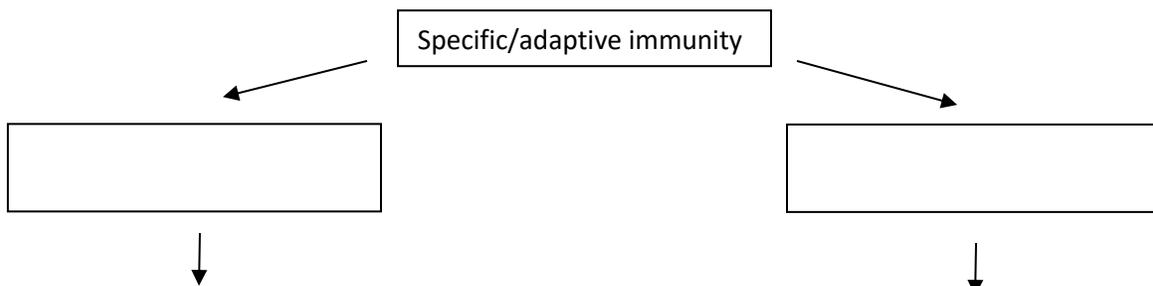


BIO 26 PAL Worksheet

Week 11 (#1): The Lymphatic and Immune System

1. A 'reference man' (one who is 70 kilograms, 20–30 years old and 5'7 feet tall) contains on average about 30 trillion human cells and 39 trillion bacteria (Abbott, A. Scientists bust myth that our bodies have more bacteria than human cells. *Nature* (2016)).
 - a) Use the whiteboard and draw a very simple human body.
 - b) Add all the organ systems you collectively remember being in contact with the external environment (prone to be used by pathogens to get into your body).
 - c) Discuss ways how these organ systems fight off pathogens.
 - d) What line of defense do these mechanisms represent?
2. Assume a pathogen made it past the barriers you discussed under 1. due to a puncture wound. Give this pathogen a name and a body (be creative!). Draw your newly labeled pathogen inside your human body.
 - a) Next, draw and name a couple of cell types attacking your pathogen (be creative, e.g. Pac-Man cells).
 - b) Discuss their typical locations and their responses to the pathogen.
3. Assume some of your pathogen's offspring has already invaded some of your human body's cells, while others avoided the response described under 2. and are still floating in the bloodstream.
 - a) Use the whiteboard to create a concept map of the specific immune response. Start with the two main branches that will take care of your pathogens (start your map as outlined below).



- b) Now add the following to your concept map:
 - Type of lymphocyte(s) involved in both branches. Leave lots of space around these lymphocytes for additional information (see below).
 - Indicate if antigen is presented by antigen-presenting cells (APCs) or not.
 - In cases of APC involvement, indicate which major histocompatibility complex (MHC) is being utilized (I or II). Draw simple cells and displaying MHC molecules next to your lymphocytes. Name one cell presenting MHC I molecules, and one cell presenting MHC II molecules.
 - Add CD receptors (CD4 or CD8) to those lymphocytes interacting with MHC I and MHC II molecules.
 - Each lymphocyte needs a couple of signals (costimulation). You already discussed the first stimulation (antigen) above. To visualize the second signal, draw arrows from

lymphocytes stimulating other lymphocytes. Indicate the type of signal next to the arrow.

- End the concept map with the final products of specific/adaptive immunity after first and second signals have been received (two cell types for each lymphocyte). Underline the cell types that are activated upon reexposure to the same pathogen.