The Immune System (11.1): Cambridge (CIE) A Level Biology 9700 Exam Questions by Topic

22 questions · 59 marks · about 71 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · information from earlier in the question

2 Alveolar macrophages are cells of the immune system that remain in the alveolar region of the gas exchange system. The macrophages protect against infection caused by pathogens that have been inhaled.

(ii) Fig. 2.1 is a diagram of an alveolar macrophage showing:

- some of the cell structures that would be visible using an electron microscope
- a newly formed phagocytic vacuole (phagosome) containing two cells of *Mycobacterium tuberculosis*.

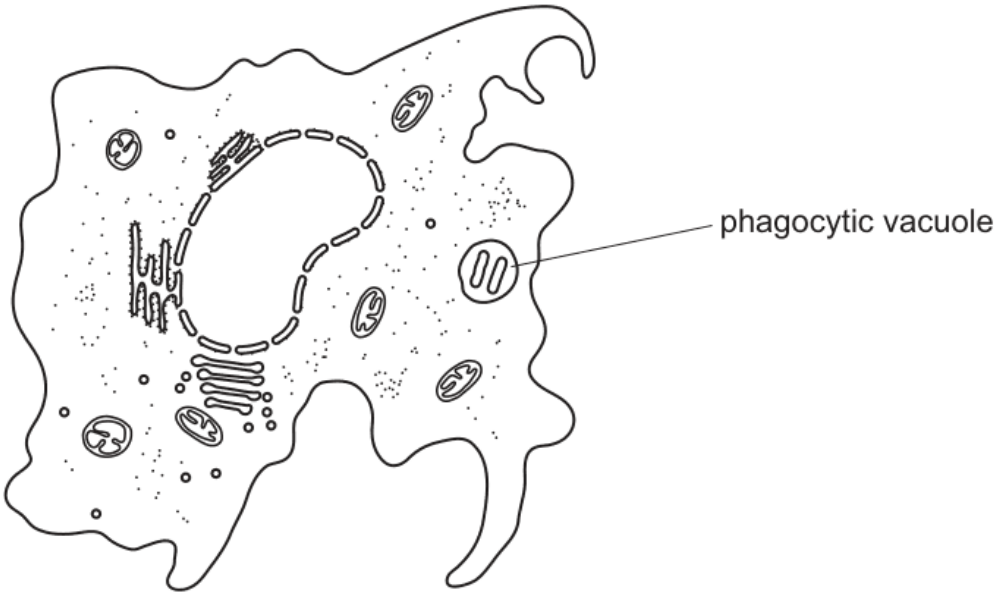


Fig. 2.1

Question 1 · Paper 2 · May/June 2024 (22) · Q2(b)(i) · 2 marks

(b) Tuberculosis (TB) can be prevented if the bacterial cells that have reached the alveoli are rapidly destroyed. Alveolar macrophages can detect the presence of *M. tuberculosis* in the alveolar space and can carry out phagocytosis to form phagocytic vacuoles, such as the one shown in Fig. 2.1.

(i) Outline the sequence of events that leads to the formation of a phagocytic vacuole after detection of the bacterial cells by an alveolar macrophage.

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Question 2 · Paper 2 · May/June 2024 (22) · Q2(b)(ii) · 1 mark

(ii) Name the cell structures that fuse with the phagocytic vacuole and release hydrolytic enzymes to destroy the bacterial cells.

Question 3 · information from earlier in the question

(b) Blood arriving at the liver enters specialised blood vessels known as sinusoids.

Fig. 3.1 is a diagram of part of a sinusoid and surrounding hepatocytes. A second type of cell found in the liver, a Kupffer cell, is also shown.

Kupffer cells are phagocytic cells of the immune system.

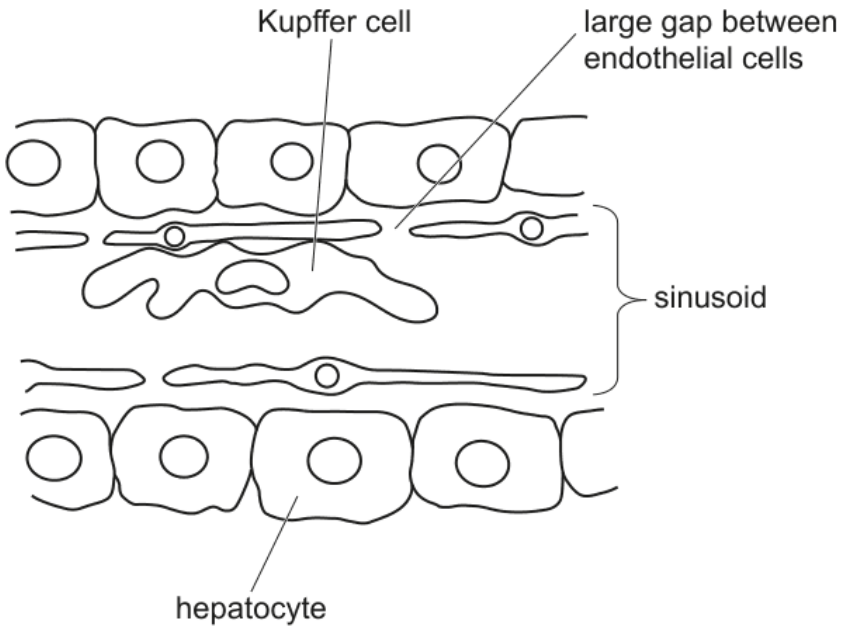


Fig. 3.1

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Question 3 · Paper 2 · October/November 2023 (22) · Q3(b)(ii) · 4 marks

(ii) In addition to removing bacteria present in the blood inside the sinusoid, Kupffer cells are also able to remove old or damaged red blood cells.

Describe the mode of action of a Kupffer cell in removing and breaking down a damaged red blood cell.

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Question 4 · Paper 2 · October/November 2022 (23) · Q2(a)(i) · 3 marks

2 Fig. 2.1 is a scanning electron micrograph showing a macrophage engulfing some bacteria.

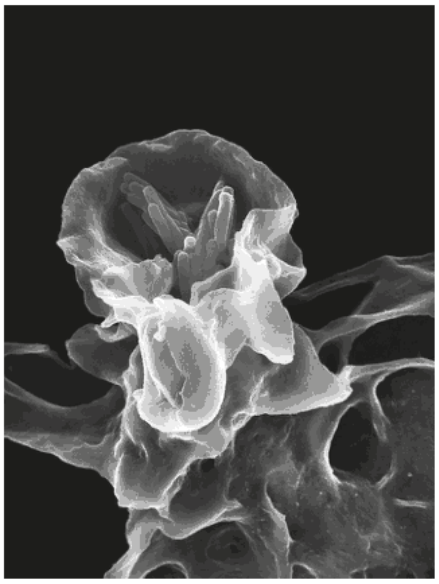


Fig. 2.1

(a) (i) Describe how macrophages engulf bacteria.

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Question 5 · information from earlier in the question

2 The main cause of tuberculosis (TB) in humans is the bacterium *Mycobacterium tuberculosis*. Most cases of the disease involve the lungs. The bacterium can enter cells and remain inactive in a latent (dormant) state. However, the bacterium can become active to produce symptoms of the disease.

In a person with active TB, the pathogen can be present in airborne droplets that are exhaled. Generally, a healthy person who inhales these droplets has effective defence mechanisms in the gas exchange system to prevent infection.

(a) One example of a defence mechanism against pathogens in the gas exchange system involves the action of macrophages.

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Question 5 · Paper 2 · February/March 2018 (22) · Q2(a)(ii) · 3 marks

(ii) Describe the mode of action of a macrophage.

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Question 6 · Paper 2 · February/March 2018 (22) · Q2(a)(iii) · 1 mark

(iii) It is sometimes possible for *M. tuberculosis* to survive within macrophages.

Suggest **one** way in which *M. tuberculosis* may survive within a macrophage.

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Question 7 · Paper 2 · May/June 2025 (22) · Q5(a) · 1 mark

5 There is a global shortage of blood for transfusions. Researchers can culture bone marrow stem cells in the laboratory to manufacture red blood cells for potential use as an artificial blood product.

The researchers collect bone marrow stem cells that are present in small quantities in blood, rather than extracting them from bone marrow.

- Antibodies, specific to bone marrow stem cells, are attached to tiny magnetic beads.
- The beads are added to a sample of blood.
- An electric field is applied to immobilise the beads so that the bone marrow stem cells can be collected.

(a) The antibodies are attached to the beads so that the sites used for binding to specific molecules on the bone marrow stem cells are left exposed.

Name the term given to the specific molecules on the bone marrow stem cells that attach to the antibody binding sites.

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Question 8 · Paper 2 · October/November 2024 (22) · Q4(g) · 3 marks

(g) The differentiation of T-lymphocytes begins in the bone marrow and continues in an organ known as the thymus to produce fully differentiated T-helper and T-killer cells.

In the thymus, T-lymphocytes that bind to self antigens are destroyed.

Explain why T-lymphocytes that bind to self antigens need to be destroyed in the thymus.

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Question 9 · information from earlier in the question

4 Gene therapy can be used to treat some genetic disorders. An appropriate vector is chosen to carry the normal allele into the target cell. Three types of vectors commonly chosen are naked DNA, viruses and liposomes.

Question 9 · Paper 4 (A level) · May/June 2020 (42) · Q4(c)(i) · 2 marks

(c) A trial was carried out to find a new vector for use in gene therapy.

The new vector was made from red blood cells taken from the person with the genetic disorder. The cells had most of their cytoplasmic content removed and were then broken up to make small spherical vectors.

Most of these vectors lacked the ability to bind to receptors on the target cells.

To solve this problem, genetically engineered stem cells taken from the person were used to form red blood cells. These red blood cells had membrane proteins that were complementary to the target cell receptors. The vectors that were produced were well-tolerated by the immune system.

(i) Explain why the vectors were well-tolerated by the immune system.

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Question 10 · Paper 2 · May/June 2023 (22) · Q3(a) · 3 marks

3 Cells of the immune system respond to the presence of non-self antigens.

(a) Outline the features of non-self antigens.

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Question 11 · Paper 2 · May/June 2023 (22) · Q3(b) · 4 marks

(b) Four different types of cells of the immune system are shown in Table 3.1.

Complete Table 3.1:

- use a tick (✓) if the description applies to the named cell of the immune system
- use a cross (✗) if the description does **not** apply.

Table 3.1

description of cell	cell of the immune system			
	B-lymphocyte	plasma cell	T-helper cell	T-killer cell
able to go through a number of cell cycles (clonal expansion)				
main role is to secrete cytokine during an immune response				
present during a **primary** immune response to a virus				

[4]

Question 12 · information from earlier in the question

4 Food crops such as barley and wheat contain gluten. Gluten contains two proteins, glutenin and gliadin.

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(b) Coeliac disease is a condition in which the immune system of a person responds to gluten in their diet.

In coeliac disease, there is a response to the presence of peptides (short chains of amino acids) that are produced as a result of gliadin digestion.

Question 12 · Paper 2 · May/June 2023 (23) · Q4(b)(ii) · 4 marks

(ii) The presence of gliadin causes the immune system of a person with coeliac disease to respond by producing anti-gliadin antibodies.

Describe the sequence of events that results in the immune system producing anti-gliadin antibodies.

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5 T-lymphocytes are produced in bone marrow and mature in the thymus gland.

When mature, T-lymphocytes leave the thymus gland to travel throughout the body. They remain inactive inside organs, such as the spleen and lymph nodes, until activated by the presence of antigens.

Fig. 5.1 shows what happens to two inactive T-lymphocytes, **U1** and **V1**, in the presence of an antigen from a virus.

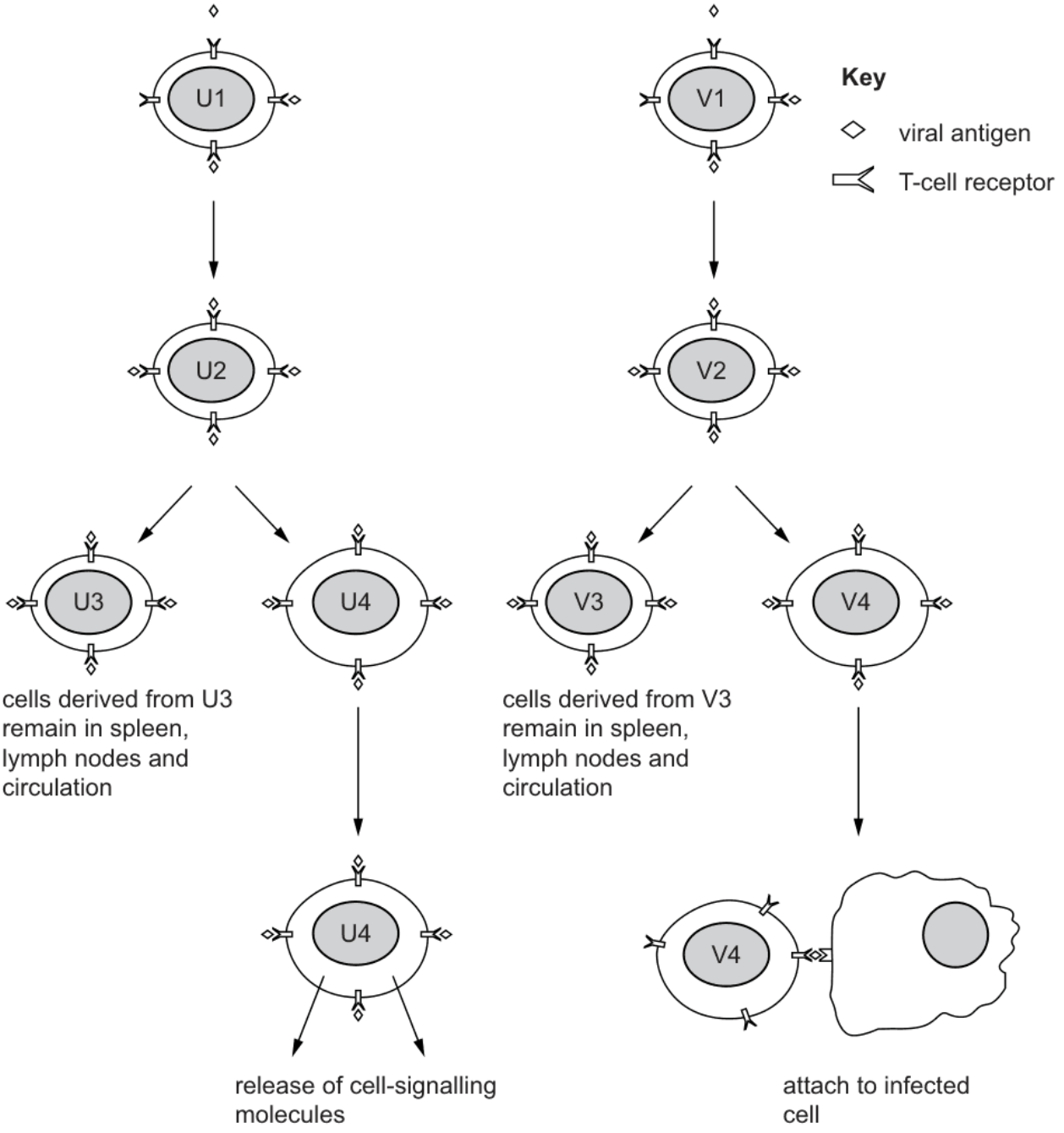


Fig. 5.1

(a) (i) **U4** and **V4** are types of active T-lymphocyte. State the names given to these types of T-lymphocyte.

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Question 14 · Paper 2 · October/November 2024 (23) · Q5(a)(ii) · 4 marks

(ii) Describe the roles of cells **U4** and **V4** in a primary immune response.

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Question 15 · Paper 2 · February/March 2024 (22) · Q6(b) · 3 marks

(b) Explain how the ability of the immune system to resist the damaging effects of a pathogen is affected by destruction of T-helper cells.

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Question 16 · Paper 2 · October/November 2022 (22) · Q2(g) · 4 marks

(g) After a person has been infected with HCMV, the virus remains in a dormant state in the body for life.

If the virus becomes active again (reactivates), the virus will only cause serious illness if the person has a weak immune system at that time.

Explain why the response to reactivation of HCMV is more likely to cause serious illness in a person who has a weak immune system.

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Question 17 · Paper 2 · February/March 2021 (22) · Q3(a) · 1 mark

3 T-helper lymphocytes and Leydig cells are two types of mammalian cells. The main role of T-helper lymphocytes and Leydig cells is to synthesise and secrete cell-signalling molecules.

- T-helper lymphocytes synthesise proteins known as cytokines.
- Leydig cells synthesise the steroid (lipid) hormone testosterone from cholesterol. Leydig cells also synthesise cholesterol.

(a) State **one** way in which cytokines are involved in an immune response.

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Question 18 · Paper 2 · February/March 2020 (22) · Q5(c) · 3 marks

(c) Explain why it is important that ART maintains a healthy number of T_h cells in a person living with HIV.

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Question 19 · information from earlier in the question

4 **(a)** Vaccination programmes are widely used to help control the spread of infectious diseases.

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(ii) A person was given an injection to give protection against infectious disease **E**. The person had **not** previously been infected with disease **E**. 26 days later, a second injection to give protection against disease **E** was given.

The concentration in the blood of the antibody specific to disease **E** was measured over a period of 60 days from the time of the first injection.

Fig. 4.1 shows the concentration of the antibody in the blood over the period of 60 days.

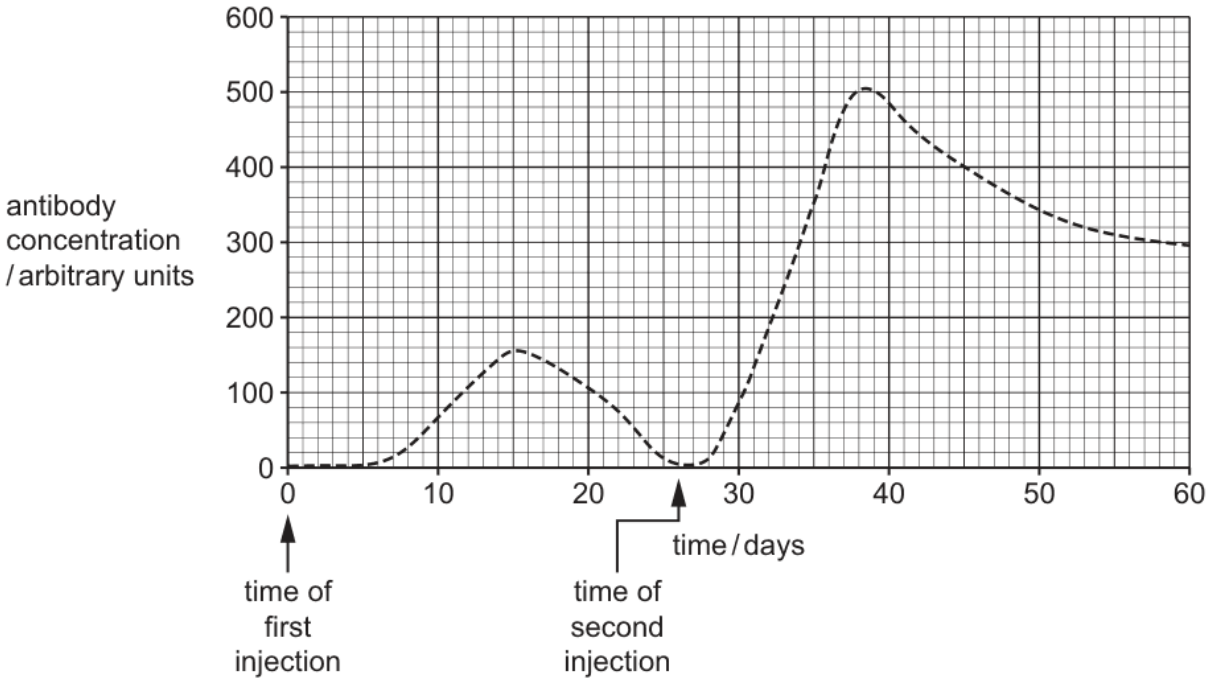


Fig. 4.1

The concentration of the antibody in the blood after the second injection was higher than the concentration after the first injection.

Explain why the concentration of the antibody in the blood was higher after the second injection than after the first injection.

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Question 20 · information from earlier in the question

4 In the immune system, a plasma cell develops from an activated B-lymphocyte. Mature plasma cells synthesise and secrete antibody molecules.

Question 20 · Paper 2 · October/November 2020 (22) · Q4(c) · 3 marks

(c) Clonal expansion also results in the production of memory B-lymphocytes.

Explain the importance of clonal expansion **and** the production of memory B-lymphocytes in providing protection for a person against an infectious disease.

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3 Bacteria may be classified according to differences in cell wall structure. The differences are shown by using the Gram stain.

- A Gram-positive bacterium has a cell wall mainly composed of a thick layer of peptidoglycan (murein).
- A Gram-negative bacterium has a more complex cell wall. This wall is composed of a much thinner layer of peptidoglycan and an outer layer known as the outer membrane.

Escherichia coli is a Gram-negative bacterium.

Fig. 3.1 is a diagram through the cell surface membrane **and** the cell wall of *E. coli*.

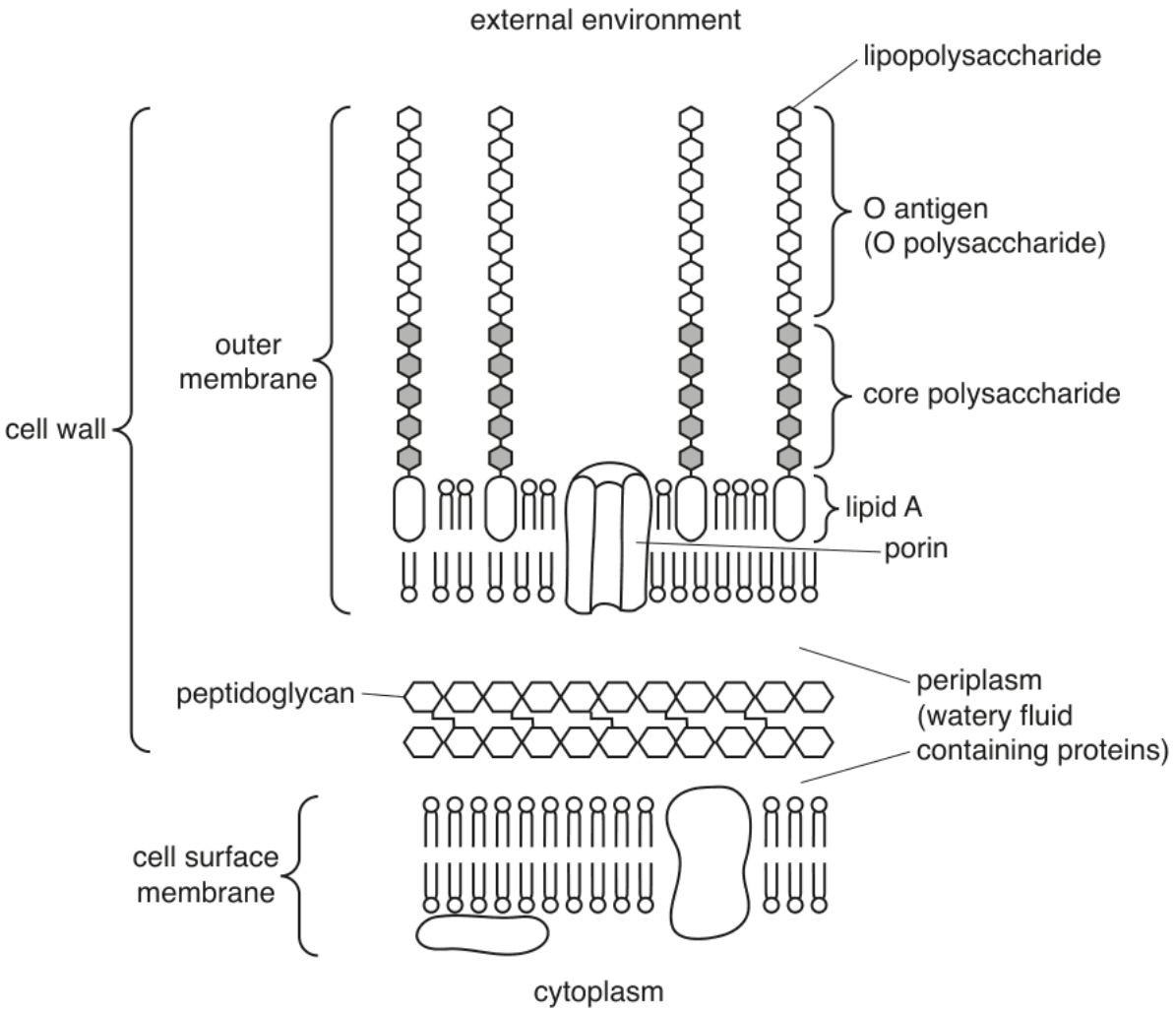


Fig. 3.1

(c) Fig. 3.1 shows that the outer membrane of the cell wall of *E. coli* contains lipopolysaccharides. These are not present in the cell surface membrane. Each lipopolysaccharide (LPS) consists of a lipid and a polysaccharide portion.

The O antigen is the outer part of the polysaccharide portion of the LPS. It faces the aqueous external environment.

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Question 21 · Paper 2 · May/June 2018 (22) · Q3(c)(ii) · 3 marks

(ii) Some strains of *E. coli* are pathogenic. Different pathogenic strains have different O antigens.

Suggest **and** explain why infection with one pathogenic strain of *E. coli* does not provide immunity to a different pathogenic strain.

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Question 22 · Paper 4 (A level) · May/June 2020 (42) · Q4(a) · 3 marks

4 Gene therapy can be used to treat some genetic disorders. An appropriate vector is chosen to carry the normal allele into the target cell. Three types of vectors commonly chosen are naked DNA, viruses and liposomes.

(a) A trial of gene therapy to treat cystic fibrosis used a viral vector. The viral vector caused a primary immune response with the production of memory cells.

Explain why the production of memory cells prevents the gene therapy from working in long-term chronic conditions such as cystic fibrosis.

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Mark schemes

Question 1 · Paper 2 · May/June 2024 (22) · Q2(b)(i) · 2 marks

2(b)(i)	*allow, M. tuberculosis / pathogens / bacteria, for bacterial cells* endocytosis occurs / described **;** e.g. (macrophage cell surface) membrane, surrounds / AW, bacterial cells pseudopodia, surrounds / form round / AW, bacterial cell (alveolar) macrophage / phagocyte / (phagocytic) cell, envelops / engulfs, bacterial cells **;** event occurring before <u>or</u> after **;** *e.g. before* *ref. to* chemotaxis / chemotactic response bacterial cells / bacteria / (bacterial) antigens, bind / attach / join / AW, to (macrophage cell surface), receptors / membrane **I** binding to, macrophage / cell *suggestion of* (in alveolar space) opsonisation of /antibody binding to, bacterial cells *e.g. after* membrane fusion / (phagocytic), vacuole pinches off / AW **A** vesicle for vacuole	**2**

Question 2 · Paper 2 · May/June 2024 (22) · Q2(b)(ii) · 1 mark

2(b)(ii)	lysosomes / lysosome **;** **A** lysosomal vesicles	**1**

Question 3 · Paper 2 · October/November 2023 (22) · Q3(b)(ii) · 4 marks

3(b)(ii)	*max 3 if described as phagocytosis of a pathogen rather than a red blood cell* *allow rbc for red blood cell* *any **four** from:* 1 endocytosis / phagocytosis **;** 2 described **;** e.g. red blood cell, engulfed / enveloped pseudopodia surround red blood cell *max three from* 3 forms (phagocytic) vacuole / (phagocytic) vesicle / phagosome **;** 4 lysosome fuses (with phagosome) **;** AW merges / joins to / combines with **I** attaches / binds to 5 (lysosome contains) hydrolytic / digestive, enzymes **; A** hydrolases / named examples 6 digestion to produce haem and globin **; A** amino acids for globin 7 AVP **;** e.g. suggestion of, detection / recognition, of red blood cell	**4**

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Question 4 · Paper 2 · October/November 2022 (23) · Q2(a)(i) · 3 marks

2(a)(i)	*any **three** from:* **1** phagocytosis / endocytosis ; **2** (antigens on) bacteria, attach / bind, to cell (surface) membrane / receptors ; **I** 'bonding' / binding sites **A** in context of, opsonins / antibodies, attached to bacteria **3** infolding / invagination / pinching in of membrane / AW ; **A** pseudopodia / cytoplasm, moves around bacteria **4** fusion of membrane of macrophage (to form vacuole) ; **5** formation of, vacuole / vesicle / phagosome ; **6** active process / uses ATP / uses energy ; **R** active transport **I** lysosomes	**3**

Question 5 · Paper 2 · February/March 2018 (22) · Q2(a)(ii) · 3 marks

2(a)(ii)	*accept points from a diagram* *max **three** from:* 1 detection / recognition ; e.g. detects (named type of) pathogen recognises, (foreign) antigens / antibodies complexed to antigens has receptors (for antigens) 2 engulfs / envelops, pathogen / bacterium / AW ; **A** phagocytosis occurs **A** endocytosis occurs **A** pseudopodia form 3 forms, vacuole / vesicle / phagosome ; 4 ref. to lysosome fusion ; 5 ref. to hydrolytic / digestive, enzymes ; **A** named examples **A** hydrolases 6 ref. to antigen presentation ; 7 AVP ; e.g. (response is) non-specific / innate	**3**

Question 6 · Paper 2 · February/March 2018 (22) · Q2(a)(iii) · 1 mark

2(a)(iii)	*any **one** valid suggestion from:* produces inhibitors for / deactivates, lysosomal enzymes ; escapes out of phagosome ; forms resistant spore / is resistant to digestive enzymes ; AVP ; e.g. suggestion of macrophage malfunction	**1**

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Question 7 · Paper 2 · May/June 2025 (22) · Q5(a) · 1 mark

5(a)	antigen(s) ; I self– / non-self	1

Question 8 · Paper 2 · October/November 2024 (22) · Q4(g) · 3 marks

4(g)	*mp2 and 3 need to see knowledge that self-antigens are on, self- / body / own, cells* *any **three** from:* **1** *idea that,* next stage / after thymus, is (T-lymphocyte) release into general circulation / blood **;** **2** (if released) exposure to / activation by, (self-antigens on body) cells **or** (on exposure to self-antigens), immune response occurs against (body) cells **;** **ora** only (T)lymphocytes that will respond only to, pathogens / foreign substances, are, left / released **3** (if released) harm to / destruction of / kills, (body) cells **;** **4** need to prevent / otherwise, formation of memory T-cells **;** **5** AVP **;** e.g. need to prevent / (if released) may cause, autoimmune, disease / response (otherwise) T-helper will release cytokines to, enhance / AW, immune response against (body) cells (if cytokine released) may lead to, phagocytosis of / antibodies produced against, (body) cells (otherwise) T-killer cell will release substance to kill cells *also mp3* (faulty T-lymphocytes) cannot bind to, foreign / non-self, antigens	**3**

Question 9 · Paper 4 (A level) · May/June 2020 (42) · Q4(c)(i) · 2 marks

4(c)(i)	1 red blood cells had 'self' antigens ; 2 not recognised as foreign ;	**2**

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Question 10 · Paper 2 · May/June 2023 (22) · Q3(a) · 3 marks

3(a)	*any **three** from:* stimulates an <u>immune response</u> ; (usually) protein / glycoprotein / polysaccharides ; **A** polypeptides **I** glycolipids recognised by / activates / stimulates, **and** named immune system cell ; e.g. phagocyte / macrophage / neutrophil (B- / T-) lymphocyte **I** plasma cell **A** *idea of* leads to production of antigen-presenting cell *allow correct example of response by named cell* cause production of (specific) antibodies / bind to (specific) antibodies ; **A** plasma cells releasing (specific) antibody **A** complementary shape to (antigen binding site on) antibody **A** complementary to receptors on lymphocytes example of location of non-self antigen ; **I** whole cells as non-self antigens e.g. surface of / AW, pathogens / infected cells / tumour cells / non-body cells / foreign cells bacterial, cell wall / flagella viral, capsid / protein coat / envelope AVP ; e.g. high molecular weight can be a toxin produced by a pathogen	**3**

Question 11 · Paper 2 · May/June 2023 (22) · Q3(b) · 4 marks

3(b) **4**

one mark each correct column = 4 marks
if 0 or 1 mark gained, check for correct row to max 2

In the whole table:
- *if only ticks are used, assume blanks are crosses*
- *if only crosses are used, assume blanks are ticks*

If there are ticks and crosses and blanks in the whole table, **R** the columns or rows with the blank(s)

description of cell	**cell of the immune system**			
	B-lymphocyte	**plasma cell**	**T-helper cell**	**T-killer cell**
able to go through a number of cell cycles (clonal expansion)	✓	x	✓	✓
main role is to secrete cytokine during an immune response	x	x	✓	x
present during a **primary** immune response to a virus	✓ ;	✓ ;	✓ ;	✓ ;

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Question 12 · Paper 2 · May/June 2023 (23) · Q4(b)(ii) · 4 marks

4(b)(ii)	*any **four** from*:	**4**
	1 *ref.* presence of, non-self / foreign, antigen **or** gliadin acts as antigen **or** *ref.* to antigen presentation (by macrophages) **;**	
	2 recognition / activation / AW, of (specific) B- / T-lymphocytes **;** **A** clonal selection	
	3 clonal expansion of B-lymphocytes (and T-lymphocytes) **;** AW e.g. form a clone of cells (by mitosis) / divide many times by mitosis	
	4 T-helper cells, secrete / release, cytokine **;**	
	5 cytokine stimulates, humoral / B-lymphocyte, response **;** *if mp4 and mp5 not gained allow one mark for T-helper cells stimulate B-lymphocyte response*	
	6 B-lymphocytes (differentiate to) form plasma cells **;**	
	7 plasma cells, produce / secrete, (anti-gliadin) antibodies **;**	

Question 13 · Paper 2 · October/November 2024 (23) · Q5(a)(i) · 1 mark

5(a)(i)	U4 – T-helper (lymphocyte / cell) **AND** V4 – T-killer / T-cytotoxic (lymphocyte / cell) **;** **A** 'helper and killer' **I** helping and killing	**1**

Question 14 · Paper 2 · October/November 2024 (23) · Q5(a)(ii) · 4 marks

5(a)(ii)	*any **four** from:* *U4 / helper* **1** secretes / produces / releases, cytokines / interleukins **; I** cell signalling molecules / cytokinins **2** to stimulate, B-lymphocytes / B cells, to, divide / develop into plasma cells **;** **A** stimulates humoral response / clonal expansion / development of memory cells **3** stimulate macrophages to, be active / carry out phagocytosis / respond (to presence of pathogens) / be 'angry' **;** **I** endocytosis *V4 / killer* **4** produces / secretes / releases, chemicals, to kill / break down, infected cells **; A** (auto)lysis / apoptosis **5** e.g. perforin / hydrogen peroxide / granzymes / proteases **; A** hydrolytic enzymes / toxins **6** detail of action of named chemical (see below) **;** **7** AVP **;** e.g. correct ref to CD4 receptors (on U4 / T-helper) / CD8 receptors on (V4 / T-killer) perforin – makes pores in cell surface membrane of infected cell for delivery of granzymes hydrogen peroxide – oxidises cell components / stimulates apoptosis granzymes / proteases – break down proteins (granzymes are serine proteases)	**4**

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Question 15 · Paper 2 · February/March 2024 (22) · Q6(b) · 3 marks

6(b)	*accept accounts based on primary and / or secondary immune response .* fewer cytokines released **;** *and any **two** from:* fewer plasma cells, so fewer antibodies produced **; A** B lymphocytes fewer macrophages stimulated / less production of 'angry' macrophages / AW / less antigen presentation by macrophages ; fewer T-killer cells stimulated to divide / less T-killer cells / less infected cells killed (by T-killer cells) **;** fewer memory cells (produced by the primary response) **;** AVP **;**	**3**

Question 16 · Paper 2 · October/November 2022 (22) · Q2(g) · 4 marks

2(g)	*allow virus or pathogen for HCMV* *look for ora in context of healthy immune system* *any **four** from:* **1** ref. to time delay in immune response (compared to normal) **;** e.g. takes a longer time for, immune system to respond slower (secondary) immune response immune response similar to primary response **2** more time / easier / AW, for HMCV to infect cells / replicate / spread (so cause damage) **;** AW **R** ref. to HCMV as, cells that reproduce / viruses that carry out mitosis *impact following primary response and after viral activation* **3** few(er), immune system cells / named, (in circulation) **; I** fewer white blood cells e.g. fewer, macrophages / neutrophils **A** phagocytes fewer (B- and T-) memory cells **A** no memory cells *(no longer present from primary response)* fewer, (B/T,-) lymphocytes / T-helper cells / T-killer (or cytotoxic) cells *context for lymphocytes could be reduced number circulating at time of viral activation or owing to poor secondary response(compared to normal)* fewer / no, plasma cells **4,5** consequence of fewer immune system cells **;;** *two marks* e.g. less chance of / AW, encounter with / recognition of / activation by, (non-self / foreign) antigen / HMCV / virus / pathogen / infected cell (fewer memory cells) ref. reduced clonal expansion / AW (so fewer lymphocytes / plasma cells)	**4**
2(g)	(fewer plasma cells) lower concentration of antibodies **A** no antibodies (as no plasma cells) **A** longer time for antibody, production / concentration to build up (fewer T-helper cells) less cytokine released **A** effect of cytokine *if spelling of cytokine* rejected (fewer T-killer cells) fewer infected cells killed / **A** perforin / granzymes / hydrogen peroxide, not released (fewer phagocytes) less phagocytosis for antigen presentation	

Question 17 · Paper 2 · February/March 2021 (22) · Q3(a) · 1 mark

3(a)	*any **one** from:* stimulate / enhance / AW, macrophage response **;** stimulate / enhance / AW, B-lymphocyte / B-cell / humoral, response **;** **A** described part of humoral response e.g. increase antibody production stimulate / enhance / AW, T-killer / T-cytotoxic, response **;** AVP **;** e.g. suppresses immune response (during recovery) role in inflammation ref chemotaxis	**1**

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Question 18 · Paper 2 · February/March 2020 (22) · Q5(c) · 3 marks

5(c)	*any **three** from:* *if T_h cell number is low:* 1 low T_h cells means increased risk of developing an infectious disease ; 2 low levels / less, cytokine, secreted / AW ; *role of cytokine:* 3 stimulates activity of macrophages / produces angry macrophages ; 4 stimulates, B-lymphocytes / plasma cells / humoral, response ; **A** activate B-lymphocytes 5 (so lower concentrations / less / no), antibody, produced / secreted ; 6 stimulates, T-cytotoxic / T-killer, cells ; 7 (so) fewer infected cells killed ; 8 more time for pathogens to, reproduce / spread ; 9 <u>fewer</u> memory cells (to fight future infection) ;	**3**

Question 19 · Paper 2 · February/March 2025 (22) · Q4(a)(ii) · 3 marks

4(a)(ii)	*any **three** from:* 1 ref. to presence of, (B / T) memory cells from primary immune response ; 2 increased chance of memory cells encountering antigen ; 3 more lymphocytes, with receptors complementary / specific, to antigens ; 4 more plasma cells created ; 5 increased / faster, production of antibodies ;	**3**

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Question 20 · Paper 2 · October/November 2020 (22) · Q4(c) · 3 marks

4(c)	*any **three** from:* *large numbers of B-lymphocytes / plasma cells (in primary immune response)* **1** large quantity of (specific) antibody, produced / released **or** (large quantity of) antibody to form antibody-antigen complexes / to bind antigen (for phagocytosis) / AW **;** *large numbers of memory B-lymphocytes so* **2** provide long term <u>immunity</u> / memory cells long-lived / provides immunological memory **;** **A** remain in, circulation (for a long time) AW **3** able to produce fast(er), secondary (immune) response **;** **A** second response will be fast(er) **A** immune response faster on second encounter (with antigen / pathogen) / AW **4** higher concentration / faster production, of antibodies (than primary response) **;** **I** 'more' alone **5** person does not have, symptoms / become ill (of / from, same disease) **;** **A** presence of same, pathogen / antigen, does not cause disease **6** AVP **;** memory cells can (divide to) produce plasma cells more plasma cells present than primary response able to form more memory cells	**3**

Question 21 · Paper 2 · May/June 2018 (22) · Q3(c)(ii) · 3 marks

3(c)(ii)	*three from:* 1 <u>specificity</u> / <u>specific</u> (in correct context) **;** 2 (B / T, -) lymphocytes have receptors complementary to antigen **;** **A** immunoglobulins / antibody *as receptors for B-lymphocyte* **A** surface molecules *as receptors for T-lymphocytes* 3 (different) antigens, stimulate / activate / AW, (different) B-lymphocytes / T-lymphocytes **;** **A** antigens stimulate an immune response 4 *idea that* different antibodies, synthesised / produced / AW, for different (O) antigens / O polysaccharides / lipopolysaccharides **;** 5 memory cells will, not respond to different antigen / only respond to same antigen / AW **;** 6 different O-antigens can, be composed of different sugars **;** **A** can have different shapes	**3**

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Question 22 · Paper 4 (A level) · May/June 2020 (42) · Q4(a) · 3 marks

4(a)	*any* ***three*** *from:* 1 repeat treatment causes, bigger / more rapid, immune response ; 2 (so) target cells (expressing new protein) short-lived / AW ; 3 decrease in (trans)gene expression on re-administration ; 4 AVP ; e.g. *ref. to* antibody binding / antibodies attract phagocytes	**3**

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