

**AS Level Biology A**  
**H020/02** Depth in biology

**Question Set 4**

1. Lymphocytes form an important part of the specific immune system in humans. They can be classified into B lymphocytes and T lymphocytes.

(a) For each of the statements in the table below, use **ticks or crosses** to identify whether the statement belongs to B lymphocytes, or to T lymphocytes, or to both B and T lymphocytes.

The first one has been done for you.

Statement	B lymphocytes	T lymphocytes
Matured in bone marrow	✓	✗
Form part of immune response	✓	✓
Differentiate into memory cells	✓	✓
Produce chemicals that can cause lysis of infected cells	✗	✓
Form plasma cell clones	✓	✗

[4]

(b) Fig. 1 shows the concentration of antibodies in a patient's bloodstream following an influenza(flu) vaccination, and then a subsequent infection with the influenza virus.

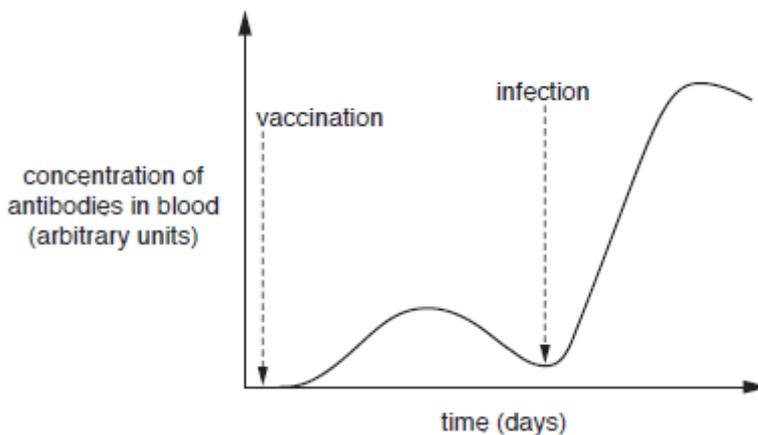


Fig. 1

Describe where the primary and secondary immune responses are taking place on Fig. 1 and explain the differences between the two processes.

[3]

The primary immune response takes place following the vaccination whilst the secondary immune response occurs after infection. The primary immune response is slower due to the lag phase in which activated B cells differentiate into plasma cells which secrete antibodies. It takes time for antigen presentation, clonal selection and expansion, B cell differentiation etc. The secondary response is quicker and a greater concentration of antibodies is produced due to immunological memory.

(c)\* In West Africa during 2015 there was a serious outbreak of the viral disease Ebola which spread by contact with infected bodily fluids.

- At the start of the outbreak there was a severe lack of trained health workers in the affected areas and much of the nursing was carried out in the family home or at local clinics.
- Many residents lived in close proximity to one another and sanitation was often of a poor standard.
- In times of illness it was common for people to travel to stay with close relatives, often in nearby villages or towns.
- As the outbreak spread, some residents left their villages to flee from the disease.
- Local mourning and burial practices involved gathering at the family house to pay respects to the deceased. Prior to burial the deceased was usually bathed by close family members.

A number of common factors affect the spread of communicable diseases in humans and some of them are relevant to the spread of Ebola. From the information above, discuss these factors and suggest what actions could have been put in place to address them.

[6]

Lack of trained healthcare workers means that there are too few trained professionals available to carry out a successful vaccination programme. Vaccinations may be administered at a significantly lower rate than necessary, or less qualified personnel may be involved in vaccine administration, introducing the potential for incorrect practice. Moreover, a lack of healthcare workers may mean a lack of education of the population regarding measures to reduce viral transmission. To address these problems, trained professionals could have been sent to smaller infection hotspots from less affected regions in West Africa. Local programmes to train professionals in greatly affected areas could have been established. Additionally, there should have been a focus on educating the population as to how to reduce the transmission of the disease (e.g. using condoms to prevent sexual transmission of the virus). Overcrowded living conditions would increase viral transmission as living in close proximity to infected individuals would promote transmission via droplet infection. As the probability of infection depends on the number of droplets, ventilation and the duration of exposure, a focus on improving housing conditions (e.g. increasing ventilation, reduced room sharing etc.) would be important. Education of the public regarding the use of face masks and the importance of hand washing could have also been useful to reduce pathogen transmission in such conditions. Finally, the movement of individuals to and from regions with disease would have led to the rapid spread of the pathogen to different areas. A travel ban could have been imposed to prevent movement of the vast majority of the population. Moreover the government could have enforced the mandatory quarantine of villages with high infection rates to limit the spread. The ill are cared by family so they are exposed to pathogen and so it will spread more easily. Thus, better access to hospitals & clinics is recommended. Poor sanitation also is a way to easily pick up pathogen from so use handwashing gels or improve sewage disposal.

**Total Marks for Question Set 4: 13**

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