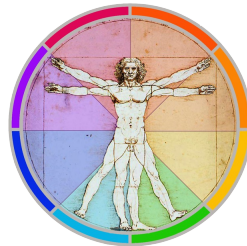


HUBS191 Lecture Material

This pre-lecture material is to help you prepare for the lecture and to assist your note-taking within the lecture, it is NOT a substitute for the lecture !



Please note that although every effort is made to ensure this pre-lecture material corresponds to the live-lecture there may be differences / additions.

HUBS 191

Lecture 33

Linking innate and adaptive immunity

A/Prof Joanna Kirman



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Today's Objectives

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To be able to:

- describe how immune cells communicate with each other
- explain how dendritic cells are activated and communicate with adaptive immune cells
- explain what major histocompatibility complex molecules are
- explain what cytokines and chemokines are
- understand the basic role of helper T cells and how they communicate to B cells
- explain how complement can help activate B cells

Pre-reading: Marieb 10e Chapter 21 page 804-805 (Section “Antigen Presenting Cells”)

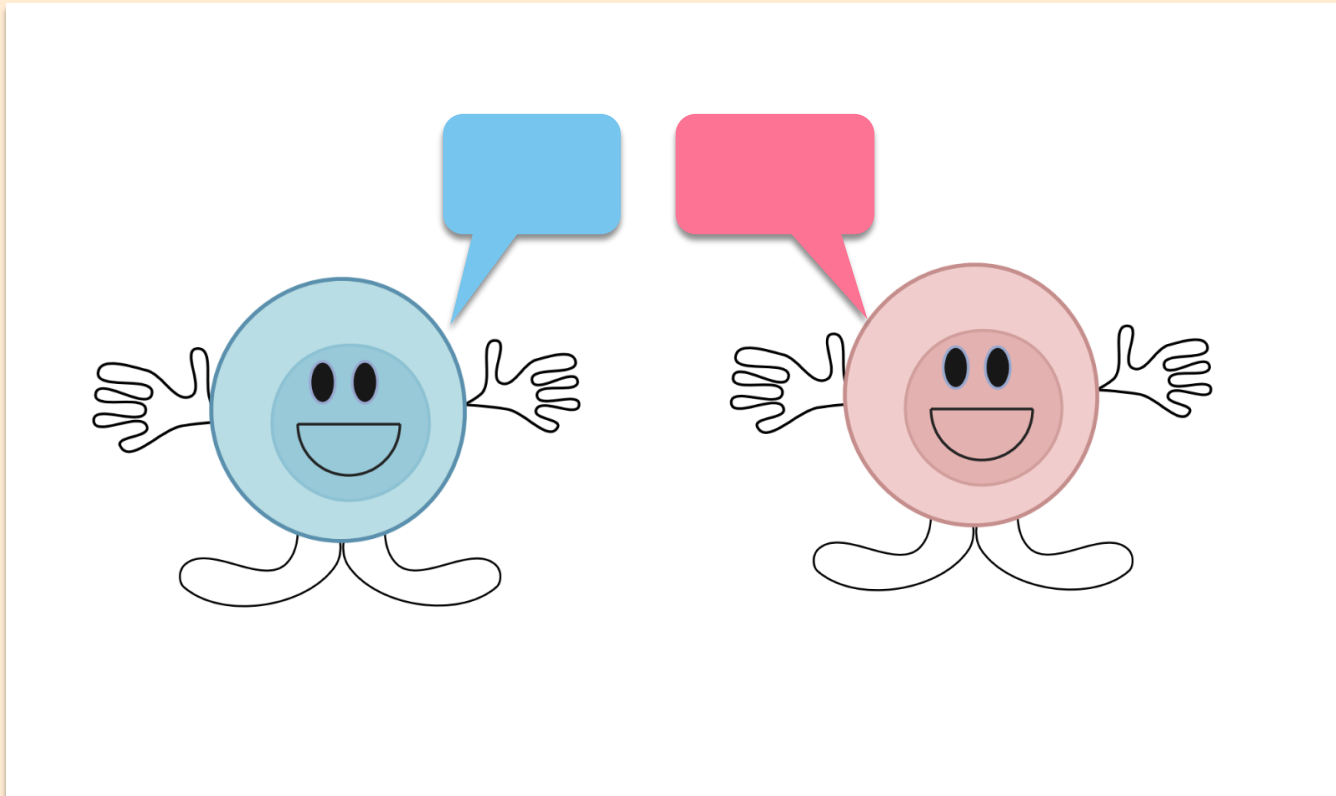
Marieb 10e Chapter 21 page 812-813 (Section “MHC Proteins and Antigen Presentation” – first paragraph)

Marieb 10e Chapter 21 page 815 (Section “Cytokines” and Table 21.7)

Marieb 10e Chapter 21 page 816 (Section “Helper T cells” – first paragraph and Figure 21.18)

Objective 1: How immune cells communicate with each other

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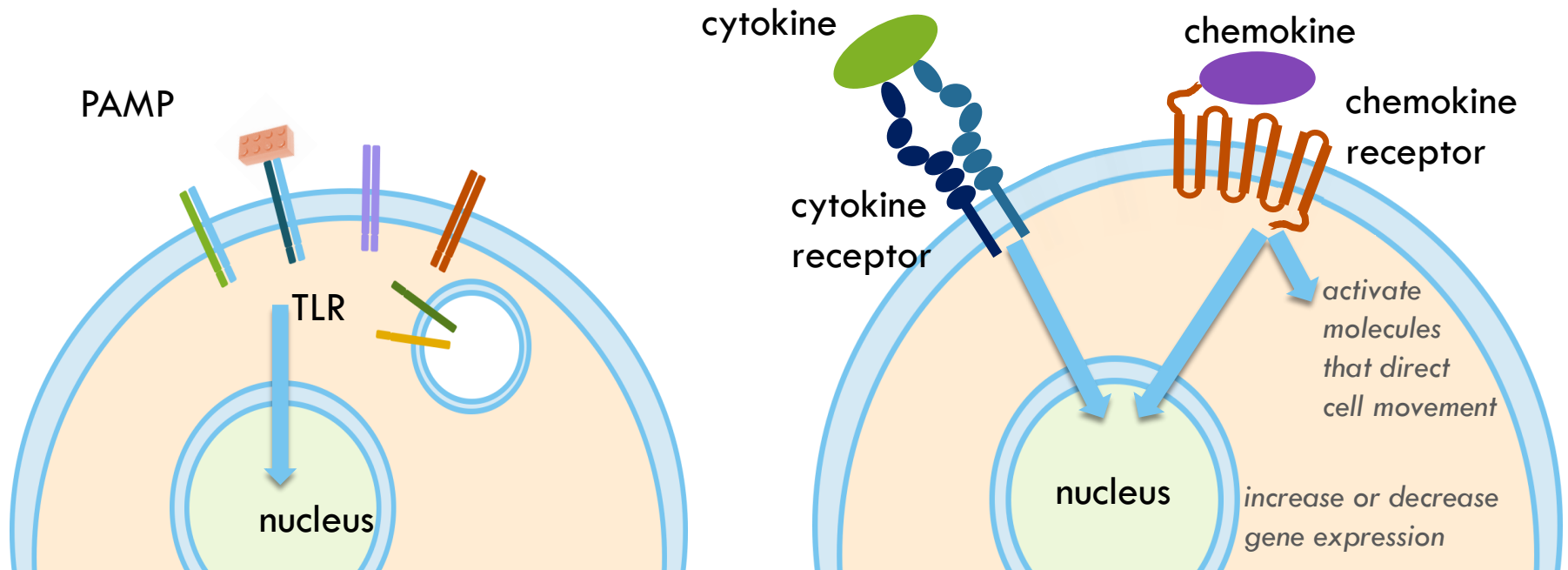
Major immune cell communication methods

4

- Soluble molecules (cytokines or chemokines) binding to receptors on a cell membrane
- Cell surface-bound receptors binding to cell surface-bound ligand
- Antigen (pathogen parts) being presented to cell surface-bound receptors

Soluble chemical messengers binding to receptors

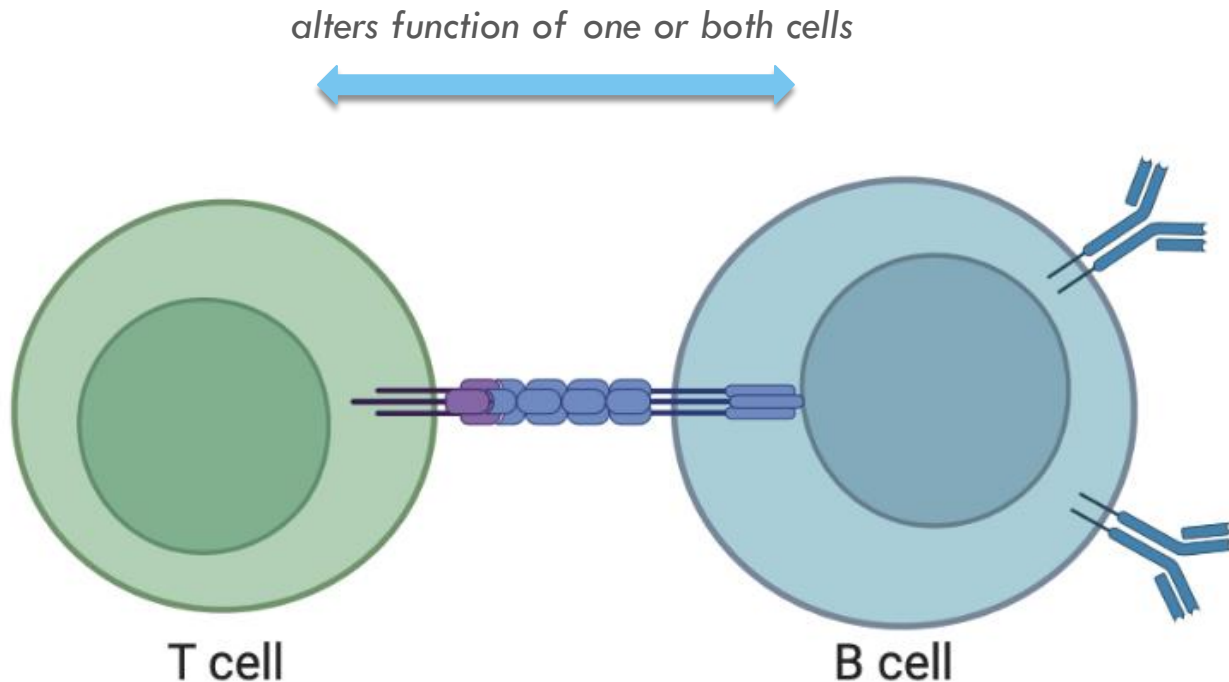
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Lecture 31: Pattern Recognition Receptor slide

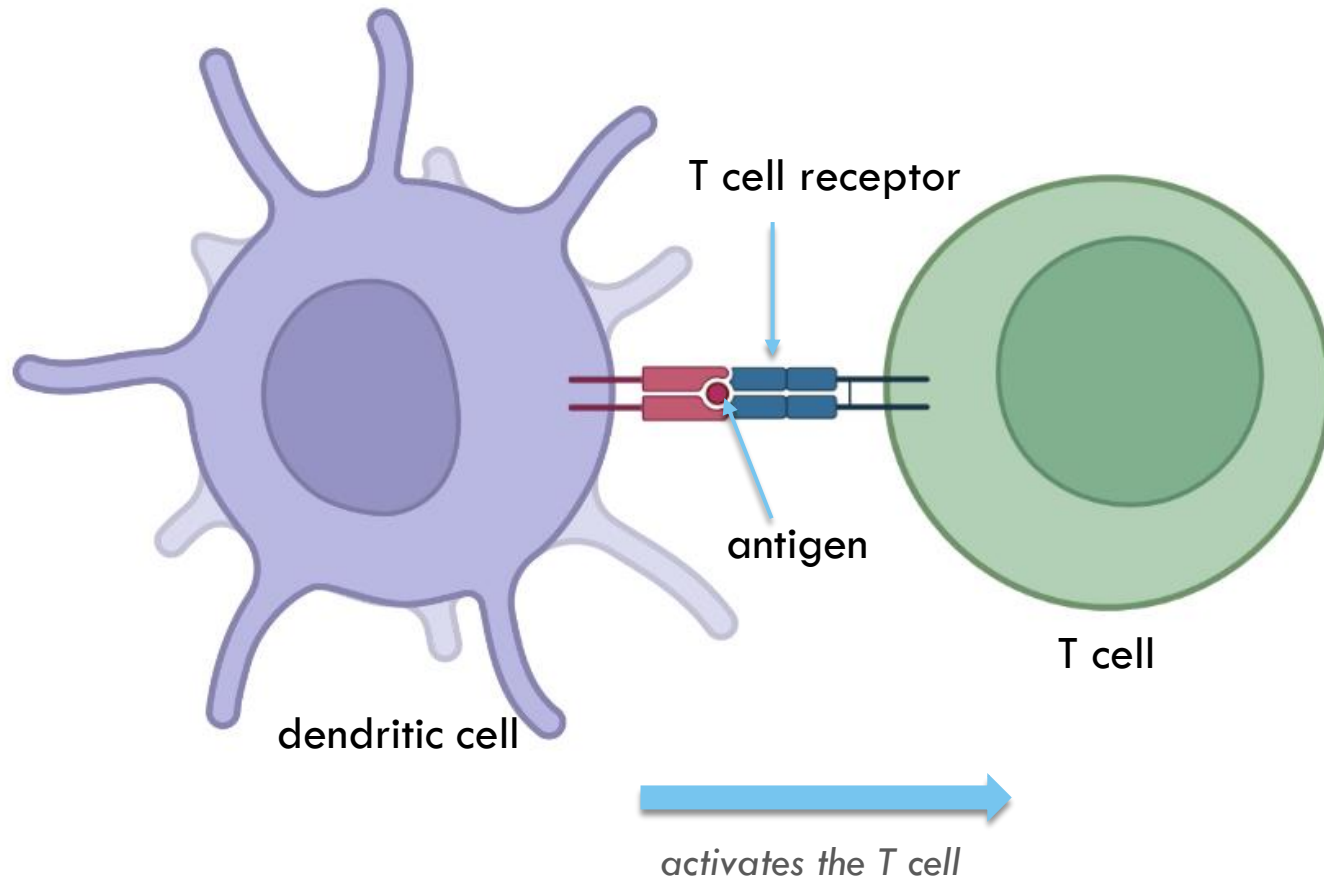
Cell surface-bound receptors binding to cell surface-bound ligands

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Antigen being presented to a cell surface-bound receptor

7



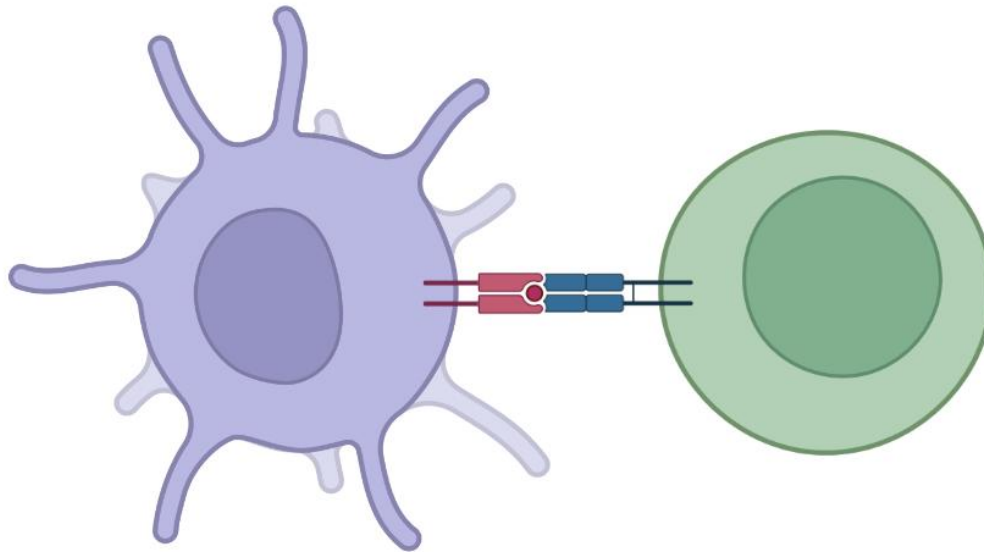
What is 'antigen'?

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- Anything that has the potential to be recognised by the immune system
- Foreign antigen: anything from 'outside' (transplants, pathogens, some chemicals)
- Self-antigen: immune system *usually* tolerant of self-antigen

Objective 2: how do activated dendritic cells communicate with adaptive immune cells?

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Activated dendritic communication with T cells

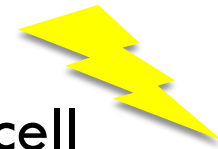
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Activated dendritic cells:

- Make cytokines that bind to receptors on T cell membranes
- Have cell surface-bound receptors that bind to T cell surface-bound ligand (or vice versa)
- Present antigen to cell surface-bound receptors on T cells

This communication leads to activation of the T cell

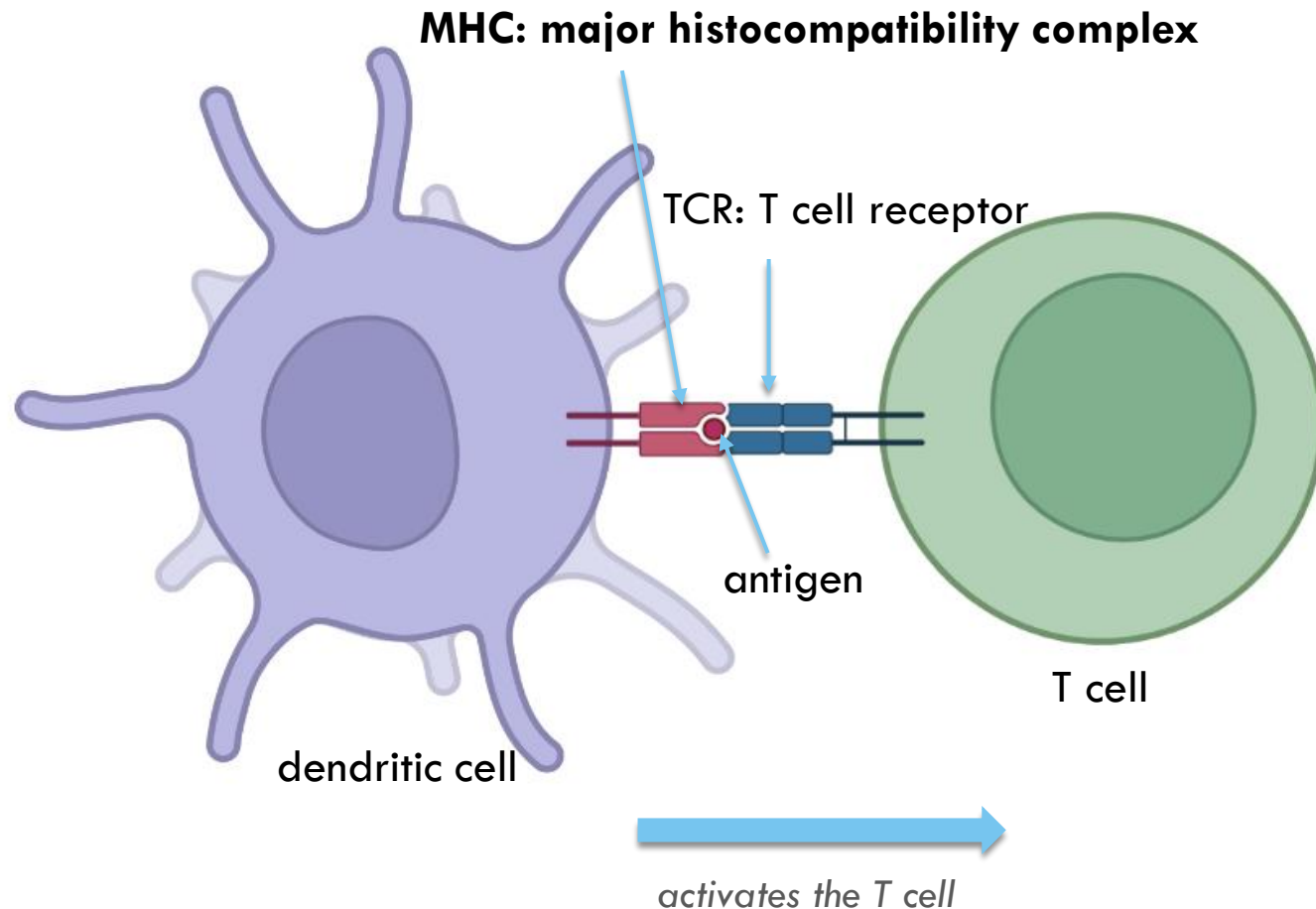
It is an example of innate and adaptive immune responses interacting



Objective 3: major histocompatibility complex (MHC)

Antigen being presented on MHC to the TCR

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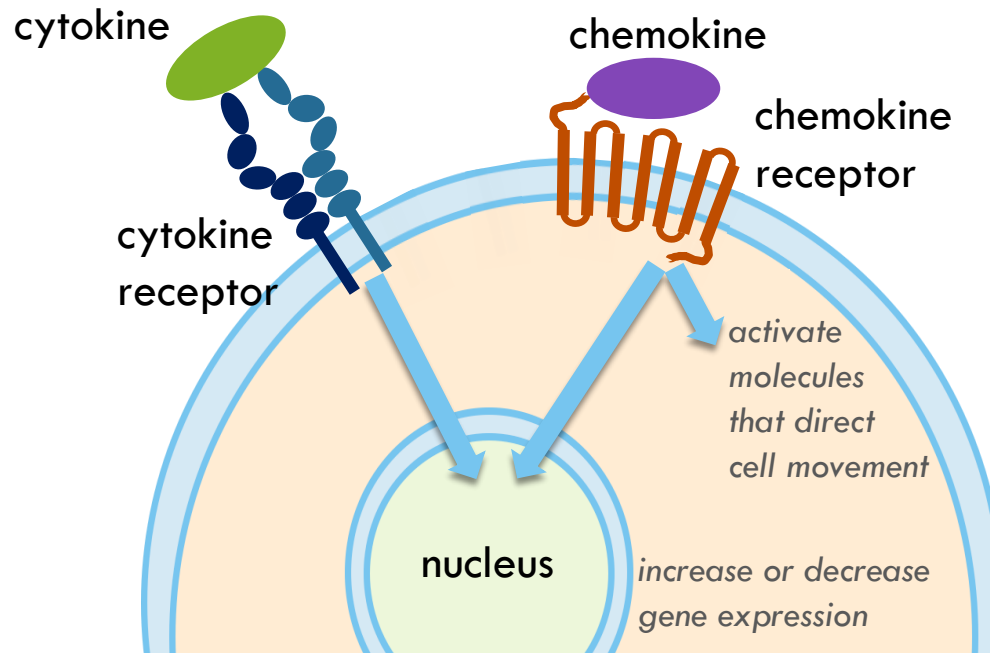
There are two types of MHC

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- MHC-I presents endogenous (intracellular) antigen.
Expressed on all nucleated cells.
- MHC-II presents exogenous (extracellular) antigen.
Expressed only on antigen presenting cells such as dendritic cells.

Objective 4: Cytokines and Chemokines

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Cytokines and Chemokines

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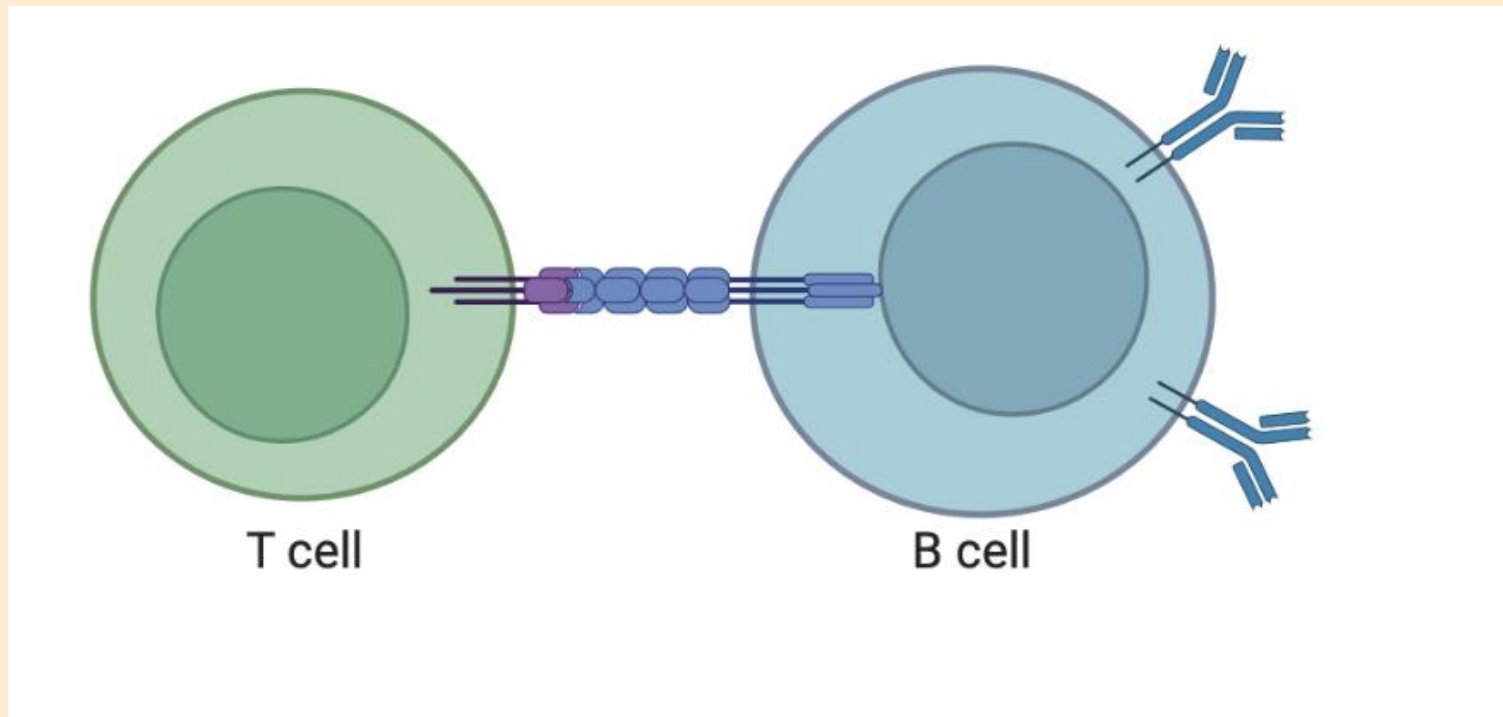
Cytokines are molecules such as interleukins and interferons that control growth and activity of immune cells

Chemokines are molecules that stimulate cell migration

Both are produced by innate and adaptive immune cells as well as cells that influence the immune system (eg epithelial cells)

Objective 5: Helper T cells activating B cells

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Helper T cells activate B cells

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Helper T cells that have been activated by a dendritic cell can then “help” B cells by:

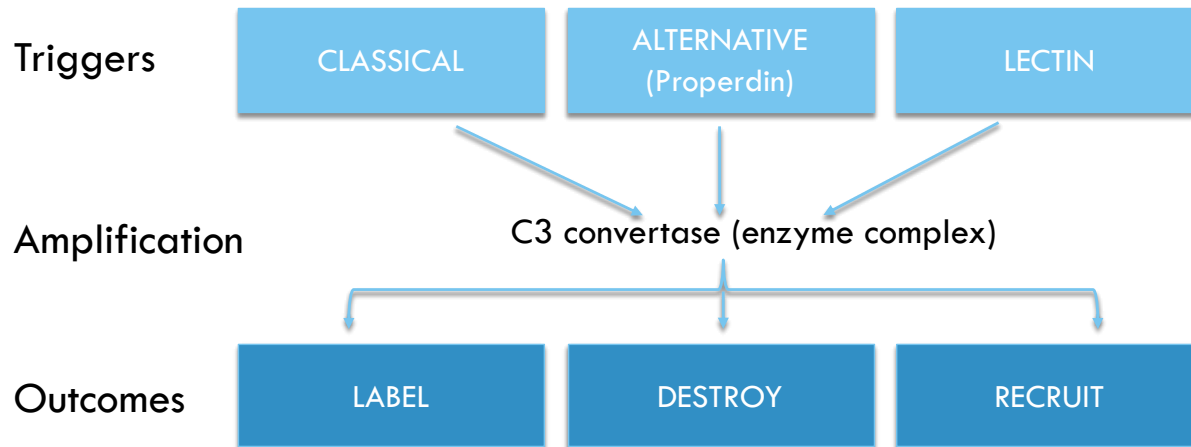
- Making cytokines that bind to receptors on B cell membranes
- Have cell surface-bound receptors that bind to a B cell surface-bound ligand (or vice versa)

This communication leads to activation of the B cell, and helps the B cell to make antibodies



Objective 6: Complement activating B cells

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Linking innate and adaptive immunity:

B cells and complement

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Antibody binding to a pathogen can trigger the classical pathway of complement activation



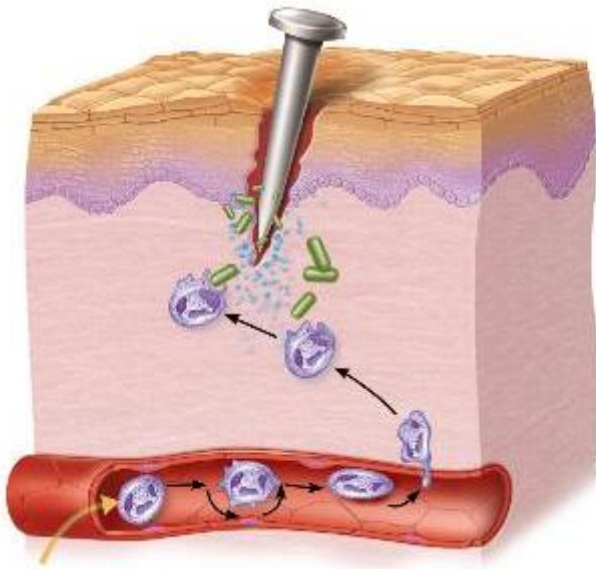
AND ... complement fragments that are bound to antigen can also help activate B cells to make antibodies



These are both examples of how innate and adaptive immunity interact with each other

Summary: putting it all together

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1. Stand on nail, breaking the physical barrier (skin)
2. Pathogens (eg bacteria) enter the body
3. Chemical mediators lead to vasodilation and entry of phagocytic cells to the tissue to “eat and destroy”
4. The complement pathway is triggered
5. Dendritic cells in the skin become activated through recognition of pathogen associated molecular patterns
6. Dendritic cells move to the local lymph node
7. Activated dendritic cells activate T cells via MHC
8. Antigen + T cells and complement activate B cells
9. B cells produce antibody
10. Complement, phagocytosis and antibodies help clear the pathogen

Use Your Objectives To Study

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Ask yourself:

- how do immune cells communicate with each other?
- how are dendritic cells activated and how do they communicate with adaptive immune cells?
- what are major histocompatibility complex molecules?
- what are cytokines and chemokines?
- what is the role of helper T cells and how do they communicate to B cells?
- how does complement help activate B cells?

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