Immunoengineering

Immune Cell Summary Sheet

Adaptive Immune System

A.K.A. Learned or Specific system

Immune Cell	Analogy	Function	How
B cells	Engineering War Department	Produce antibodies	Recognize antigen by antibody on surface of FDCs
			Activate and take up antigen
			Migrate to T cell zone
			Stimulated by CD4+ T cell
			Produce soluble antibodies
			Divide and mutate to produce more potent antibodies
CD4+ T cells (helper)	Government	Support immune cell activation	Activated by MHC II from DCs & costim
			Move to B cell interface and activate cognate antigen B cells
			Help CD8+ T cell stimulation with cytokine secretion (IL-2)
			(can also deactivate immune response-regulatory)
CD8+ T cells (cytotoxic)	Marine corp sepcial forces	Kill infected cells	Activated by MHC I from DCs & costim
			Help from CD4+ T cells
			Leave lymph node to infection site via lymphatics and circulation
			Kill infected cells by MHC I presentation of pathogen digested

Innate Immune System

A.K.A. Unlearned or Generic system

Immune Cell	Analogy	Function	How
Macrophages	Sentinels	Recruit other immune cells: macrophages/ neutrophils	Activated secrete cytokines and chemokines
			Toll-like receptors (TLRs) recognize pathogen patterns (PAMPs) and are activated
			Eat foreign objects/pathogens
Nuetrophils	Front-line Soldiers (army)	Eat and destroy pathogen	Abundant in circulation (2/3 of white blood cells)
			Recruited and phagosomes contain reactive oxygen species (ROS)
Dendritic Cells	Spies	Present antigen to adaptive immune cells	Take up pathogen through phagocytosis/or infected
			Digest antigen and present in MHC I/II proteins
			Activated by TLRs like macrophages
			Travel to LNs where adaptive cells are
			Express receptors to stay while adaptive cells scan
Natural Killer Cells	CIA	Kill pathogens and infected cells	Recognize antibody labeled pathogens and release perforins
			Recognize absence of MHC I (viral proteins)
Follicular Dendritic Cells	Computer screen	Present antigen to B cells	Secrete chemokine to attract B cells
			Present antigen to B cells to stimulate

Innate Immune System

A.K.A. Unlearned or Generic system

Other Defense Factors	Analogy	Function	How
Skin & Mucus	Fences/Barrack/Fortress/Trap	Intrisic barrier	Layer of dead cells (epidermis)
			Tight junctions
			Oils, Thick sticky gel
			Bactericidal proteins
			Cilia
Complement Proteins	Flares/detectors	Immunomodulating chemicals	Dilate vessels for antibody/cell escape at infection site
			Recruit other immune cells (chemotractant)
			Kill pathogen (chemical reaction to form pore)
			React with antibody to promote phagocytosis
Toll-like Receptors	Radars	Let DCs and Macrophages recognize foreign pathogens	Examples: Lipopolysaccharide (bacterial cell wall component)
			Double stranded viral DNA
			Unmethylated CpG DNA
Antibodies	Target missiles	bind specific epitopes (exposed parts) of pathogens to kill	Coating prevent ability to enter/infect cells
			Coating promote killing by neutrophils/ macrophages/NK cells which have receptors for Fc portion (non-specific) of antibody
Lymph Nodes/ Spleen	Bases	Bring together rare immune cells for immune response	Organ where adaptive immune cells (B & T cells live)
			Dendritic Cells travel to present antigen and activate adaptive immune response (chemokines)
			Connections to blood supply and lymphatics
Lymphatic system/ Circulation	Transportation	Connect immune response to different parts of the body and lymphoid organs	White blood cells circulate between lymphatic vessels and blood vessels and lymphoid organs
			Antigen collected in lymph travel to LN

Immunoengineering

Instructions:

1. Complete the three sections, the analogy, primary function, and how it accomplishes its function for every immune cell and other defense factors.
2. The Macrophages is filled in for an example of how much detail you should provide for
3. When finished save as a pdf and upload with your other problems

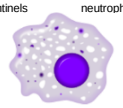
Adaptive Immune System

A.K.A. Learned or Specific system

Immune Cell	Analogy	Function	How
B cells			
CD4+ T cells (helper)			
CD8+ T cells (cytotoxic)			

Innate Immune System

A.K.A. Unlearned or Generic system

Immune Cell	Analogy	Function	How
Macrophages	Sentinels 	Recruit other immune cells: macrophages/ neutrophils	Activated secrete cytokines and chemokines Toll-like receptors (TLRs) recognize pathogen patterns (PAMPs) and are Eat foreign objects/pathogens
Nuetrophils			
Dendritic Cells			
Natural Killer Cells			
Follicular Dendritic Cells			

Innate Immune System

A.K.A. Unlearned or Generic system

Other Defense Factors	Analogy	Function	How
Skin & Mucus			
Complement Proteins			
Toll-like Receptors			
Antibodies			
Lymph Nodes/ Spleen			
Lymphatic system/ Circulation			