

Bio257 Immunology Practice Questions #3

1. X-linked hyper-IgM (XHM) syndrome is a heritable **immunodeficiency** syndrome with a number of **B-cell phenotypes**. **B cells** from XHM patients:

Produce **high levels** of **IgM** antibodies

Produce **no IgG, IgA and IgE** antibodies

Can be **activated** by **mitogens** such as **LPS**, but **not** by **specific antigens**.

Also, **XHM** patients **frequently** suffer from **recurrent infections** by opportunistic pathogens. XHM is caused by a **mutation** in the **gene** that **encodes CD40 ligand (CD40L)**; XHM patients therefore do **not** produce **functional CD40L**.

a) What is the **normal role** of **CD40L** in the **adaptive** immune system?

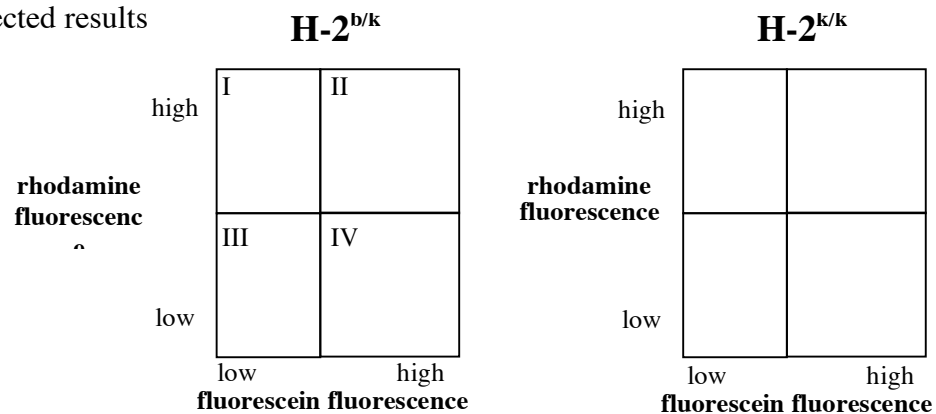
b) **Why** would a **defect** in **CD40L** result in the **absence** of **IgG, IgA and IgE** antibodies?

c) **Why** would **XHM** patients suffer from **recurrent infections**?

2. You are interested in studying **T-cell development** in mice. Having read about the **H-Y antigen** (which is encoded on the Y chromosome), you decide to get the **gene** for the **H-Y-specific TCR** used by von Boehmer and Kiselow. They cloned this gene from a **cytotoxic T cell line** originally **derived** from an **H-2^{b/b} mouse**. You make **two transgenic mouse lines** bearing the **H-Y TCR gene**--one line is **H-2^{k/b}** and the other line is **H-2^{k/k}**. Previous work has shown that in **H-Y TCR transgenic mice**, T cells bearing the **transgenic TCR** vastly outnumber other T cells.

You isolate **thymocytes** from **transgenic female mice**, **stain** the cells with **fluorescein-conjugated anti-CD8** antibody and **rhodamine-conjugated anti-CD4** antibody and perform **FACS analysis**.

a) **Sketch** your expected results



b) For the **H-2^{k/b}** FACS profile, indicate the **type of cells** that are found in **each quadrant** and explain **why** you do or **don't** expect to see cells in that quadrant.

c) **Explain** the **difference(s)** between **the two profiles** shown in (a). What **process** do your results reflect?

3. The regulation of gene expression is crucial for cellular differentiation and organismal development. Whereas most cells have exactly the same genes, which genes are expressed vary with time, place, and cell type. The bone marrow contains many different cells types, some of which express RAG1 and RAG2 and others of which do not express these genes.

- Name the two main types of cells in the bone marrow that we have discussed.
- Which cells express the RAG genes in the bone marrow and why?
- Which cells do NOT express the RAG genes in the bone marrow and why?
- Some cells in the bone marrow do not express RAG genes when they are in the bone marrow, but turn on their RAG genes elsewhere in the body. What cells are these and where and why do they express RAG genes outside the bone marrow?

4. You discover a new virus that infects T cells and you name it Ursavirus. Interestingly, Ursavirus produces high quantities of a protein called ULLP (Ursavirus Lck-like protein) that acts exactly like Lck except that it is constitutively active (enzymatic activity is always on). You express ULLP in a cultured T-cell line and you test IL-2 production by the cells under different conditions and get the following results:

<u>Fixed APCs (no B7 expression)</u>	<u>purified B7 in solution</u>	<u>IL-2</u>
-	+	+
+	-	-
+	+	+

- Explain why APCs (antigen-presenting cells) are not needed to induce IL-2 expression when ULLP is expressed. Describe the molecules involved.
- Explain why soluble B7 is required to induce IL-2 expression in this system. Describe the molecules involved.
- If you deleted the CD45 gene from the T cell line would you expect to get the same results after expression of ULLP? Why or why not? If not, indicate the results you would expect for the conditions shown in the table.
- If you deleted the ZAP70 gene from the T cell line, would you expect to get the same results after expression of ULLP? Why or why not? If not, indicate the results you would expect for the conditions shown in the table.

5. We have discussed a few reasons why haptens are not immunogenic. Given what you now know about the process of B-cell activation, can you think of another reason why haptens would not be immunogenic?

Questions from the book

Chapter 10: 1*, 4, 5* (you can refer to fig. 8-1), 6*, 7a-h,k and 8*

Chapter 11: 2, 8, 9, 11, 12