

BIOL 483 - Infection, Immunity, and Evolution of Disease
Spring 2022
Homework 9

Directions:

Part 1: Watch the youtube video that provides an animation of the Complement System and answer the questions below.

<https://www.youtube.com/watch?v=DPNnZE4OtCM&t=3s>

What does it mean that C5a and C3a are “chemoattractants”? What kinds of cells are they attracting and why is that helpful?

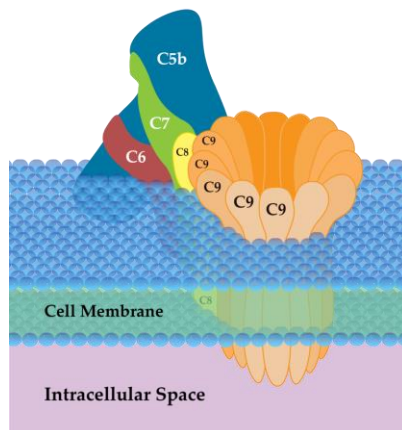
C5a and C3a are potent chemoattractant in that they induce movement of cells in the direction of its highest concentration. C3a are chemoattractant for mast cells, while C5a are chemoattractant for macrophages and neutrophils. C3a binds with mast cells (as well as basophils) inducing degranulation and release of histamine and other vasoactive amines. On the same note, C5a binds to macrophages and neutrophils priming them in mediating host defense functions.

What are some of the key steps that form the Membrane Attack Complex (MAC)? Feel free to draw if you prefer.

The Membrane Attack Complex (MAC) is formed through the terminal complement pathway.

Formation Steps:

1. Generation of C5b
2. C5b associates with C6, C7, and C8 → forms a large multimolecular complex
3. C6, C7, and C8 begins to disrupt the cell membrane
4. Subsequently, many C9 molecules binds with C8 creating a large pore in the cell membrane
 - a. Pore is large enough to allow water, ions, and small molecules to enter the cell leading to lysis



Part 2: For your edition of the textbook, please find the section called “Principles of Adaptive Immunity” and answer the questions below.

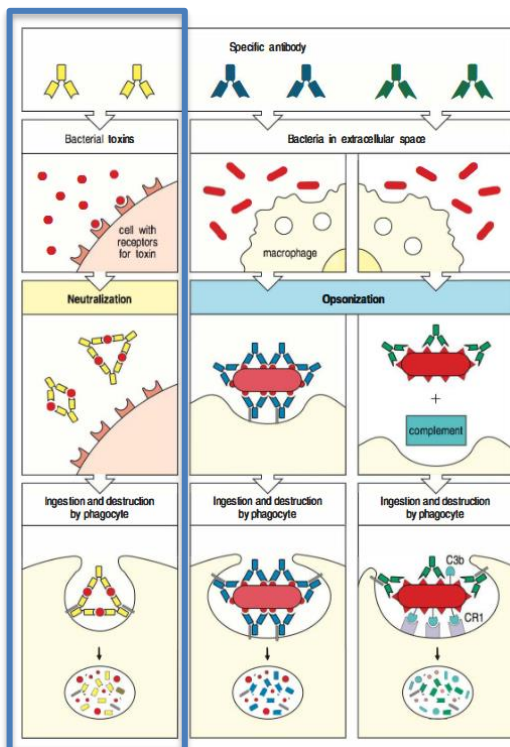
What is an MHC molecule? What does an MHC molecule "present" (i.e., what is its main action)? To what does it make its "presentation"?

The Major Histocompatibility Complex (MHC) region of the genome encodes for proteins that the immune systems use to identify cells and tissues in the body. MHC molecules binds to a single peptide which is then carried to the cell surface. The binding of the MHC molecule and the peptide creates a complex that are the ligands for T-cell receptors. The MHC molecules are the ones that “present” the antigens to the T-cells, and the cells carrying the bonded peptide:MHC complex on the cell surface are the antigen-presenting cells. This “presentation” is important in starting the primary T-cell response.

What are some of the key differences between MHC Class I and MHC Class II molecules?

MHC Class I and II molecules differ in their constituent polypeptide chains. MHC Class I molecule is a large polypeptide that contains three extracellular domains, while MHC Class II is comprised of two smaller, but similar sized polypeptides that contains two extracellular domains. Additionally, MHC Class I is comprised of a smaller polypeptide making up the fourth extracellular domain that is not attached to the cell membrane. Both MHC Class I and Class II are anchored in the plasma membrane. Furthermore, MHC class I presents antigens from intracellular pathogens, while MHC Class II presents antigens from extracellular pathogens.

Pick one of the main ways that antibodies combat infection and draw and explain how that works.



One way that antibodies combat infection is by binding to the bacterial toxins neutralizing them before they interact with a cells' receptors. The newly bonded toxin and antibody complex is recognized by macrophage receptors in which they are ingested and degraded. (Shown in leftmost panel)