review questions

1. What are the goals of a molecular diagnostic test? What are some of the factors that are considered in the development of an accurate diagnostic test?

2. What is a biomarker?

3. Describe the structural features of an antibody molecule that are important for its function.

4. For diagnostic assays, what is meant by sensitivity, specificity, and simplicity?

5. What are monoclonal antibodies? How are they different from polyclonal antibodies?

6. Briefly, explain how the HAT selection for hybridomas works.

7. Compare and contrast indirect and sandwich ELISAs. Describe an application for each in the diagnosis of a human disease.

8. Describe a method to identify the causative agent of an infection.

9. What is the advantage of using a protein microarray in a diagnostic test compared to an ELISA?

10. Why might an immunological approach be more appropriate than a DNA-based approach to diagnose Alzheimer disease?

11. What is a hybridization probe? How are hybridization probes employed to detect disease-associated SNPs?

12. Why is PCR commonly used in molecular diagnostic tests?

13. Describe an allele-specific PCR.

14. How can two different alleles be distinguished using a TaqMan assay?

15. Why is real-time PCR quantitative? Why would this be useful for a diagnostic test?

16. Describe one application for DNA microarrays in disease diagnosis.

17. Describe an application for a SNP microarray.

18. What is DNA methylation? What role does it play in human disease? How can DNA methylation patterns be detected in clinical samples?

19. When assessing the antibiotic susceptibility of a pathogen, what are the advantages of determining RNA profiles rather than detecting the antibiotic resistance gene directly?

20. What are miRNAs? Why are they useful biomarkers of some diseases?

21. You have been given the task of developing a simple, sensitive, and reproducible diagnostic procedure for a double-stranded DNA virus that is devastating a local cattle population. Because effective treatment of this disease depends on early and correct diagnosis, you need to be able to detect the very low levels of this virus that are present in infected animals before the onset of disease symptoms. Briefly explain how you would proceed and why you have chosen a particular course of action.

22. How would you develop a microbial biosensor to detect environmental contaminants?