COVID-19-Molecular Basis of Infection-ADAPTATION
Teaching Notes

By ***Didem Vardar-Ulu***

Boston University,
Department of Chemistry
590 Commonwealth Ave - Room 358A
Boston, MA 02215
e-mail: dvardar@bu.edu
phone: (617) 353-2553

Course Information
Department: **Chemistry**
Level: **Lower/Upper Undergraduate** (select one)
Course type: **Lab/Lecture/Both** (other, please describe) (select one)
Students: **Majors/Non-majors** (select one) **BOTH (Primarily science majors/ pre-med/ pre-health)**
Number of Students: **112**

Module Information
Original Module Name: **Molecular Basis of Infection**
Link to Original: https://qubeshub.org/qubesresources/publications/1919/1
[Adapted Module Name: (if applicable)
Link to Adapted Module]
Modified Module Name:
Files associated: **Student Worksheet, Answer Key, Grading Rubric**

Modification Learning Goals:
Following the completion of the module, the students should be able to:

- **retrieve protein sequences from public repositories**
- **search for similar protein sequences to a query sequence using open license software**
- **align and compare protein sequences using open license software**
- **use RCSB Protein Data Bank to retrieve structural information about proteins whose 3D structure is deposited in the databank**
- **explore molecular interactions by visualizing available 3D protein structures with freely available online tools**
- **explain the molecular basis of SARS CoV-2 infection through viral entry to the cell.**
- **explain the differences between SARS CoV-2 and SARS CoV interaction with the host cell at the molecular level and discuss their impact on infection**
- **propose alternative ways to social distancing to prevent infection based on a molecular understanding of virus entry to the cell**

Teaching Notes

(Think about what you would like to read about this activity if you came back to it in 2 years)

Suggestions for this section (not all required, and extras always welcome):

- What did you change and why?

This adaptation to the original case was made so that it could be used entirely in a flipped format (specific implementation was a take home final exam component for students who had completed "Molecular Basis of Sickle Cell Disease" case during the semester.

The major difference between this adaptation and the original case is in Part 3 where the students are asked to draw conclusions based on provided structural figures rather than required to create their own figures. In this adaptation the skills needed to navigate RCSB PDB site and use deposited structures to create visual stories are developed and used only in Part 2 allowing Part 3 to be also usable as an independent module for instructors who have introduced molecular visualization and literacy to their students through the study of structural papers.

Similarly it allows Part 3 of this adaptation to be used as an assessment tool rather than a part of the skill developing activity.

- How did the activity go?
    - What went well and why?

This adaptation was implemented as an oiptional take home final exam component. Students were given 4 days at the end of the students until their in-class exam time to complete the work. Students who opted to complete this work received 25% credit towards their final exam grade from this work with the 75% contribution from the timed class final. All students had completed the "Molecular Basis of Sickle Cell Disease" adaptation of the Nicholas's Story Case study earlier in the semester. About 30% of the students chose the molecular case take home final option. All received a grade that is equivalent or slightly higher than what they received in their timed final exam part with the quality of work trending similarly for most students. The most significant exception was a few students who clearly benefited from having more time and opportunity to integrate their learning to explain a given problem. They reported spending significantly more time on the case compared to some of their other peers producing a product similar in quality to some of the strongest students in the class. All students reported that they very much enjoyed the case study and the opportunity to work on a current problem as a part of their final during this pandemic impacted semester. They also noted that even though they knew it would take them significant amount of time to complete the case study, the time investment was still more than what they expected.

    - What went wrong and why?

Nothing.

- What was the prep like?
    - How much time went into prep?

Since this was a very targeted modification for a case study I co-authored the biggest prep time was to create good figures for students to use in Part 3 and developing the key and the rubric to enable others (teaching assistants) help with grading.

    - Did you have to do any prep (i.e. grow cultures, grow seeds, order supplies) ahead of implementation?

No

- Would you do this activity again?

Yes

    - What would you change in the future?

If I had time I could consider doing this as an in class activity for the entire class to teach the skills rather than all flipped take home exam.

- What do you wish you'd known before you ran the activity?
  Based on my observations and feedback from students for the "Molecular Basis of Sickle Cell Disease" Case study we coved as a class, I knew that different students needed a very different level of guidance to be able to successfully go through these molecular case studies and benefit in the intended level from the activity. Given that I was planning to use this case as a final exam, I knew going in that the success of the implementation relied heavily on giving the students an opportunity to opt in or out of the activity. Given that ~30% of the class opted in, but all the ones who did were satisfied with their investment supports that this optional approach was important for the successful implementation.
- Is there anything else you would like to make note of?
  See above/
- How does this activity fit in your overall course curriculum?

This adaptation was specifically design to parallel with a slight build up to the "Molecular Basis of Sickle Cell Disease" case covered earlier which was an adaptation made to perfectly fit the existing curriculum, using the textbook: Biochemistry: A Short Course by Tymoczko, Berg, and Stryer)

- In what ways, if any, did you modify your teaching practice with this activity?

N/A