MICB 306 Practice Questions

Q1: A new virus was isolated from the fountain near the Biological Sciences Building and the Chemistry Building. This virus is a non-enveloped virus and has a ssDNA genome. The new virus is peculiar in that it completes its entire replication cycle in the cytoplasm of susceptible cells.

What type of genes would you expect to find in its genome, and why?

Q2: What viral genome structures can be replicated entirely by the host replication machinery? Where in the cell does their replication occur?

Q3: A new virus was isolated from the reflecting ponds between the Biological Sciences Building and the Chemistry Building. After only a few weeks of study, this is what you already know:

1. the virus genome survives treatment with RNases, but not DNases
2. the virus genome is composed of 30% guanine and 30% cytosine
3. when the purified genome is electroporated into cultured cells, infectious virus particles are produced

a. What is the genome structure of this virus? How do you know?
b. How and where does the replication of viral nucleic acid occur? What is the source of the enzymes used to replicate the virus genome? How do you know?

Q4: Identification of virus receptors is important but not always straightforward.

Suppose we have a cell line that can be infected with the M&I virus. We think that this virus binds to the cell surface protein MICB306. How can we test this hypothesis in cell culture?

Q5: A new graduate student is studying the replication cycle of Picornaviruses. To gain a better understanding of the role of Vpg, she decides to make a genetically modified version of the virus and then study how this modification impacts the virus' replication cycle.

She first isolates genome of the Picornavirus and uses an RNA recombination technique to specifically delete only the part of the genome that encodes the VPg protein. An *in vitro* translation test shows that the RNA can still be translated on a ribosome to yield a polyprotein product that contains all of the proteins except for VPg. The modified genome is then electroporated into the cytoplasm of a permissive host cell. The electroporation step is used because it bypasses the need for packaging the genome in a capsid and infecting cells with virus particles.

List the events in the replication cycle that would occur in the Picornavirus with the modified genome.

Q6: How do viruses "recognize" and package the appropriate nucleic acid structure as their genome?

Q7: Herpesvirus is a DNA virus that replicates in the nucleus of the cell, but is independent of the cell's cycle. Parvovirus is also a DNA virus that replicates in the nucleus of the cell, but it is highly dependent on the cell's cycle. Discuss two examples of why they are so different.

Q8: Two students are studying how UBCV infects susceptible host cells. One believes the UBCV is endocytosed and that the virus releases its genome from the endosome. The other believes that the UBCV particles remains outside of the host cell and that the genome is released into the cell at the plasma membrane.

Design an experiment that you could ask the students to do to determine how the genome enters into the cytoplasm of the cell.

Q9: Why do single stranded genomes form secondary structures but not double stranded genomes? What types of secondary structures are there? What purpose do these structures have?

Q10: Molecular biologists describe the genomes of single stranded viruses as being either (+) sense or (–) sense. For an RNA virus, what does this mean?

Q11: Is the assembly and disassembly of virus particles simply reverse processes? Discuss your answer using an enveloped virus as an example.

Q12: The N protein of the rhabdovirus binds non-specifically to both the (–) and (+) RNA strands during genome replication. What type of molecular interactions would you expect to see here? Would they be the same for both the (–) and the (+) strands? Why would these interactions be important?

Q13: Compare and contrast the bidirectional (theta) and rolling circle (sigma) mechanisms of DNA synthesis employed by Herpesviruses during their replication cycle. How are they the same? How are they different?