

本試題是否可以計算機: 可使用, 不可使用 (請命題老師勾選)

Bacteriology section:

1. How can you determine how many kinds and the quantity of each kind of culturable and non-culturable bacteria in a sewage sample? (15%)
2. Describe the host defense mechanisms against bacterial infection and the bacterial strategies to overcome each of these defense mechanisms. (15%)

Read the following paragraph and answer the questions.

Streptococcus mutans, one of the primary etiologic agents of dental caries, possesses a two-component signal transduction system, VicRK, which regulates multiple virulence factors. The operon encoding VicRK contains a third gene, *vicX*. To characterize *vicX*, a nonpolar deletion mutation in the *vicX* coding region in *S. mutans* UA159 was isolated. The doubling time of this mutant was longer and that there was considerable sensitivity to paraquat-induced oxidative stress. Addition of paraquat to a culture of the wild-type strain significantly increased the expression of *vicX*, confirming the role of this gene in oxidative stress tolerance in *S. mutans*. The biofilms of the mutant seemed to be denser than that of the wild-type strain. Moreover, a sucrose-dependent adhesion assay performed using an *S. mutans* GS5-derived *vicX* null mutant demonstrated that the adhesiveness of this mutant was enhanced compared with that of the parent strain. Also, disruption of *vicX* reduced the genetic transformability of the mutant approximately 10-fold compared with that of the parent strain. Collectively, these findings provide insight into important phenotypes controlled by the *vicX* gene product that can impact *S. mutans* pathogenicity. (Modified from Senadheera MD, et al., J. Bacteriol., 2007, 189:1451-1458.)

3. Explain "nonpolar deletion mutation" (5%)
4. How may each of the VicX-mediated phenotypes mentioned in this paragraph be associated with the pathogenicity of *S. mutans*? (15%)

Virology section:

5. Both herpes simplex virus and hepatitis B virus are double-stranded DNA viruses. But the ways which they duplicate their DNA genomes during replication are very different. Please describe the replication of (a) herpes simplex virus and (b) hepatitis B virus in infected cells, and (c) compare the differences in the process of their DNA duplication. (20%)
6. If you suspect that a mouse gene, A, makes mice more susceptible to virus infection, please design two different approaches to prove it. (15%)
7. Oncogenic viruses transform and immortalize cells to induce tumors. Please describe at least two mechanisms used by oncogenic viruses to transform and immortalize cells. (15%)