**Biochem COVID: Video Presentations and Critique Instructions**

* **Video Presentation**: Each group will be assigned one of the questions shown below. Your group will investigate and present the topic and answer the questions. In your assigned groups of three or four students, use the linked resources to research your questions. Start with these resources then if you need more information, search the web using reliable sites and information. Create a one or two slide presentation and record/post your presentation. (20 points)
* **Video Review**: Each student group will be assigned a second question to watch the video and critique for clarity, accuracy and general presentation. Each student will provide feedback individually using the topic thread on the Bb posting. (10 points)
* **Group Questions** - WITH YOUR GROUP review two of the most interesting questions that your group did not present or review/critique. Using just the student generated videos, answer each question in no more than 250 words. (20 points)

**HOW TO ALIGN PROTEIN SEQUENCES**: To align the primary amino acid sequence of proteins, use either the pre-supplied sequences in the resource link. You may be interested in expanding your comparisons. To do so, the simplest way is to click on the [UniProt](https://www.uniprot.org/align/) link to bring you to a program that includes protein sequence alignment called Clustal. The alignment requires you find the PROTEIN sequence (you can search in UniProt or NCBI) but make sure you have the protein and not nucleotide record ID number/sequence. Following the instructions in this [video](https://www.youtube.com/watch?v=IAYFLfPQ0Gs), you can use a FASTA sequence or other options to paste protein data for comparison. Not sure how to find the FASTA or other ways to do an alignment? Click [here](https://youtu.be/WbdsfkzaVqk) for a tutorial.

1. What are the different classifications of Coronaviruses (CoV)s and how do MERS, SARS fit into the CoV order? What is the difference in genetics and biochemistry of the four genera of Coronaviruses? Some social networking memes have recognized that Coronavirus has been around for a long time and suggest this is nothing new. How would you explain that COVID-19 is new and different?
2. Describe the genomic and protein (virion) structure of Coronavirus. Present the different roles for each of the structural, nonstructural and accessory proteins. See the other questions to avoid extensive overlap.
3. Are there sub-strains to the COVID-19 virus? If show where are they different and how might this difference impact the protein structure and function?
4. Compare the sequences of S, proteins between SARS-CoV, SARS-CoV2 and MERS-CoV (start by using the [“Nature” paper with S protein alignment](https://www.nature.com/articles/s41591-020-0820-9)). What are the conserved, semi-conserved and non-conserved amino acids?
5. How does the primary structure compare of E proteins for SARS-CoV, and MERS-CoV? What do these changes in the primary structure have to play on the function of the E protein? (there are links to the E protein already aligned in the resource list)
6. Describe the role of N proteins and investigate if they may be regulated by phosphorylation ([Fehr and Perlman 2015](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4369385/)), do you see possible mutations between MERS, SARS and COVID-19 that indicate changes which might impact how N protein binds viral DNA?
7. What is the role of the individual accessory proteins in determining the outcome of lethal SARS-CoV infection? Are the SARS-CoV accessory gene deletion mutants less virulent and if so, which accessory gene(s) is responsible for attenuation?
8. How is S protein post-translationally modified and does this modification impact the function of S protein? What are the domains or key regions of the S protein? How is the S protein involved in attacking the epithelial cell? Use this [Nature article](https://www.nature.com/articles/s41591-020-0820-9) to start.
9. What are the structural regions of S protein? Where are the mutations occurring at the S protein? How might this impact the structure and function of S protein? This [Nature article](https://www.nature.com/articles/s41591-020-0820-9) explains that the mutations are naturally occurring, how do they make their argument?
10. What is the role of the S protein in attachment and entry in the Coronavirus life cycle? Include changes to the structure of S protein during binding and uptake.
11. What is a peptidase (remember, always describe the kind of molecule, then the reaction or function of the biomolecule, THEN the role the biomolecule plays in biochemistry). Which viruses utilize a peptidase vs other receptors? SARS-CoV binds to an ACE2 protein. How does this relate to the clinical manifestation of respiratory infection by the virus? i.e. where the virus seems to infect humans aka route of infection?
12. M proteins play an important role in virion assembly and release. What is assembly and release? Are there mutations in the M protein that would enhance or decrease the ability of a virus to finish replication?
13. What are the different types of tests used to detect COVID-19 in patients? Can you describe how a PCR test detects a virus (hint – real time PCR) and what are the requirements to design a PCR Primer? What region of the virion is the target for these tests.
14. There are “molecular” and “serological” tests for COVID-19. What are differences? How do the serological tests work? Research an ELISA and compare that to how the two serological tests are performed. Can you find the accuracy on the serological tests?
15. What is the pathology of the virus? What causes the pneumonia like symptoms? Sometimes the post infection is called a cytokine storm. We also see hypoxia and other issues that cause mortality in some infected patients. What are these effects and how does the virus bring this about the hyper and sustained inflammatory response?
16. Some viruses are particularly lethal and difficult to generate a vaccine against as they rapidly mutate. How does the ability to mutate make these viruses more lethal and how do they “rapidly mutate”? Does SARS-CoV-2 have a proofreading polymerase? Is this proofreading function of a polymerase the same as seen in eukaryotic or prokaryotic cells? Can you compare and contrast this function?
17. This virus can frame shift. How is does “slipping” or the frame shifts differ from other viruses? How does this “slipping” occur on the molecular level and what is the impact the function of the virus?