



RAJARATA UNIVERSITY OF SRI LANKA  
FACULTY OF APPLIED SCIENCES

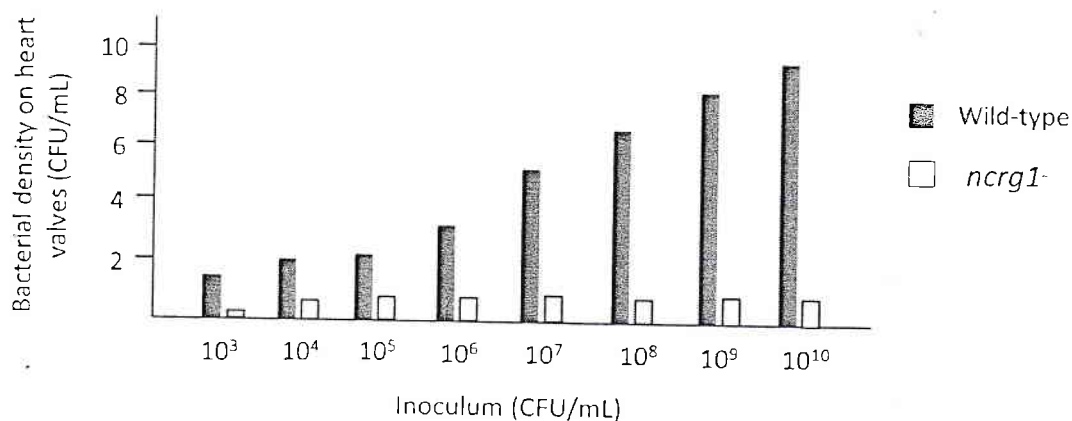
B.Sc. (Special) Degree in Applied Biology  
Fourth Year – Semester I Examination – January/February 2021

MIB 4202 – MEDICAL MICROBIOLOGY

Time: Two (02) hours

Answer ALL questions.

1. To evaluate the role of a non-coding regulatory gene (*ncrg1*) of a pathogenic *Staphylococcus aureus* strain, a mutant lacking the *ncrg1* was constructed (*ncrg1*<sup>-</sup>). The phenotypic profiles of both the *ncrg1*<sup>-</sup> and wild-type strains were comparatively evaluated in a mouse model. A broad range of challenge inoculum ( $10^3 - 10^9$  CFU/mL) was used to directly infect animals' bloodstream. After challenging, infectivity in terms of endocarditis and sepsis were analyzed. Endocarditis was analyzed by calculating the bacterial density of the heart valves of infected animals. Results obtained for bacterial endocarditis and sepsis are presented. Based on the results, provide a detailed account of the possible role of the *ncrg1*<sup>-</sup> and any other factors related to the virulence of the *Staphylococcus aureus* strain. (100 marks)



Inoculum (CFU/mL)	$10^3$	$10^4$	$10^5$	$10^6$	$10^7$	$10^8$	$10^9$	$10^{10}$
<i>ncrg1</i> <sup>-</sup>	-	-	-	-	-	+	+	+
Wild-type	-	-	-	-	-	+	+	+

(+) sepsis positive, (-) sepsis negative

2. A vaccine manufacturer is considering producing a live attenuated whole-cell vaccine for *Listeria monocytogenes*. Two teams of scientists within the organization have put forward plans to develop vaccine candidates by genetically engineering a non-pathogenic *Listeria monocytogenes* by deleting virulence genes. One team of scientists advocate for deleting only the gene encoding for internalin. The rival team proposes deleting genes encoding for internalin, listerolysin O (LLO), and actin polymerization. Discuss these two approaches and their advantages and disadvantages. (100 marks)
  
3. Explain how  $\beta$ -lactam antibiotics differ in their mode of action from aminoglycosides and why they are preferred over aminoglycosides in treating bacterial infections? (100 marks)
  
4. A patient with a clinical picture of *Staphylococcus* food poisoning was presented to a hospital. Following appropriate and timely antibiotic treatment, the patient fully recovered. Serum antibody tests for the *Staphylococcus* infection during the first 7 days were negative, but later confirmed positive. However, blood culture results were negative during the entire course of the infection. Explain the basis for the disparity between the laboratory tests. (100 marks)

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