Module 13 Assignment

585.751.81 Immunoengineering

1. Read the following paper on models of T cell activation: <https://www.nature.com/articles/nri3728> at least up to “Extensions of phenotypic models” on page 623. Describe each of the five possible models for T cell activation listed in the paper (in 2-3 sentences each). Which model best describes T cell activation and why? (50 points)
2. You are studying HIV and want to identify viral epitopes that may be recognized by CD8+ T cells to kill HIV-infected CD4+ T cells. Use the following database (<http://www.iedb.org/home_v3.php>) to search for linear peptide epitopes from the organism Human immunodeficiency virus 1 (the more common type of the HIV virus) that bind to HLA-A\*02:01 (the most common HLA-A allele in humans) in human hosts. Once you submit the search, change the linear peptide length to 9 amino acids (as most HLA molecules have a strong preference for binding 9mers) on the left hand side. Export your results, pick the first 50 epitopes in your search results and input them into the netMHC artificial neural network prediction program using the PEPTIDE format (<https://services.healthtech.dtu.dk/service.php?NetMHC-4.0>). For this problem, look at the binding affinity of your peptides to HLA-A\*02:01 allele in the HLA-A species/loci. (50 points)
   1. Please list/provide a screenshot of the peptides that you tested in the software and list the peptides that were predicted to be strong binders to the HLA molecule (those labeled “SB”). (15 points)
   2. Are there any features in common between the peptides listed as “strong binders”? If so, what are those features and why are they conserved between the peptides? If you do not see any features in common or only have 1-2 strong binding peptides, answer the question more generally: what common features would you expect to see between peptides that bind strongly to a given HLA/MHC allele? (20 points)
   3. Describe (in no more than a few sentences) how netMHC could be utilized in an immunoengineering context. (15 points)