Immunology Section Solutions

A.

You would like to generate antibodies against a specific antigen, antigen A, derived from a mammalian virus. You inject a rabbit with antigen A to hopefully elicit antibodies, and you assay antigen A specific antibody levels in rabbit blood every seven days. On day 28 you inject the same rabbit with more antigen A and measure antibody response for the next four weeks.
The results of your measurements are shown below. As a necessary control, you tested the blood of this rabbit prior to any injections (0 time point).

Days after injection	Presence of antibodies against antigen A
(before injection) 0	-
7	++
14	++
21	+
28	+
35	++++++++
42	+++++++
49	++++++

a) Why is the antibody response low on day 28 and high after day 35?

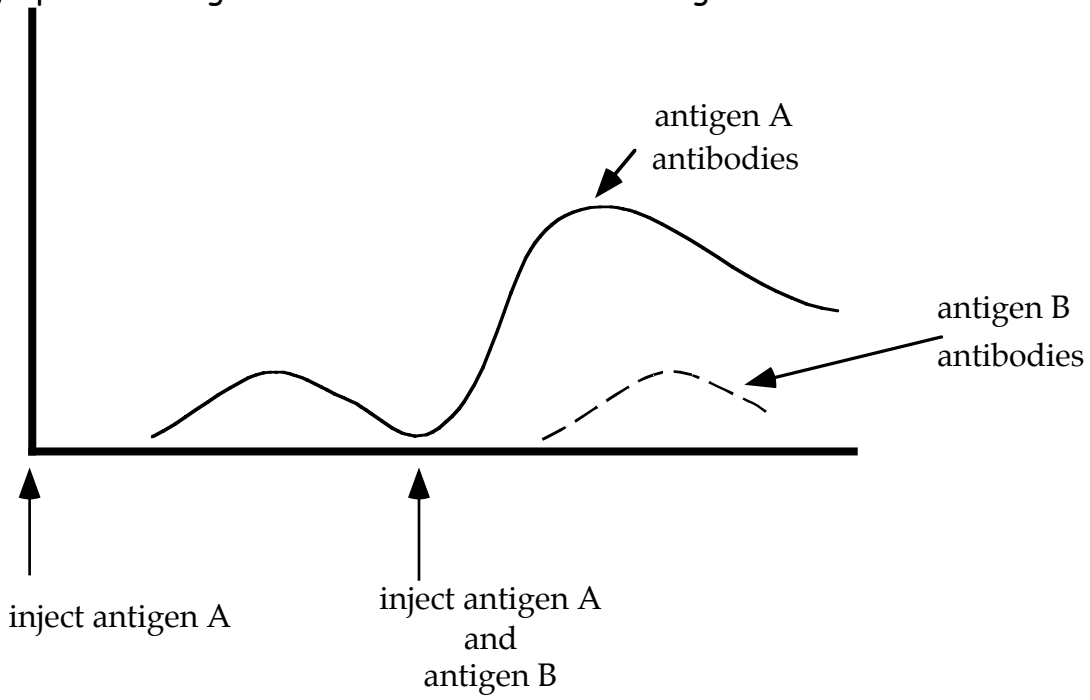
On day 28, the level of antibodies produced in the initial response has fallen. After the second injection, there is a rapid increase antibody production in the secondary response to an antigen due to clonal expansion of the memory B cells.

b) Antibodies to antigen A were detected on day 0 (prior to injection of antigen A) in a second rabbit in this study. How could this be explained?

The presence of antibodies to antigen A on day 0 suggests that the rabbit had previously been infected with the mammalian virus and had raised antibodies to counter the infection.

c) Suppose on day 28 the rabbit was injected with both antigen A and a different antigen, antigen B. Would you expect the levels of antibody against antigen B on day 35 to be higher, lower, or the same as the levels af antibodies against antigen A?

Draw a graph indicating the levels of antibodies to antigens A and B vs. time.



B.

a) Which virus does T_HA cells recognize?

virus 1

b) Which virus does T_HB cells recognize?

virus 2

c) Why are T_HA cells stimulated to grow by B cells plus virus 1, but not by B cells plus virus 2?

The T_HA cells have a TCR that can recognize virus 1 peptide but not virus 2 peptide presented on MHC II molecules on the B cells. The virus 1 peptide on MHC II molecules on B cells was displayed after the antibody on the B cell recognized virus 1 as an antigen and the antibody-antigen complex was internalized.

d) Why are T_HB cells stimulated to grow by macrophages plus virus 2, but not by B cells plus virus 2?

Macrophages non-specifically engulf virus 2 and present viral peptides on MHC II proteins. B cells only internalize antigen by way of a specific antibody. The antibody on the B cell clone in this experiment is does not recognize virus 2.