

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Please read the following paragraph and answer questions 1 to 5

The SecA2 secretion system of Gram-positive bacteria promotes the export of virulence proteins essential for colonization of the host in the case of both *Mycobacterium tuberculosis* and *Listeria monocytogenes*, two intracellular bacteria causing diseases in humans. This secretion system is also linked to the onset of long-term CD8⁺ T cell-mediated protective immunity in mice. To test whether SecA2 may be required for promoting the differentiation of CCL3⁺ memory CD8⁺ T cells, a stable *L. monocytogenes* chromosomal mutant that expressed a SecA2 ATPase bearing a mutated nucleotide binding site (NBS) was generated. Similarly to a SecA2 deletion mutant, the NBS mutant exhibited rough colonies, a bacterial chaining phenotype, and impaired protein secretion profile and *in vivo* virulence in comparison to wild-type (wt) *L. monocytogenes*. Importantly, mice immunized with the SecA2 NBS mutant were not protected against secondary infection with wt *L. monocytogenes* and did not develop CCL3⁺ memory CD8⁺ T cells. NBS mutant and wt SecA2 proteins were expressed to comparable extents by bacteria, suggesting that SecA2 itself is unlikely to promote the induction of these cells. Rather, one or several of the SecA2 substrate proteins released inside the cytosol of infected cells may be involved. (modified from Rahmoun et al, 2011)

1. Explain the differences between the cell wall of Gram-positive and Gram-negative bacteria. Be sure to include how to carry out Gram-staining. (10%)
2. In addition to SecA2, there are many other types of secretion systems found in bacteria and most are important for bacterial virulence. Describe 1 type of secretion system in detail. (10%)
3. Both *Mycobacterium tuberculosis* and *Listeria monocytogenes* are well studied human pathogens. Please choose one and describe its morphology and virulence characteristics. (10%)
4. Describe the experimental evidence provided within the text that suggests one or several of SecA substrates, rather than SecA itself, may be involved in the induction of CCL3⁺ memory CD8⁺ T cells. (10%)
5. Design and describe an experiment to identify SecA secreted proteins responsible for such induction. (10%)

背面還有題目，請繼續作答。

系所組別：微生物及免疫學研究所甲、丁組

考試科目：微生物學

考試日期：0223，節次：2

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6. What are antigenic drift and antigenic shift of influenza virus? (5%)
7. Compare the major characteristics between DNA and RNA tumor viruses, including mechanisms of transformation. (10%)
8. Describe potential mechanisms of viral immunopathogenesis. List one virus for each mechanism. (10%)
9. Describe laboratory methods for diagnosis of viral infections. List one virus for each method. (10%)
10. Although effective vaccines are available for both smallpox and polio, smallpox has been eradicated by a massive WHO campaign, whereas polio cases remain high in four endemic countries despite the efforts of long-running Global Polio Eradication Initiative. Please compare the properties of the two diseases and viruses to explain these situations. (15%)