11. Immunity

1.

In the hybridoma method, what is grown by cell culture to produce monoclonal antibodies?

A antigens

B clones

C lymphocytes

D myeloma cells

Ans: B

2.

Which type of immunity does a baby have at birth?

A active artificial

B active natural

C passive artificial

D passive natural

Ans: D

3.

Which types of cell are stimulated to divide by the cytokines produced by T-helper cells?

A macrophages

B B-lymphocytes only

C T-killer cells only

D B-lymphocytes and T-killer cells

Ans: D

NOTE:

- Cytokines stimulate B-lymphocytes and T-killer cells to divide
- They also stimulate macrophages to carry out phagocytosis/ antigen presenting BUT do not stimulate division of macrophages!

4.

T-lymphocytes have a protein, PD-1, on their surface. Some cancer cells have a receptor molecule on their surface which binds with PD-1, inactivating the T-lymphocyte.

A monoclonal antibody, lambrolizumab, has been produced against this receptor.

Trials showed that in 54 of 135 people with advanced skin cancer who were given lambrolizumab the tumours more than halved in volume. In six of the 57 people who were given the highest dose the tumours disappeared.

What may be correctly concluded from this information?

1 Lambrolizumab binds with a receptor on the surface of skin cancer cells.

2 Cancer cells to which lambrolizumab is bound cannot inactivate T-lymphocytes.

3 Lambrolizumab targets and kills skin cancer cells.

4 Lambrolizumab allows a patient's own immune system to kill cancer cells.

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2, 3 and 4 only

Ans: B

5.

Rabies is a viral disease which can be spread to humans by a bite from an infected animal.

One method of treatment is to inject the patient with antibodies specific to the rabies virus.

Which statements about this treatment are correct?

1 The patient will have natural passive immunity to rabies.

2 The injected antibodies will be broken down by the patient.

3 The patient's memory cells will be able to produce this antibody more rapidly in the future.

4 The immunity provided will only last a short time.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

Ans: D

- Injecting antibodies = artificial passive
- Injected antibodies will be broken down over time, once it is no longer required

6.

Rheumatoid arthritis is a disease which causes the body's immune system to attack its own cells. The disease can be treated using monoclonal antibodies.

The table shows how five different monoclonal antibodies can work.

monoclonal antibody	mode of action
1	binding to proteins on cell surfaces and triggering the immune system
2	blocking molecules on cell surfaces that inhibit T-lymphocytes
3	blocking cell signalling receptors that trigger cell division
4	binding to antigens on cell surfaces and releasing a drug
5	blocking cell signalling receptors that trigger the immune response

Inflammation and swelling of joints are symptoms of rheumatoid arthritis. The cytokine, TNFalpha, activates cells in the immune system leading to death of cells in the joint.

Which types of monoclonal antibody could be used to treat rheumatoid arthritis?

A 1, 2, 3, 4 and 5

B 1, 2, 3 and 4 only

C 2, 3 and 5 only

D 4 and 5 only

Ans: D

- 1 is wrong and 5 is right, since the immune system should not be triggered
- 2 is wrong since the T-lymphocytes must remain inhibited
- Thus only option left is D = 4&5

7.

Which statement correctly explains why viruses are unaffected by penicillin?

A Penicillin only affects host cell metabolism.

B Penicillin only binds with 70S ribosomes.

C Penicillin only blocks mRNA synthesis in prokaryotes.

D Penicillin only blocks peptidoglycan synthesis.

Ans: D

8.

Which processes characterise the mode of action of phagocytes?

1 antibody production

2 receptor binding

3 endocytosis

4 exocytosis

5 hydrolysis

A 1, 2 and 4 **B** 1 and 4 only **C** 2, 3, 4 and 5 **D** 3 and 5 only

Ans: C

9.

Which blood cell type does **not** recognise, engulf and digest non-self particles?

A macrophages

B neutrophils

C phagocytes

D T-killer cells

Ans: D

10.

Repeated infections with malaria result in more effective immunity to malaria.

Which type of immunity is responsible for the more effective immunity?

A artificial active

B artificial passive

C natural active

D natural passive

Ans: C

11.

Antibiotic-resistant strains of *Mycobacterium tuberculosis* are a major problem when treating TB. A new antibiotic, teixobactin, could be very effective at killing *M. tuberculosis* with only a small risk that the bacteria will evolve teixobactin resistance.

Penicillin and similar antibiotics bind to a single protein, but teixobactin binds to two lipids that are needed for the formation of the bacterial cell wall. Teixobactin binds to regions of the two lipids that do **not** vary across many different species of bacteria.

Which statements help to explain why the use of teixobactin is thought to be less likely to lead to the evolution of antibiotic resistance than the use of many other antibiotics, such as penicillin?

1 A single mutation can result in bacteria that are resistant to penicillin and similar antibiotics but at least two mutations are required to produce teixobactin-resistant bacteria.

2 Mutations can affect the structure of proteins but **cannot** affect the structure of lipids because only proteins are made of amino acids.

3 The lack of variation across many species of bacteria in the two lipids that bind to teixobactin suggest that the particular structure of these lipids is essential for successful bacterial cell wall formation.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Ans: C

- Statement 1: correct, because teixobactin binds to 2 different kinds of lipids. 2 mutations would be needed to produce bacteria that cannot respond to teixobactin.
- Statement 2: incorrect, because mutations can affect structure of lipids, by altering the proteins making the lipids

12.

Monoclonal antibodies are now being used to treat some human diseases.

What explains why monoclonal antibodies are suitable for this purpose?

1 They can divide by mitosis to produce the large numbers of antibodies required for treatment.

2 They are specific to a particular antigen.

3 They can be modified so that they do **not** act as antigens themselves.

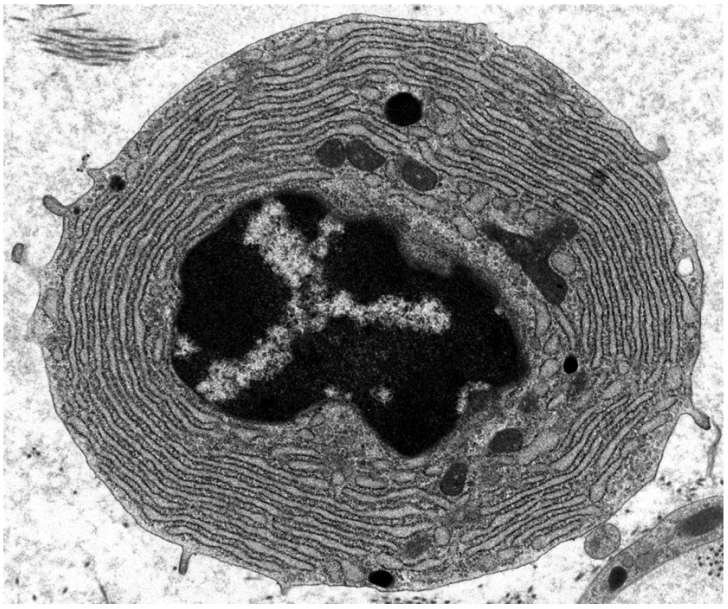
A 1, 2 and 3 **B** 1 only **C** 2 and 3 only **D** 2 only

Ans: C

- Monoclonal antibodies don't divide as they are not cells.

13.

The electron micrograph shows a type of blood cell.



What can be concluded from the electron micrograph?

A The cell secretes products that are toxic to pathogens.

B The cell synthesises a large quantity of proteins.

C The cell synthesises large quantities of antigens.

D The cell digests pathogenic bacteria.

Ans: B

- There is a large nucleus and a lot of RER, so the cell must be producing a lot of proteins = antibodies

14.

An antibiotic inhibits the formation of cross-links between the molecules that form cell walls in bacteria.

Which statements explain why bacteria are killed by the antibiotic?

1 The bacterial cell is destroyed by osmotic lysis.

2 Cellulose molecules **cannot** form hydrogen bonds.

3 The cell wall is no longer partially permeable.

A 1 and 2 only **B** 2 and 3 only **C** 1 only **D** 2 only

Ans: C

15.

What is the correct sequence of events in a primary immune response?

A T-lymphocyte activation → B-lymphocyte selection → plasma cell release

B antigen presentation by macrophages → cytokines released by T-helper cells → B-lymphocyte differentiation

C antigen presentation by neutrophils → T-memory cell activation → B-lymphocyte selection

D T-memory cell activation → B-memory cell activation → antibody production

Ans: B

16.

Which statement about the properties of the antigen-binding sites in different antibody molecules is correct?

A They are located on the light chains only.

B They have a hinge region to give flexibility for different antigens.

C They have binding sites for receptors on phagocytes.

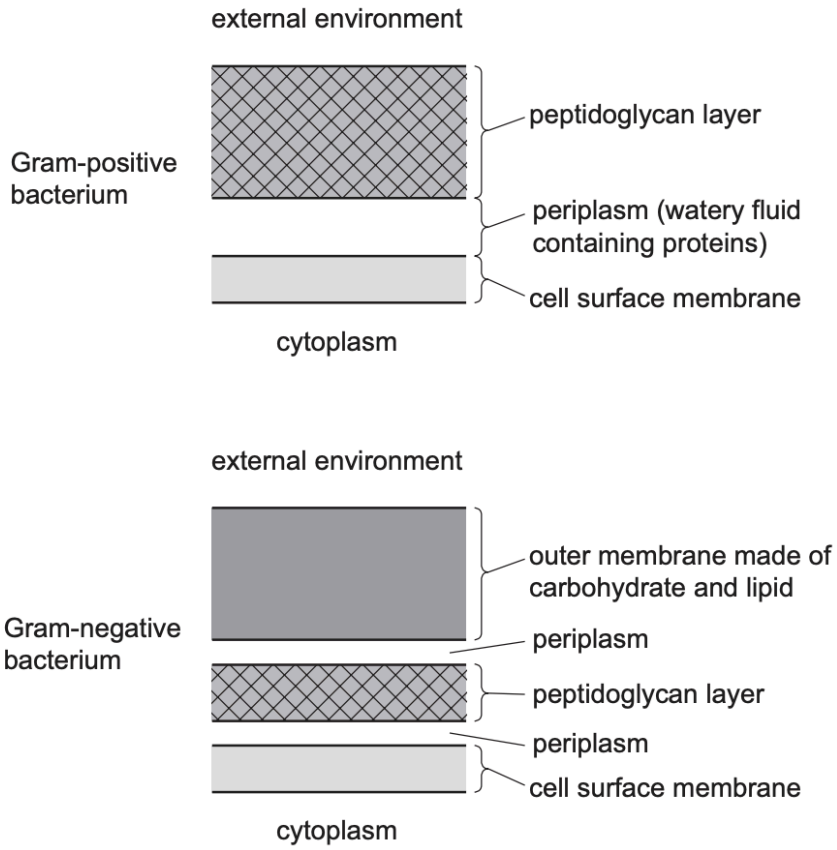
D They have variable amino acid sequences for different antigens.

Ans: D

17.

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

The diagram shows part of a Gram-positive bacterium and part of a Gram-negative bacterium, drawn to the same scale.



The antibiotic penicillin kills bacteria by inhibiting the synthesis of the cell walls during bacterial cell growth.

Which type of bacteria will be killed by penicillin more easily and why?

A Gram-positive bacteria because the peptidoglycan layer is exposed to penicillin directly

B Gram-positive bacteria because it has a thinner layer surrounding the cell membrane overall

C Gram-negative bacteria because the thin peptidoglycan layer can be broken down faster

D Gram-negative bacteria because there is more periplasm available, which gives a weaker structure

Ans: A

18.

The events listed occur during the primary immune response to a specific pathogen.

1 activation of B-lymphocyte to produce plasma cells and memory cells

2 phagocytosis of invading pathogens by macrophages

3 T-helper cell activation and production of T-killer cells

4 expression of antigens on phagocyte cell surface

5 production and release of antibodies

Which row identifies a correct sequence of events?

	first → last				
A	5	1	2	4	3
B	2	4	3	1	5
C	4	2	1	5	3
D	4	2	3	1	5

Ans: B

19.

Influenza is an infectious disease caused by a virus.

It is possible to have influenza more than once.

Which statements explain why it is possible to have influenza more than once?

1 The viral antigens change as a result of mutations.

2 The immune system may be weak and make few B-memory cells.

3 Untreated HIV infection has resulted in a low T-helper cell count.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Ans: A

20.

What will be produced by the division of memory cells during a secondary immune response?

A macrophages

B plasma cells

C neutrophils

D monocytes

Ans: B

21.

A bacterial pathogen produces a protein that acts as a toxin. This toxin is harmful to humans.

Scientists are developing monoclonal antibodies that can be used to detect the presence of the toxin in the body so that early treatment can be given.

Which statements describe steps in the development of these monoclonal antibodies?

1 The toxin protein is injected into a mouse and triggers mitosis of specific B-lymphocytes.

2 Antibodies are collected from the spleen of the mouse and fused with myeloma cells.

3 A hybridoma cell produces many antibodies with a variety of different variable regions.

A 1 and 2 **B** 1 only **C** 2 and 3 **D** 3 only

Ans: B

22.

Which statements are correct for penicillin?

1 It is harmful to prokaryotic cells.

2 It disrupts cell wall synthesis.

3 It becomes less effective with regular use.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Ans: A

23.

Why is passive immunity effective for only a short time?

A Antibodies are rapidly broken down.

B Antigens are rapidly broken down.

C Memory cells soon die.

D Phagocytes soon die.

Ans:A

24.

Which row is correct?

	involved in phagocytosis	secrete antibodies
A	T-lymphocytes	B-lymphocytes
B	T-lymphocytes	T-lymphocytes
C	B-lymphocytes	B-lymphocytes
D	B-lymphocytes	T-lymphocytes

Ans: A

25.

A successful vaccination programme provides a level of immunity where the majority of a population is protected.

There are several factors that can affect the success of a vaccination programme.

Which row correctly shows the factors that can affect the success of a vaccination programme?

	frequent mutation of the pathogen	vaccination from eight weeks old	pathogen is able to invade T-cells	booster vaccinations needed frequently
A	✓	✓	✗	✓
B	✓	✗	✓	✓
C	✗	✓	✓	✗
D	✓	✗	✓	✗

key

✓ = affects

✗ = does not affect

Ans: B