1. Compare and contrast the development of B cells and  T cells including the following:
* where the majority of development is occurring **(*1 mark*)**;
* the signals and cellular interactions that are needed to promote commitment to the B or T cell lineage **(*4 marks*)**;
* the steps in gene rearrangement that take place (i.e. which genes rearrange first; you don’t need to discuss all the details of gene rearrangement) and what percentage of pro-B and pro-T lymphocytes are successful at rearranging their first receptor genes **(*4 marks*)**;
* the structure of the pre-B and pre-T cell receptors and what happens when the lymphocytes are successful at making one of these **(*7 marks*)**;
* what accessory molecules are expressed at the pre-B and DP pre-T cell stage **(*2 marks*)**;
* which receptor genes are rearranged next and what percentage of pre-B and pre-T cells are successful at making a true BCR or TCR **(*5 marks*)**;
* when and where positive and negative selection take place, the purpose of each kind of selection and the percentage of each type of lymphocyte that survives both processes **(*15 marks*)**;
* the purpose of receptor editing and when it takes place **(*2 marks*)**.
1. Autoimmune diseases develop when tolerance to self-antigens is lost. Two such diseases are due to defects in the gene for AIRE or the gene for FOXP3. List the symptoms associated with these diseases and explain what has gone wrong with the systems that are normally responsible for tolerance to self-antigens. (See Chapter 16, section 16-2 in the textbook). **(*10 marks*)**
2. Answer one of the following: **(*5 marks*)**
3. Both B cells and T cells can become “anergic”. What is “anergy” and how is it accomplished in B cells and T cells? What is the purpose of making some lymphocytes anergic?

**OR**

1. Leprosy is a disease caused by persistent infection of macrophages by *Mycobacterium leprae.* The disease can present in two forms, tuberculoid and lepromatous, depending on the type of TH response that is mounted. Discuss the symptoms associated with each form of the disease and how the progression of the disease relates to the immune response that is mounted in each case. (See Chapter 8, sections 8-11 and 8-18)
2. Look at the paper by Pierre Miossec & Jay K. Kolls, 2012, [Targeting IL-17 and TH17 cells in chronic inflammation](https://ezproxy.tru.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=mnh&AN=23023676&site=eds-live) (also available as a PDF in the Resources area of your online course materials), from the Nature Reviews, Drug Discovery journal. Note: this article is available through TRU Library - you will require your student ID login to access this article.

Pick one of the diseases they discuss (either rheumatoid arthritis, psoriasis, or COPD and lung disorders). Consider the evidence that TH17 cells and IL-17 may be involved in the pathogenesis of the disease and evaluate the clinical studies that use therapeutic monoclonal antibodies against IL-17 and IL17R for treatment of the disorder (see Table 1 in the paper). ***(5 marks*)**

1. Answer one of the following questions: **(*10 marks*)**
2. In Chapter 12 (section 12-9 and section 3-18) of the textbook, the topic of uterine NK cell involvement in formation of the placenta is discussed. Summarize how uNK cells interact with fetal trophoblast cells to control the remodeling of maternal blood vessels in the placenta. Include a discussion of the kinds of HLA molecules that the uNK cells interact with and how uNKs promote blood vessel formation and remodeling in the placenta. What may happen to the placenta if there are reduced numbers of inhibitory interactions between the uNK cells and the trophoblast cells or too many inhibitory interactions due to the paternal HLA-C haplotype?

Why doesn’t the immune system reject the fetal trophoblast cells?

**OR**

1. In Chapter 12 (section 12-17) the topic of mucosal-associated invariant T cells (MAIT cells) is discussed. Summarize characteristics of MAIT cells and how they act to help control infections by certain bacteria and fungi.

What antigens do MAIT cells recognize and how are they presented to the MAIT cell TCRs? What is special about the MAIT cell TCRs? Where do MAIT cells develop and where are mature MAIT cells found in the body? In what proportions compared to other lymphocytes? What is the phenotype of most MAIT cells in the adult? How do they act to control infection?

See also A. Kurioka et al, 2016, MAIT cells: new guardians of the liver in the journal Clinical and Translational Immunology. (Available through TRU library and as a PDF in the Resources area of your online course materials).

1. Make a video or a comic strip or come up with some other way of presenting the activation of clones of CD4+ TH1 and TFH1 helper T cells and CD8+ cytotoxic T cells in a lymph node in response to a viral infection. You will have to illustrate/show the activating interactions between naïve T cells and the APCs and the cytokines responsible for cell division and differentiation of the activated T cells. Show where the T cells will go to accomplish their tasks of supporting B cell development (what kind of antibodies will be made?), and assisting the innate immune system in eliminating the viral infection. Be sure to include the cells and antibodies involved. **(*30 marks*)**