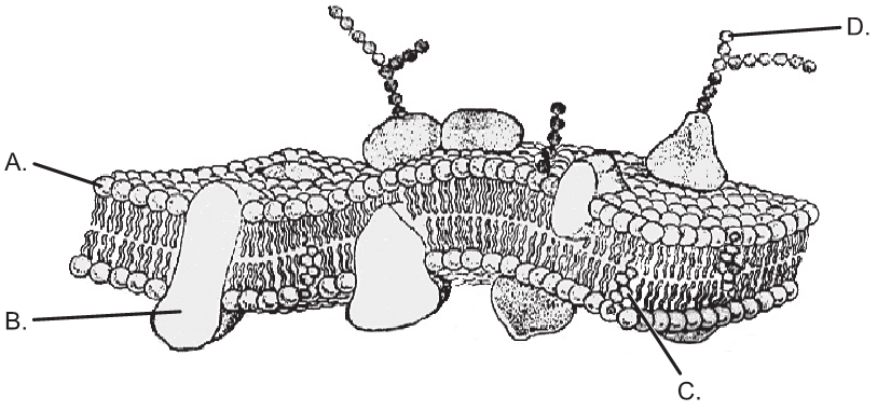
What is the structure labeled X in the electron micrograph of a rat liver cell?



[Source: “0315 Mitochondrion new” by OpenStax College - Anatomy & Physiology, Connexions Web site. http://cnx.org/content/col11496/1.6/, Jun 19, 2013.. Licensed under CC BY 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:0315_Mitochondrion_new.jpg#/media/File:0315_Mitochondrion_new.jpg]

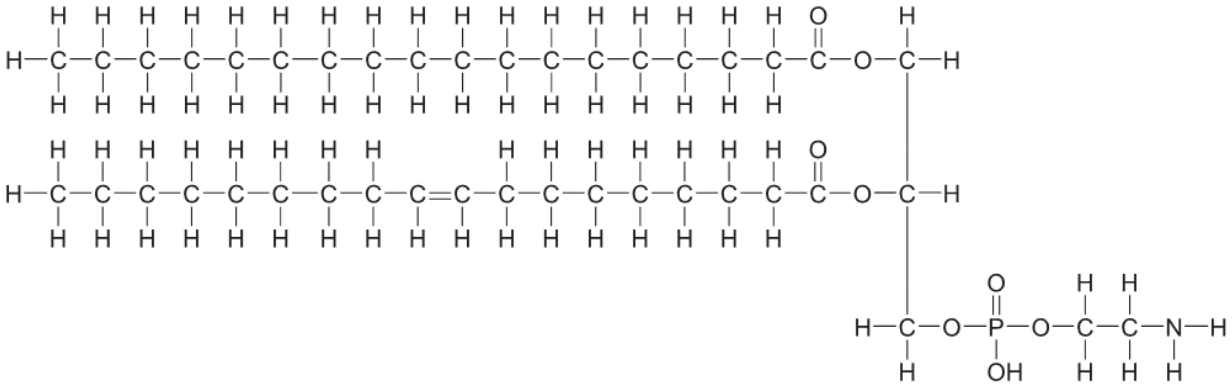
A. Ribosome
B. Lysosome
C. Mitochondrion
D. Nucleus

A diagram of a membrane

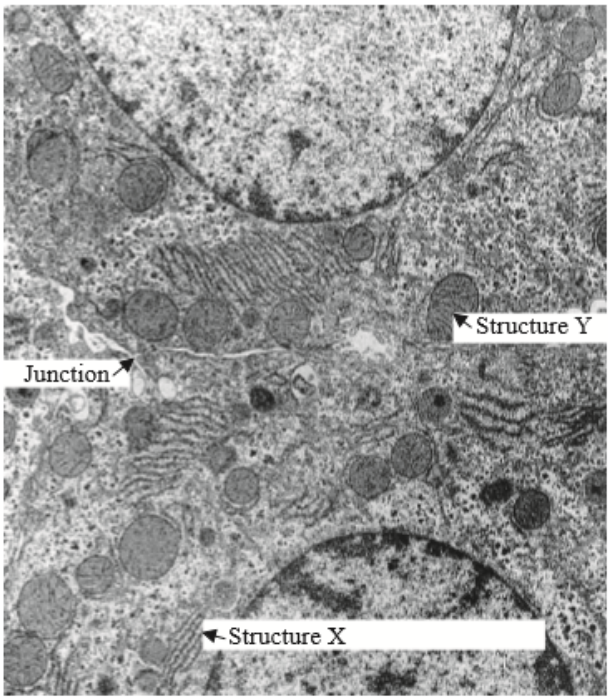


[Source: © International Baccalaureate Organization 2017]

In the diagram, which part of the membrane structure does the molecule below form?



The following electron micrograph which shows part of two adjacent liver cells.

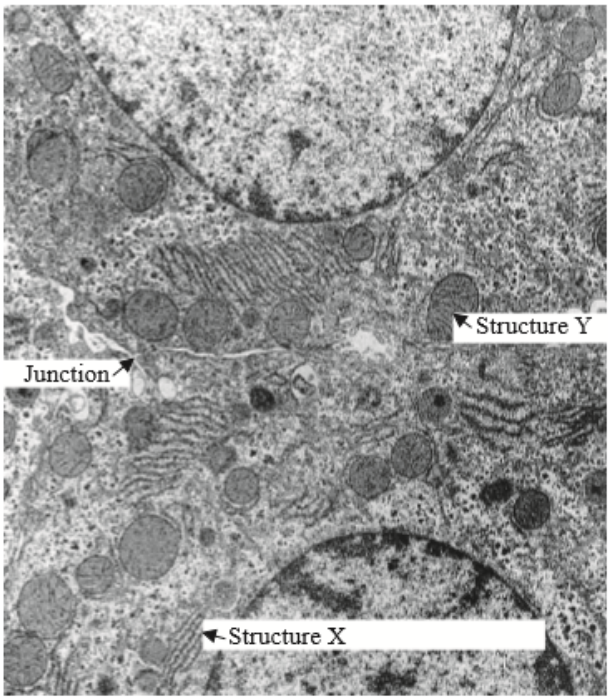


[Source: www.relfe.com/Images/ratlivercells.gif]

What is happening at the structure labelled X?

A. Synthesis of proteins
B. Transport of proteins to the nucleus
C. Modification of proteins prior to export
D. Secretion of proteins through the plasma membrane

The following electron micrograph which shows part of two adjacent liver cells.

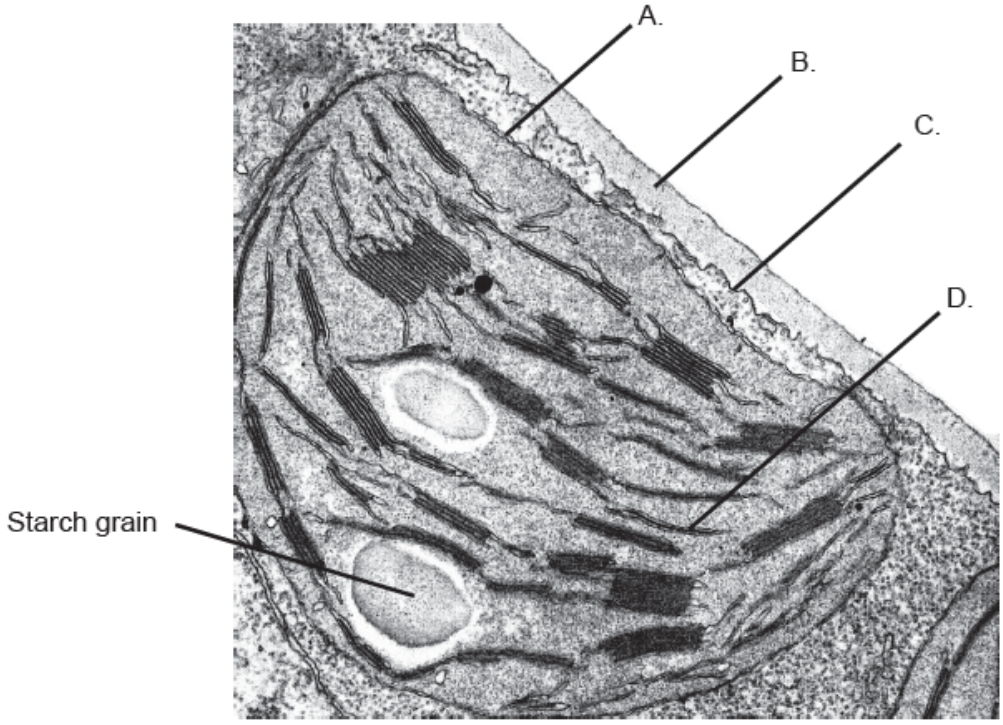


[Source: www.relfe.com/Images/ratlivercells.gif]

What is the structure labelled Y?

A. Nucleus
B. Starch grain
C. Lysosome
D. Mitochondrion

The following electron micrograph shows part of a palisade mesophyll cell. Which of the labelled structures controls the exchange of substances to and from the cell?



[Source: adapted from Eldon Newcomb, http://botit.botany.wisc.edu/about.html]