Birla Institute of Technology and Science, Pilani
First Semester 2022-23
Immunopharmacology (PHA G538)
Comprehensive Examination

Max. Marks: 80 **Open Book** **Duration: 180 Minutes**

Q1. Cell surface recognition occurs during many types of immune responses, including immediate and induced immune responses. How do natural killer cells and B cells represent one of each type of immune response (immediate and induced), and how does cell surface recognition play a role in differentiating both types of immune responses? **[3]**

Q2. Suppose a person was born without the ability to produce intracellular TLR ligands (TLR3, TLR7, TLR8, TLR9, TLR11, TLR12, and TLR13). What problem would that create? **[3]**

Q3. The innate immune system cells depend on a specific set of receptors for the recognition of pathogens, whereas adaptive immune system cells use a highly specific receptor for identifying pathogens. Discuss the functional implication of this phenomenon. **[3]**

Q4. Describe the transcription factors and cytokines critical for determining the differentiation of post-thymic naïve CD4 T cells. Describe the resulting phenotypes and functions of each T helper cell subset. **[3+3=6]**

Q5. What function does the diversity of the variable region of an antibody help it perform? Discuss in detail. **[3]**

Q6. How immunity is intricately dependent on the lymphatic system? **[3]**

Q7. Is there a relationship between antigenicity and immunogenicity? Can immunogenicity be influenced? If so, describe how? **[2+2 = 4]**

Q8. What type of (same) antibodies you can expect to get in the mother's body as well as in an infant's body? Discuss the anatomical localization of these antibodies. **[3]**

Q9. Immunity can be acquired actively or passively, and it can be natural or artificial. What is an example of natural immunity acquired passively? **[2]**

Q10. Discuss the most "ideal" characteristic features of a candidate vaccine designed against SARS-Cov-2. What functionality should be there, and how to impart those? Discuss at least 5 points **[10]**

Q11. Is there any rationale for developing IgM as the first responder antibody? Would there be any problem if the first antibody produced was IgG? **[2]**

Q12. Discuss the importance of seroconversion to determine the efficacy of a vaccine. What are the major biological factors that influence seroconversion? How vaccine design can modulate a preferable seroconversion? **[3+3+3 = 9]**

Q13. The major immune response against *Salmonella typhimurium* is directed against bacterial flagella. Each *Salmonella* bacterium can have up to 10 flagella, which are required for bacterial adhesion and locomotion. These flagella are comprised of the polymerized flagellin protein FliC. Injection of purified, soluble flagellin into mice is known to induce anti-FliC IgG. However, in your experiment, you have taken a new genetically modified strain of mice, which exhibited only anti-FliC IgM after flagellin injection. What type of genetic modification would have been performed in these mice? Explain. **[3]**

Q14. Discuss about the interdependence of innate and adaptive immune systems for generating a robust immune response. How absence of one would negatively impact the other? **[5]**

Q15. Different mice have different susceptibilities to some pathogens. For example, BALB/c mice are extremely susceptible to infection with the intracellular pathogen Leishmania. C57Bl/6 mice are resistant to Leishmania infections, and are able to easily overcome the infection. What type of T-helper response do you hypothesize the BALB/c mouse is inherently skewed towards? What cytokine modulatory therapy could you imagine giving the BALB/c mouse to improve its ability to combat Leishmania? **[3+3 = 6]**

Q16. **a)** A young girl with a skin disorder was also found to have high levels of IgM, and barely detectable IgG, IgA, or IgE. B cells were purified from her peripheral blood revealed normal levels of CD40 on B cells. The CD40 sequence was also found to be normal. Make an educated guess as to the nature of the gene defect in this girl. Explain. **[3]**

b) Do you think that immunization with a pneumococcal polysaccharide vaccine will or will not result in specific antibodies being generated in this girl. Briefly explain your answer. **[2]**

c) Will immunization with tetanus toxoid result in similar or different antibodies being generated in this girl and a normal unaffected cousin? Provide a brief explanation for your answer. **[2]**

Q17. A pneumococcal polysaccharide vaccine is known to produce specific antibodies in immunized healthy children. Do you think that immunization with pneumococcal polysaccharide will or will not result in specific antibodies being generated in a boy with a CD40L deficiency? Briefly explain your answer. **[3]**

Q18. Discuss about the cytokine network and how that modulate immune responses. **[5]**

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