LIMITATIONS OF ADAPTIVE IMMUNITY

1. Memory T and B cells don't always last for the rest of your life. Some examples:
    - Rabies vaccines are only effective for a couple of years.
    - Tetanus, may last for a bit more than a decade
    - Booster shots of vaccines attempt to build up a strong supply of memory cells for a disease.
2. Pathogens change.
    - Antigenic variation may mean that the new "outfit" the pathogen wears is no longer recognized by the memory cells.
3. Sometimes, a successful attack mounted against a pathogen can backfire.
    - Antibodies to strep throat sometimes also match antigens on the cells of heart valves and joint capsules. This can lead to rheumatic fever.

Development of B and T cells.

- Hematopoietic stem cells differentiate into prolymphocytes which differentiate into B and T lymphocytes.
- B and T cells circulate through the bloodstream and through lymph organs such as the thymus, spleen, tonsils, and Peyer's Patches in the intestines.
    - Lymphocytes are concentrated in lymph organs, but also patrolling the blood and mucous membranes.
- During fetal development and youth, the lymphocytes are "challenged" by self-antigens in the lymph tissue.
    - Lymphocytes that recognize "self"- antigens are destroyed.
    - Autoimmune diseases are caused by lymphocytes that recognize "self" but that are not destroyed by the body. A few examples:
        - ✓Type I diabetes
        - ✓Rheumatoid arthritis
        - ✓Lupus
        - ✓Multiple sclerosis
        - ✓Crohn's Disease
    - Allergies are caused by lymphocytes that recognize non-pathogenic environmental antigens (peanuts, eggs, pollen, dander, mold, latex, penicillin, etc.)
    - Childhood is the most critically time for development of a strong, yet not autoreactive immune system.
    - The thymus is a "training ground" for lymphocytes. Those that recognize self-antigens are normally destroyed.
    - The thymus degenerates during adolescence and is no longer around to "train" lymphocytes.