

## Section 18-Solution key

1. Retinoblastoma is caused by the mutation in the retinoblastoma tumor suppressor gene. There are several mechanisms, which can cause a cell to lose its normal gene and thus be predisposed to develop into a tumor. These may result in a "loss of heterozygosity" or "LOH".

a) What do you mean by LOH? *Loss of heterozygosity.*

b) Many clinicians and scientists are currently trying to develop cancer treatments that are more specific and targeted than chemotherapy. If a patient had a tumor that was caused in part by mutations in Rb do you think it would be a good therapeutic decision to provide this cancer patient with a wild-type copy of the Rb gene?

*Yes, since mutations in the tumor suppressor genes are the loss-of-function mutations and providing a wild-type copy of the tumor suppressor gene would restore the cell to remain in its wild-type form.*

3. Why do some people think that viruses are alive and some people don't?

*They need the host cells to replicate otherwise they remain dormant. Therefore they are regarded as being at the borderline of living and non-living.*

4. Could you treat a viral infection by antibiotics (Yes/No)? Explain.

*No, antibiotics are used to treat bacterial infections. They do so by arresting bacterial growth (bacteriostatic) or kill the bacteria (bacteriocidal). Viruses replicate inside the eukaryotic cell, which are not targeted by antibiotics.*

5. What is the genetic material (DNA / RNA) in a plus and minus stranded virus? How does a plus stranded virus differ from a minus stranded virus?

*Both have RNA as their genetic material. A plus stranded RNA virus has the same polarity as the mRNA of the host cell in comparison to a minus stranded virus that has a genome with opposite polarity. It still needs to make its RNA polymerase using the host cell machinery. In comparison, the minus stranded RNA virus needs to bring its own RNA dependent RNA polymerase in the host cell at the time of infection.*

6. The following sequence is a short viral gene from a double-stranded DNA virus that actually encodes three different proteins. The sequence shown is from the transcription start site to the transcriptional end site. The upper strand of this gene is used as a template in transcription.

5'TACTCTATCGCTTTAGCGGTATGCTATCAGAGCCATGCATGCATC 3'  
3'ATGAGATAGCGAAATCGCCATACGATAGTCTCGGTACGTACGTAG 5'

a) How do you know that it is true that these three short proteins are not produced from alternative splicing of a single transcript?

*Alternative splicing does not occur in viruses.*

b) How many amino acids long would each of the three proteins be that are produced from this gene?

*The peptides produced will be 5, 11 and 7 amino acids long using the 1st, 2<sup>nd</sup> and 3<sup>rd</sup> open reading frames from the 5' end of the transcript.*

c) What is a major advantage for the virus to using this strategy?

*It can use the same transcript to produce different proteins and allowing it to use limited space more efficiently.*

d) What is a major disadvantage for the virus to using this strategy?

*A single mutation in one transcript influences not just one viral protein but may have an effect on all the viral proteins that are being made from the single transcript.*

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