**Virology – Biology 4310 Spring 2020**

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**Study questions for lecture 4: Structure of viruses**

1. What are the different functions of viral structural proteins?

Protect the viral genome; package the genome; interact with membranes; interact with receptors; allow uncoating (release) of genome; transport genome to correct place in cell

2. What is meant when we say that viral capsids are metastable? Why must they be metastable? How is this property achieved?

Metastable means they are both stable and unstable. Needed to allow stability during passage from host to host, and unstable to release genome. It is achieved by capsids in which the subunits are repeated and symmetric, leading to a stable capsid; and they are non-covalently bonded so they may come apart.

3. Distinguish among subunit, structural unit, capsid, nucleocapsid, envelope, and virion.

Subunit: single polypeptide; structural unit: unit from which the capsid/nucleocapsid are formed Capsid- protein shell surrounding genome Nucleocapsid- nucleic acid-protein subcomplex within the particle Envelope- cell derived lipid bilayer Virion- infectious virus particle

4. What are the two rules of symmetry by which virus particles are assembled? Give an example of a virus that is built with each type of symmetry.

Each subunit has ‘identical’ bonding contacts with neighboring subunits; bonding contacts are non-covalent, reversible. Helical symmetry: influenza virus, tobacco mosaic virus; icosahedral: poliovirus.

5. Know the principles of icosahedral symmetry as they apply to viral capsids: 20 equilateral triangles, 5-, 3-, and 2-fold axes of symmetry

An icosahedron is a solid with 20 triangular faces, 12 vertices related by 2- 3- and 5 fold axes of symmetry. Each face is an equilateral triangle. 5 triangles interact at the 12 vertices

6. What does the T number describe?

The number of subunits per structural unit

7. How is the simplest icosahedral capsid constructed?

The simplest icosahedral capsid is that of parvovirus, T=1. 60 copies of a single protein subunit, subunit = structural unit

8. If capsid proteins are not larger than 20-60 kDa, how do you make larger capsids? How do these capsids differ from smaller capsids?

Can make larger capsids by adding additional subunits, but the interactions between the subunits are not chemically the same as there are now pentamers and hexamers (=quasiequivalence)

9. What is the function of viral envelope proteins?

Viral envelope proteins are necessary for attachment and fusion of the virus particle with the cell, and they contain antigenic sites to which antibodies bind.