Birla Institute of Technology and Science, Pilani

Pharmaceutical Microbiology (PHA F217)

Second Semester 2022-23; Mid-semester Examination

Time: 1.5 hr **50 Marks** (Weightage 30%): **Closed book** **Date**: 16/03/2022

Q1. A scientist isolates a new species of prokaryote. They note that the specimen is a bacillus with an outer lipid bilayer and cell wall that stains positive for peptidoglycan. Its circular chromosome replicates from a single origin of replication. Is the specimen most likely an Archaea, a Gram-positive bacterium, or a Gram-negative bacterium? How do you know? **[3]**

Q2. What issues do dsRNA viruses face? How do they overcome these issues? **[3]**

Q3. What strategies are used by –ve RNA, +ve RNA, and double-stranded RNA viruses to replicate? **[3X3=9]**

Q4. The vaccine Gardasil which targets human papillomavirus (HPV), the etiological agent of genital warts, was developed after the anti-HPV medication podofilox. Why would doctors still want a vaccine created after anti-viral medications were available? **[3]**

Q5. How does the mechanism of the Gram stain relate to specific components of the bacterial cell wall? **[3]**

Q6. What are the various stages of bacterial growth, and what is occurring at each stage physiologically? What can influence the lag phase? **[3+2]**

Q7. As part of a LOP project, you get a chance to quantify bacterial numbers in environmental samples. The PhD student you are working with has used centrifugation to concentrate 10 1-liter samples of lake water 1000-fold (i.e. in a final volume of 1 ml). She asks you to determine the number of viable bacteria in the samples. By plating 10-fold serial dilutions on minimal media and incubating in ambient O_2 at 37°C, you get small, slow-growing colonies:

Starting dilution (1 ml)	Amount spread on plate	Number of colonies
Concentrated sample	100 µl	Too numerous to count
10^{-1}	100 µl	50
10^{-2}	100 µl	5
10^{-3}	100 µl	None
10^{-4}	100 µl	None
10^{-5}	100 µl	None

The graduate student asks if you made a mistake with your dilutions because she counted an average of 10^5 bacteria in the samples under the microscope. What might account for the discrepancy between your CFU counts and her direct total counts? **[3]**

Q8. A microbiology instructor prepares cultures for a gram-staining practical laboratory by inoculating a growth medium with a gram-positive coccus (nonmotile) and a gram-negative rod (motile). The goal is to demonstrate the staining of a mixed culture. The flask is incubated at 35 °C for 24 hours without aeration. A sample is stained and reveals only gram-negative rods. Both cultures are known as facultative anaerobes. Give a likely reason for the success of the gram-negative rod. Assume that the cultures have comparable intrinsic growth rates. **[3]**

Q9. In which settings would it be appropriate to achieve sterilization by **(i)** autoclaving, **(ii)** γ irradiation, **(iii)** chemical sterilants, **(iv)** dry heat sterilization, and **(v)** filtration? Give an example of each. **[5×2]**

Q10. Many people use antimicrobial soap to kill bacteria on their hands. However, overuse may actually increase the risk of infection. How could this occur? **[2]**

Q11. Briefly discuss the most interesting or surprising thing you learned about viruses. **[3]**

Q12. A microbiologist has identified a new gram-negative pathogen that causes liver disease in rats. She suspects that the bacterium's fimbriae are a virulence factor. Describe how molecular Koch's postulates could be used to test this hypothesis. **[3]**

All the best wishes