



VCE BIOLOGY 2015

YEAR 12 UNIT 3

Topic Test 3 – Detecting & Responding (2)

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Time allowed: 50 minutes

Total marks: 40

14 Multiple Choice Questions

4 Short Answer Questions

An Answer Sheet is provided for Section A.

Answer all questions in Section B in the space provided.

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STUDENT NUMBER

Figures

Words

Letter

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Student Name.....

VCE Biology 2015 Year 12 Topic Test 3 Unit 3

Detecting & Responding (2)

Student Answer Sheet

There are **14 Multiple Choice** questions to be answered by circling the correct letter in the table below. Use only a 2B pencil. If you make a mistake, erase and enter the correct answer. Marks will not be deducted for incorrect answers.

Question 1 A B C D

Question 2 A B C D

Question 3 A B C D

Question 4 A B C D

Question 5 A B C D

Question 6 A B C D

Question 7 A B C D

Question 8 A B C D

Question 9 A B C D

Question 10 A B C D

Question 11 A B C D

Question 12 A B C D

Question 13 A B C D

Question 14 A B C D

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SECTION A – Multiple Choice Questions

The following information refers to Questions 1 and 2.

Corynebacterium diphtheriae is a pathogen that affects the respiratory tract.

Question 1

Most likely, the entry point for *Corynebacterium diphtheriae* would be

- A. the gastrointestinal tract.
- B. broken skin on the arm.
- C. the mouth.
- D. urogenital openings.

Question 2

Corynebacterium diphtheriae is a bacterium so it would be classed as a

- A. eukaryote.
- B. prokaryote.
- C. viral pathogen.
- D. hormone.

Question 3

Part of the immune response involves plasma cells such as the one in **Figure 1**.

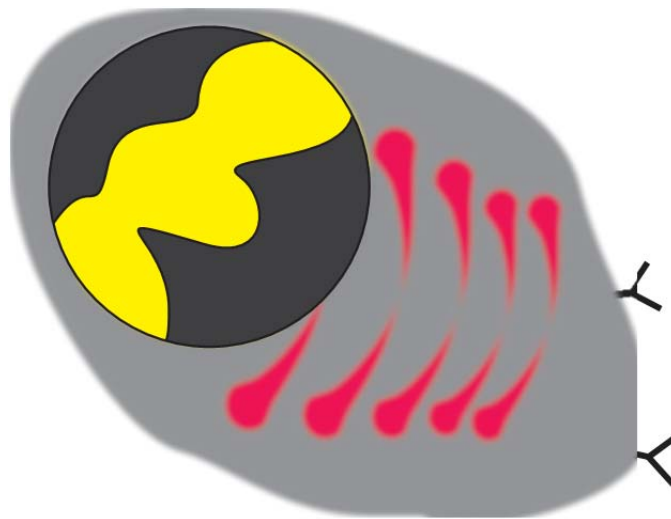


Figure 1: A plasma cell.

A plasma cell

- A. is a type of T cell.
- B. is phagocytic and removes damaged cells.
- C. secretes complement and is part of cell-mediated immunity.
- D. secretes antibodies and is part of humoral immunity.

The following information refers to Questions 4 and 5.

Plants such as the raspberry plant *Rubus idaeus*, have a range of defence mechanisms to prevent herbivory.

Question 4

One of the defence mechanisms of *Rubus idaeus* is the many tiny thorns on the plant which prevent some insects eating the plant. This type of defence is an example of

- A. a physical barrier.
- B. specific immunity.
- C. a chemical barrier.
- D. a leukocyte.

Question 5

It is possible that the stems of *Rubus idaeus* contain a substance that paralyses an insect when the insect bites the plant. This type of defence is an example of

- A. a physical barrier.
- B. specific immunity.
- C. a chemical defence mechanism.
- D. a leukocyte.

Question 6

Leukocytes, like those in **Figure 2**, are involved in innate immunity in humans.

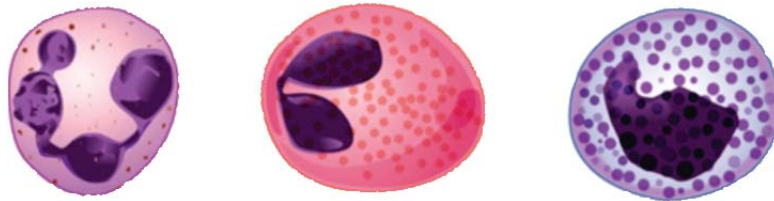


Figure 2: Three types of leukocytes.

Which of the following is **not** a characteristic of leukocytes? They

- A. can move through blood vessels.
- B. are manufactured in the bone marrow.
- C. are white blood cells.
- D. contain no nucleus.

Question 7

B cells are involved in the immune response in humans. B cells are formed in the

- A. thymus.
- B. lymph nodes.
- C. bone marrow.
- D. thyroid.

Question 8

The humoral immune response mainly involves

- A. T cells.
- B. B cells.
- C. stem cells.
- D. phagocytes.

Question 9

In a cell mediated immune response, what is the cell type that secretes chemicals which attract phagocytes and other T cells to the site?

- A. Helper T cells.
- B. Memory T cells.
- C. Cytotoxic T cells.
- D. Suppressor T cells.

Question 10

Susan became infected with a pathogen and had an immune response. Her body produced some specialised lymphocytes and antibodies, leading to immunity from the pathogen for the rest of her life. This type of immunity is both

- A. active and artificially-acquired.
- B. natural and passive.
- C. artificially-acquired and passive.
- D. natural and active.

Question 11

Magnus was bitten by a white-tailed spider whilst gardening and was taken to hospital. In hospital, he received an injection of a preformed antibody serum which was specific to the toxin from the white-tailed spider. The antibodies allowed Magnus to survive but did not result in any long term immunity because his body produced no antibodies. This type of immunity is both

- A. active and artificially-acquired.
- B. natural and passive.
- C. artificially-acquired and passive.
- D. natural and active.

Question 12

Charlie's immune system only attacks foreign cells and not its own tissues because his immune system recognises the

- A. leukocytes on cells.
- B. major histocompatibility complex on cells.
- C. IgE antibodies on cells.
- D. histamines on cells.

Question 13

Donna accidentally cut herself whilst scrapbooking and tore some blood vessels. Her wound can be seen in **Figure 3**.

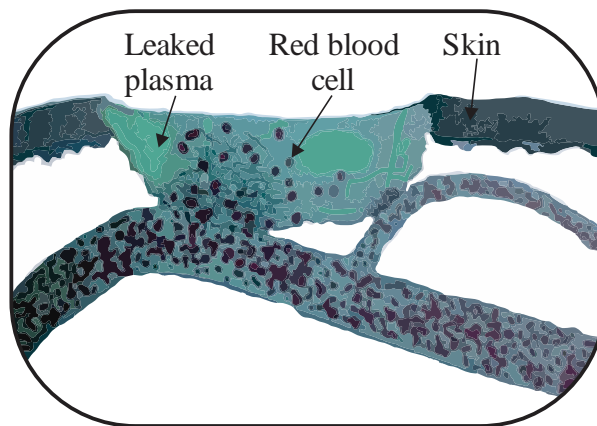


Figure 3: A cross-section of Donna's wound.

Platelets in the blood begin adhering to exposed collagen fibres in the blood vessel and eventually form a clot. One reason platelets are important in the body's defence is that they

- A. induce fever attracting T cells to the site.
- B. become a chemical barrier to the entry of pathogens.
- C. attract prions to the site.
- D. act as a physical barrier to the entry of pathogens.

Question 14

A number of microbes were found in Jackson's blood stream. The cells that ingest microbes and digest them are called

- A. phagocytes.
- B. B cells.
- C. helper T cells.
- D. lymphocytes.

End of Section A

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SECTION B – Short Answer Questions

Question 1 (8 marks)

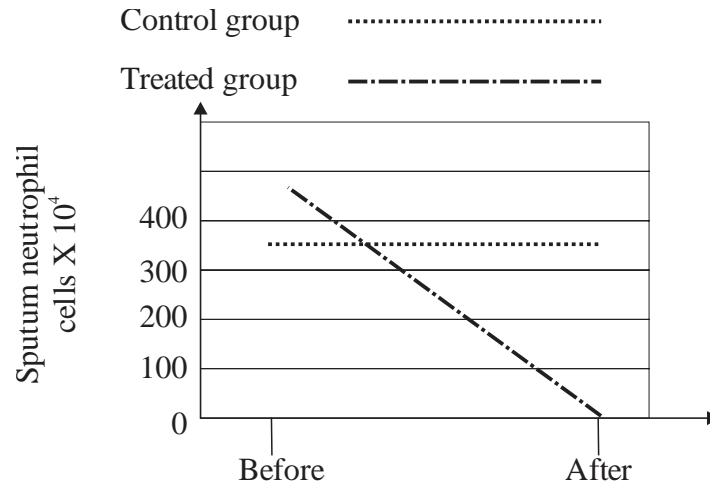
Mackenzie accidentally steps on a rusty nail, which penetrates the heel of her foot. After stepping on the nail, Mackenzie's heel becomes inflamed.

- a. What is a symptom of inflammation that Mackenzie could notice just by looking at the heel of her foot? **1 mark**

- b. Describe a vascular change that would occur for the symptom you have described in Part a. **1 mark**

- c. Fever is an inflammatory response that could occur after Mackenzie stepped on the nail. Explain what fever is and why fever can be beneficial. **2 marks**

- d.** Chronic obstructive pulmonary disease (COPD) can result in airway inflammation in humans. A study was carried out to see the effect of an inhaled medication called BPD and whether it could reduce the neutrophil count (a cell involved in the inflammatory response) of patients with COPD. Neutrophils were obtained by collecting a sputum sample (mucus from the respiratory system) and the results can be seen in **Graph 1** below.



Graph 1: Neutrophil cell count in patients before and after treatment with BPD.

- i.** Construct a hypothesis for this study. **1 mark**

- ii.** Analyse **Graph 1**. What is the effect of BPD on patients? **1 mark**

- iii.** What is the purpose of the control group? **1 mark**

- iv.** What are two factors that need to be controlled in this study? **1 mark**

Question 2 (7 marks)

Ian has asthma and tends to have more asthma attacks during spring when there are higher pollen counts.

- a.** What is hypersensitivity? **1 mark**

- b.** What is an allergen and what is the allergen that is leading to Ian’s asthma attacks? **1 mark**

- c.** Explain the role of B cells in hypersensitivity and how this process can lead to an allergic reaction. **4 marks**

To manage his asthma, Ian will sometimes take medication that has antihistamine in it, to try to decrease his allergic response. **Figure 4** shows what happens before and after the administration of the medication.

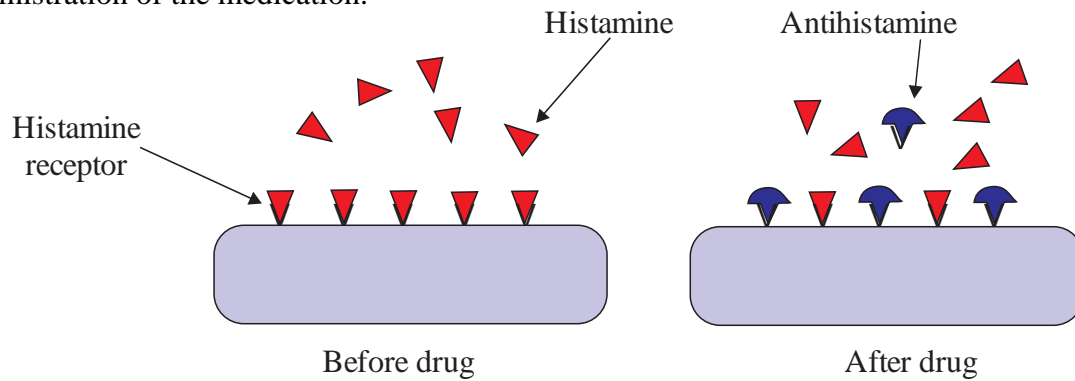


Figure 4: The effect of medication containing antihistamine.

- d.** Explain why taking medication that contains antihistamine would decrease the allergic reaction. **1 mark**

Question 3 (6 marks)

As a child, Hasting was vaccinated against the measles virus.

- a.** What is a vaccine? **1 mark**

- b.** **Figure 5** is a diagram of a virus. Label where the protein and nucleic acid are located. **1 mark**

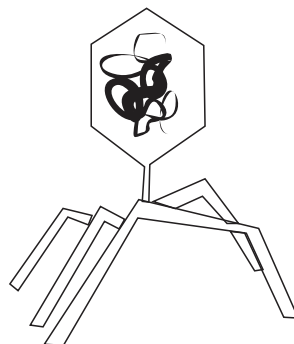


Figure 5: A virus.

- c. In Hasting's kindergarten, 48 out of 50 children were also vaccinated against the measles virus during a large scale immunisation program. This concept is known as 'herd immunity'. Why does this reduce the chance of unvaccinated children getting measles?

2 marks

- d. The measles vaccine is usually given to children in three doses. When Hasting received the second dose of the measles vaccine, his immune system produced a much larger response to the antigen in comparison to when his immune system first encountered the antigen in the vaccine.

- i. What term describes this more rapid immune response?

1 mark

- ii. Why is this immune response faster than the initial response that occurred when the vaccine was first administered?

1 mark

Question 4 (5 marks)

Gavin is concerned that he may have contracted Disease R.

- a. What line of defence would Gavin's skin be, considering that it is intact?

1 mark

- b. Assume the pathogen causing Disease R has entered Gavin's body. Explain the difference in the type of response, between the remaining two lines of defence.

2 marks

- c. i.** Assume that Gavin already has antibodies to this disease. What structural part of these antibodies would bind to the antigen? **1 mark**

- ii.** Why is not possible for any antibody to bind to this antigen? **1 mark**

End of Section B

End of Topic Test 3

Suggested Answers

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Detecting and Responding (2)

SECTION A – Multiple Choice Answers

1. C 2. B 3. D 4. A 5. C 6. D 7. C
8. B 9. A 10. D 11. C 12. B 13. D 14. A

SECTION B – Short Answer (Answers)

Question 1 (8 marks)

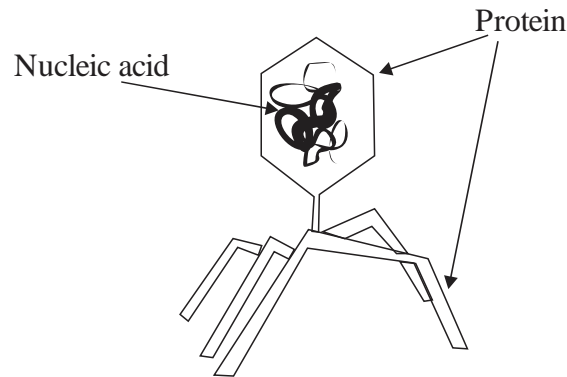
- a. Redness; swelling; and/or warmth/heat at the site (**Students only need one of the symptoms, 1 mark**).
- b. Vasodilatation – blood vessels increase in diameter **or** increased permeability of blood vessels – blood vessels become more permeable, allowing plasma, fluid and cells to the site (**1 mark**).
- c. Fever is when the internal body temperature increases to higher than normal levels (**1 mark**). It is beneficial because the increase in temperature can enable a more effective immune response by restricting the function of the pathogen that is causing the infection and enhance the cells of the immune system (**1 mark**).
- d. i. If BPD is a successful treatment for inflammation of the airways then there will be a decrease in the neutrophil cell count (**1 mark**).
- ii. BPD decreases the neutrophil cell count (**1 mark**).
- iii. The purpose of the control group is to ensure that BPD is decreasing the neutrophil count and it is not just decreasing naturally with time (**there are more possible answers, however it must be logical, 1 mark**).
- iv. The age; smoke status; diet; additional illnesses of the participants; additional medication of the participants (**there are more possible answers, students only need two factors for 1 mark**).

Question 2 (7 marks)

- a. Hypersensitivity is when the immune system has an exaggerated response to a normally harmless substance (**1 mark**).
- b. An allergen is a normally harmless substance that causes an allergic reaction. In this case study, pollen is the allergen (**1 mark**).
- c. A B cell comes into contact with an allergen (**1 mark**). The B cell differentiates into a plasma cell which produces antibodies specific to the allergen (**1 mark**). Receptors on mast cells bind to specific antibodies, which in turn bind to the allergen, when in contact (**1 mark**). The mast cells then release histamines and other chemicals, resulting in an allergic reaction (**1 mark**).
- d. Antihistamine is an inhibitor of histamine because it binds to the histamine receptor, which decreases the allergic response (**1 mark**).

Question 3 (6 marks)

- a. A vaccine is a suspension containing antigenic parts of microbes which is designed to trigger the immune system into making antibodies specifically for that microbe or antigen (**1 mark**).
- b. Students need to correctly label the diagram as shown below (**1 mark**).



- c. Unvaccinated children are indirectly protected from getting the measles (**1 mark**) because they have less chance to come into contact with a child who is infected, in turn making it less likely that they will acquire measles (**1 mark**).
- d.
 - i. A secondary response (**1 mark**).
 - ii. The presence of memory B cells in Hasting's body which already have the antibody for measles bound to receptors, dramatically increases the immune response to the measles antigen (**1 mark**).

Question 4 (5 marks)

- a. First line of defence (**1 mark**).
- b. Second line of defence reacts to the presence of any pathogen in a non-specific manner with general white blood cells involved (**1 mark**); whereas the third line of defence involves a specific response which includes lymphocytes, such as B and T cells to the Disease R antigen present in the body (**1 mark**).
- c.
 - i. Variable region (**1 mark**).
 - ii. The variable region of the antibody is specific to the epitope of the antigen. Hence, it is not possible for any antibody to recognise any antigen (**1 mark**).

End of Suggested Answers