Teaching Notes

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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/ prehealth) Number of Students: 112

Module Information

Original Module Name: Nicholas's Story Link to Original: <u>https://qubeshub.org/qubesresources/publications/1919/1</u> [Adapted Module Name: (if applicable) Link to Adapted Module] Molecular Basis for Sickle Cell Disease Modified Module Name: Files associated: Class Handouts, Post Activity Assessments (two separate versions), An in-class test, Keys and Grading Rubrics

Modification Learning Goals:

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

- retrieve protein sequences from public repositories
- obtain basic information about the protein sequences using open license software
- align and compare protein sequences using open license software
- predict secondary structure of proteins based on sequence 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 oxygen binding to hemoglobin and the structural changes associated with oxygen binding
- explain the molecular basis of sickle cell disease and the structural changes associated with the single point mutation underlying the sickle cell disease

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 to:

- 1. Directly complement the content covered in CH373 curriculum
 - 2. Allow a smaller facilitator to student ratio for the in-class activity by offering the in-class session on two consecutive time blocks each for half the student population. With this arrangement each session had 56 students (7 round tables of 8 students), guided by one instructor, one teaching assistant (graduate student), and one undergraduate assistant. Students were given a week prior to their arranged in-class activity time to complete the pre-work and four days after the completion of the in-class activity to complete and submit their post0class work. The in-class portion of the activity was carried out during the scheduled "exam block" time slot for the course that was 2 hr. long. The in-class test was delivered via TopHat test during the last 15 minutes of this time block.
 - 3. To ensure that all students came into the "in-class" portion of the activity with similar content and skill competencies (development of pre-class worksheet)
 - 4. To ensure that the in-class time (in-class worksheet) focused on competency areas where students were least familiar with (i.e. molecular literacy how to interpret structural information presented through figures to explain functional outcomes)
- 5. To create modular assessments that evaluated different levels of acquired competencies (in-class test: to evaluate immediate basic and intended direct outcomes as well as postclass assessment to evaluate the student's ability to apply what they have practiced in class to a related but new problem)
- How did the activity go?
 - What went well and why?

Overall the entire activity went very well. Students really enjoyed working through the case in teams of four, two teams per table and there was clear team work and productive information exchange among all team members. For the most part the facilitator to student ratio was satisfactory to ensure a smooth progress.

• What went wrong and why?

The most challenging part was the logistics of how to set up the in-class student product delivery system to encourage team work and individual accountability simultaneously without introducing further technical challenges and wasting time. We ended up using shared "google docs" where each team of four students populated and submitted one document which contained only the questions they needed to answer from the in-class worksheet. I wanted the team formation to happen in the class after students randomly sat at the round tables in the studio room. This became a really big problem as it required documents to be assigned shared student groups on the fly. It would definitely be better to pre assign teams to speed up the process.

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

Developing the materials took several days.

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

I had to arrange for the studio room I wanted to use for the activity and ensure that the timing of the activity, availability of the room and when the content was covered in lecture coincided as best as it could.

• Would you do this activity again?

Yes if I am given the same resources (room and additional undergrad assistant support)

• What would you change in the future?

Have specific instructions for the TA and UA who is helping me with the facilitation and a firmer outline of how to time each subsection of the activity to ensure that all teams progress at similar speeds.

• What do you wish you'd known before you ran the activity?

I was expecting a lot of the challenges going into the activity.

• Is there anything else you would like to make note of?

Although students really enjoyed this activity for many it is a lot and quite overwhelming due to so many different skills they are required to integrate and use at the same time. So if the structure of the course allows for it it would certainly be better to start introducing some of these skills from the start of the semester so that there are more "familiar" elements in the worksheets when students receive them for this case study.

How does this activity fit in your overall course curriculum?

This adaptation was specifically design to perfectly fit the curriculum, in fact I used it to replace the first half of the lecture I typically dedicate to covering the hemoglobin unit (Chapter 9 of Biochemistry: A Short Course by Tymoczko, Berg, and Stryer)

• In what ways, if any, did you modify your teaching practice with this activity? This activity was perfect for my preferred teaching practices which involved hands-on student centered activities. In this course due to the absence of a laboratory component I had always been looking for these kinds of activities to give my students these hands=on skills.