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| **Name:** |
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| **Basic Science Question:** |
| What are lymphocytes and what are their functions? |
| **Report:** |
| Lymphocytes are specific types of immune cells involved in the adaptive immune response. The adapative immune response differs from the initial innate immune response because it is slow to develop, has antigen specificity, and creates memory for future reoccurrence of the same infections. Lymphocytes arise from stem cells in bone marrow and travel to secondary lymphoid organs in order to become activated. Lymphocytes become activated when a lymphocyte receptor binds to an infectious agent’s antigens presented on an antigen presenting cell’s surface receptors (MHC receptors). Specific cytokines released from Helper T cells binding to lymphocytes are also necessary for activation. There are two main types of lymphocytes. These lymphocytes are B cells and T cells. There are also two types of T cells, CD4+ T cells and CD8+ T cells, both with different functions within the adaptive immune response along with only one type of B cell.  CD4+T cells when activated, undergo clonal expansion to become either T helper 1 (Th1) or T helper 2 (Th2) cells. T helper 1 cells are involved in the release of the cytokines IFN (Interferon) gamma and IL-2 (Interleukin-2). IFN gamma is involved in the activation of macrophages, which are immune cells responsible for phagocytizing foreign agents. IL-2 is responsible for the activation of CD8+T cells, which allow these lymphocytes to undergo clonal expansion to become cytotoxic T cells. T helper 2 cells are responsible for the release of cytokines IL-4 and IL-5. Both of these released cytokines are involved in the activation of B cells. When these B cells become activated, they differentiate into plasma cells and are involved in antibody formation.  CD8+T cells, when activated turn into cytotoxic T cells. Cytotoxic T cells are involved in the removal of virally infected cells. They do this by binding to the infected cell and release an enzyme called perforin. Perforin creates a hole in the infected cell membrane, allowing for the release of another enzyme called granzymes. Granzymes then force the virally infected cell to undergo apoptosis.  B cells, when activated transform into plasma cells. Plasma cells are involved in the creation and release of antibodies. Once created, these antibodies can then circulate and bind to foreign antigens in order to facilitate the necessary and proper response during an infection. Examples of specific responses created by antibodies include the following; agglutination, complement activation, opsonization, neutralization, and antibody-dependent cell-mediated cytotoxicity.  It is important to note, since T and B lymphocytes are involved in the adaptive immune response, memory will be generated. Therefore, after activation of both T and B cells, memory T and B cells will be created. The creation of these memory lymphocytes allows for a faster and stronger response upon future reoccurrence of the same infection. |
| **References:** |
| Cano, E., & Lopera, D. (2013). *Introduction to T and B Lymphocytes*. NCBI National Library of Medicine. https://www.ncbi.nlm.nih.gov/books/NBK459471/  Klockow, L. (2020). *Microbiology: Adaptive Immunity* [Slides]. Marquette University PPT. https://d2l.mu.edu/d2l/le/content/410590/viewContent/3076651/View |