

IB Diploma

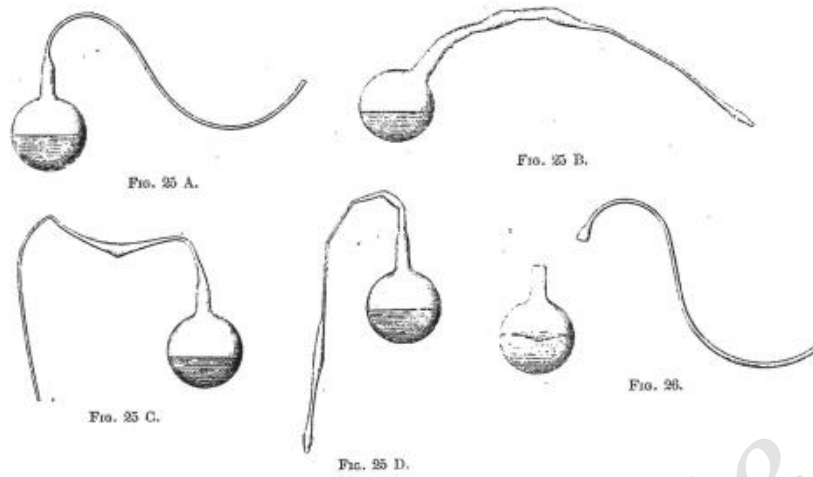
BIOLOGY

SL P2
2017 — 2023

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1 - (BIOLO/21_SL_Summer_2017_Q2) - Cell Biology, Ecology

Pictured below are Louis Pasteur's original drawings of swan-necked flasks.



[Source: L Pasteur and L Pasteur Vallery-Radot, (1922), *Œuvres de Pasteur, Vol II Fermentations et générations dites spontanées*, pages 260–261]

(a) Describe how Pasteur's experiments provided convincing evidence to falsify the concept of spontaneous generation.

[3]

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(b) State the function of life in *Paramecium* that is carried out by:

(i) cilia.

[1]

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(ii) the contractile vacuole.

[1]

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(c) Discuss the advantages and disadvantages of the use of adult stem cells.

[3]

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(d) Explain the role of decomposers in an ecosystem.

[2]

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2 - (BIOLO/22_SL_Summer_2017_Q2) - Cell Biology, Human Physiology

- (a) Glands are organs that secrete and release particular chemical substances. Melatonin is an important hormone secreted in the pineal gland in the brain. Describe its role in mammals.

[2]

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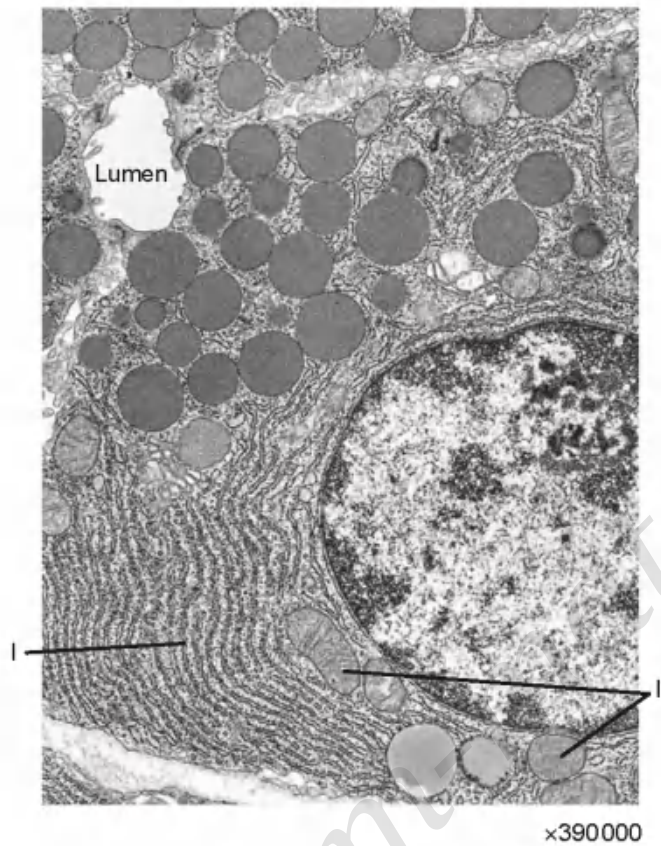
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(b) The electron micrograph shows the structures in an exocrine gland cell of the pancreas.



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

(i) State the principal product of this cell. [1]

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(ii) Using the table, identify the organelles labelled I and II on the electron micrograph with their principal role. [2]

Organelle	Name	Principal role
I		
II		

3 - (BIOLO/22_SL_Summer_2017_Q3) - Cell Biology

- (a) Outline the use of human embryonic stem cells (hESC) to treat Stargardt's disease. [2]

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- (b) The most common form of Stargardt's disease is known to be autosomal recessive. Using a Punnett grid, deduce the probability of a child inheriting Stargardt's disease, if both of the parents are carriers of the disease but do not have the disease themselves. [3]

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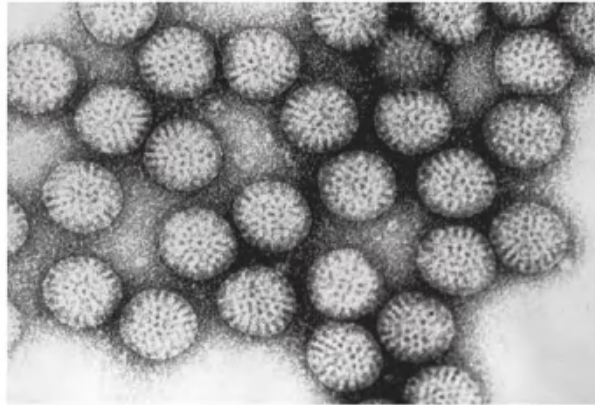
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4 - (BIOLO/20_SL_Winter_2017_Q2) - *Cell Biology, Genetics, Human Physiology*

The figure shows a transmission electron micrograph of rotavirus particles. Each rotavirus is about 70 nanometres in diameter.



[Source: CDC / Dr. Erskine L. Palmer]

- (a) State a reason for using an electron microscope to view this virus rather than a light microscope.

[1]

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- (b) Rotavirus causes diarrhea and vomiting. Explain why viral diseases cannot be treated using antibiotics.

[2]

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- (c) State an application of plasmids in biotechnology.

[1]

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ANSWERS

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1 - (BIOL0/21_SL_Summer_2017_Q2) - Cell Biology, Ecology

a	<p>a. spontaneous generation is life appearing from nothing / from non-living / cells only come from pre-existing cells/life ✓</p> <p>b. broth/culture medium (for bacteria) (used/placed) in flasks ✓</p> <p>c. broth boiled/sterilized «in some flasks» to kill microbes ✓</p> <p>d. no clouding/signs of bacterial growth/reproduction / microbes did not appear «in flasks of boiled broth» ✓</p> <p>e. after necks of flasks were snapped boiled broth became cloudy/growth of microbes ✓</p> <p>f. because microbes from the air contaminated the «boiled» broth ✓</p> <p>g. curved necks allowed indirect exposure to air but prevented entry of microbes ✓</p>	Allow bacteria or organisms instead of microbes.	3 max
b	i movement / locomotion OR feeding/nutrition ✓		1
	ii homeostasis OR maintain osmotic balance / expels «excess» water / maintains «cell» water content ✓		1
c	<p><i>Advantages:</i></p> <p>a. «adult stem cells» can divide «endlessly» / can differentiate ✓</p> <p>b. «adult stem cells» can be used to repair/regenerate «tissues» ✓</p> <p>c. fewer ethical objections «than with embryonic stem cells» ✓</p> <p>d. adults can give «informed» consent for use of their stem cells ✓</p> <p>e. adult source is not killed / «source» would not have grown into new human / no death of embryos used to provide stem cells ✓</p> <p>f. no rejection problems / patient's own cells used ✓</p> <p>g. less chance of cancer/«malignant» tumor development «than from embryonic stem cells» ✓</p> <p>h. most tissues in adults contain some stem cells ✓</p> <p><i>Disadvantages:</i></p> <p>i. difficult to obtain/collect/find in adult body/very few available ✓</p> <p>j. some «adult» tissues contain few/no stem cells ✓</p> <p>k. «adult stem cells» differentiate into fewer cell types «than embryonic cells» / OWTTE ✓</p>		3 max
d	<p>a. saprotrophs/decomposers feed on/break down dead «organic» matter ✓</p> <p>b. saprotrophs/decomposers release energy «heat» accelerating decomposition/warming soil ✓</p> <p>c. saprotrophs/decomposers recycle nutrients / make nutrients available (to producers) OR improves soil fertility / returns nutrients (minerals/nitrates/phosphates/carbon) to soil/water/environment ✓</p> <p>d. saprotrophs/decomposers detoxify waste ✓</p>		2 max

2 - (BIOLO/22_SL_Summer_2017_Q2) - Cell Biology, Human Physiology

a		a. controls circadian rhythms/biological clocks «in mammals» ✓ b. production is controlled by amount of light detected by the retina ✓ c. high production/secretion in the dark OR no production/secretion in the day OR production/secretion is directly proportional to night time duration ✓ d. affects «seasonal» reproduction/sleep-wake cycles/jet lag ✓		2 max									
b	i	«digestive» enzymes ✓		1									
	ii	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">organelle</th> <th style="width: 35%;">name</th> <th style="width: 50%;">principal role</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">I</td> <td>rough endoplasmic reticulum OR ribosome</td> <td>protein production/synthesis «for excretion»</td> </tr> <tr> <td style="text-align: center;">II</td> <td>mitochondrion/mitochondria</td> <td>aerobic «cell» respiration OR ATP/energy production</td> </tr> </tbody> </table>	organelle	name	principal role	I	rough endoplasmic reticulum OR ribosome	protein production/synthesis «for excretion»	II	mitochondrion/mitochondria	aerobic «cell» respiration OR ATP/energy production	✓ ✓	2
organelle	name	principal role											
I	rough endoplasmic reticulum OR ribosome	protein production/synthesis «for excretion»											
II	mitochondrion/mitochondria	aerobic «cell» respiration OR ATP/energy production											

3 - (BIOLO/22_SL_Summer_2017_Q3) - Cell Biology

a		a. «an inherited form of» degeneration of retinal layer/photoreceptor cells/blindness OR eye genetic disorder ✓ b. «hESC/stem cells» can provide/differentiate into healthy <u>retinal</u> cells ✓ c. injecting «hESC/stem cells» into the retina/eye can restore vision in animal/human trials ✓	OWTTE	2 max									
b		a. correct allele identification ✓ «eg. S = dominant/normal; s = recessive/disease» b. correct Punnett grid ✓ c. correct phenotypic ratio/outcome ✓	example: s = recessive, disease-causing form of gene, S = dominant, normal form parents = Ss. Any letter can be used as capital and lower case but a legend/key is not required if correct notation is used. <table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td></td> <td style="text-align: center;">S</td> <td style="text-align: center;">s</td> </tr> <tr> <td style="text-align: center;">S</td> <td style="text-align: center;">SS</td> <td style="text-align: center;">Ss</td> </tr> <tr> <td style="text-align: center;">s</td> <td style="text-align: center;">Ss</td> <td style="text-align: center;">ss</td> </tr> </table> Do not award mp b if the gametes do not show heterozygous organisms phenotypic ratio: $\frac{3}{4}$ normal : $\frac{1}{4}$ with disease OR 3 normal : 1 with disease OR «75 % normal :» 25 % disease		S	s	S	SS	Ss	s	Ss	ss	3
	S	s											
S	SS	Ss											
s	Ss	ss											

4 - (BIOLO/20_SL_Winter_2017_Q2) - Cell Biology, Genetics, Human Physiology

a	electron microscope has greater resolution/magnification OR 70 nm is too small/viruses are too small to be viewed by a light microscope ✓		1
b	a. viruses are not living ✓ b. viruses lack metabolism/lack enzymes «for metabolism»/lack cell walls ✓ c. antibiotics target metabolic «pathways»/cell wall production ✓		2 max
c	transfer/vector of genetic material/genes/DNA fragments OR to produce insulin/useful protein ✓		1

5 - (BIOLO/20_SL_Winter_2017_Q6) - Cell Biology, Human Physiology, Genetics

a	a. mitochondria and chloroplasts are similar to prokaryotes ✓ b. «host» cell took in another cell by endocytosis/by engulfing «in a vesicle» ✓ c. but did not digest the cell/kept the «ingested» cell alive OR symbiotic/mutualistic relationship «between engulfed and host cell» ✓ d. chloroplasts and mitochondria were once independent/free-living «organisms» ✓ e. DNA «loop» in chloroplast/mitochondrion ✓ f. division/binary fission of chloroplast/mitochondrion ✓ g. double membrane around chloroplast/mitochondrion ✓ h. 70s ribosomes «in chloroplast/mitochondrion» ✓	Allow "taking in" in place of "engulfing" Award up to [2] for evidence from mpe to mph	4 max
b	a. FSH stimulates the development of follicles ✓ b. follicles produce estrogen ✓ c. estrogen stimulates the repair of the uterus lining ✓ d. estrogen stimulates LH secretion ✓ e. LH causes/stimulates ovulation ✓ f. LH causes/stimulates the development of the corpus luteum ✓ g. corpus luteum secretes progesterone ✓ h. progesterone causes/stimulates thickening of the uterus lining OR prepares uterine lining for implantation OR maintains the endometrium ✓ i. progesterone/estrogen inhibits the secretion of LH/FSH ✓ j. falling progesterone levels at the end of the cycle allow FSH production/menstruation ✓ k. negative/positive feedback «control» described correctly ✓ l. LH/FSH are pituitary hormones ✓		8 max
c	a. clones are genetically identical organisms OR group of cells derived from a single parent cell ✓ b. asexual reproduction in plants such as tubers/runners/bulbs ✓ c. common in non-vertebrates such as budding in hydra ✓ d. budding in yeast/fungi ✓ e. identical twins «in humans» are clones because they originate from the same cell ✓	Allow other verifiable examples of plants Allow other verifiable examples of invertebrates Allow other verifiable examples of fungi	3 max