## Teaching Notes

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**Course Information**

Department: Biology

Level: **Lower Undergraduate**

Course type: **Lab/Lecture**

Students: **Majors**

Number of Students: 24

**Module Information**

Original Module Name: **13.2 How does blood carry oxygen?**

Files associated: (In-Class Worksheet #1, In-Class Worksheet #2, Take-home Assignment, Powerpoint Lecture Slides)

Modification Learning Goals:

* Describe cooperativity and how it produces an emergent property for hemoglobin.
* Use the Hill equation to quantify cooperative binding
* Predict how adaptations for living at high altitudes may alter the O2 binding affinity of hemoglobin
* Discuss the adaptations of high altitude living present in Tibetan and Andean populations
* Relate the process of natural selection to the adapation to high altitude living in the Tibetan population

**Teaching Notes**

* What did you change and why?

I created an in-class worksheet to accompany section 13.2 How does blood carry oxygen? in the Integrating Concepts in Biology eText. The worksheet focused on the cooperativity of hemoglobin as shown by the oxygen solubility curve, the Hill equation and the Hill plot. I did not include the latter part of the ICB section on the molecular structure of hemoglobin, as it would have deviated from the general focus of the course. I then extended the activity to a case study of adaptations to high altitude living, and as an introduction to evolution. Students were given a take-home assignment to accompany the first in-class worksheet which they submitted the following week.

* How did the activity go?
  + What went well and why?

The activity went well. Students completed the first in-class worksheet in groups and each group was actively engaged. I monitored the progress of the groups and periodically reviewed answers with the entire class. Students completed the second in-class worksheet during the next lecture. Most students were able to complete the take-home assignment on their own.

* + What went wrong and why?

The majority of groups required more direction than I had anticipated. To keep the activity to within the time slot, I had to provide groups with answers to some of the questions, whereas I had hoped groups would have figured out the answers on their own. I included the module on hemoglobin cooperativity after two lectures on the respiratory and circulatory system and then presented the case study on high altitude living which took up over four lectures. Given the pacing through the remainder of the course, the inclusion of section 13.2 felt like the respiratory and circulatory section was drawn out too long.

* What was the prep like?
  + How much time went into prep?

Once the worksheets and powerpoint slides were prepared, there was little prep aside from general photocopying and uploading of material to the classroom management system.

* Would you do this activity again?

Yes, I will certainly do this activity again. I felt that the students developed a much deeper understanding of hemoglobin cooperativity from working through the Hill equation and Hill Plot. This learning gain will serve the students well in upper-level courses. I liked how students could apply the knowledge gained from module 13.2 to the case study.

* + What would you change in the future?

I would require students to read the ICB section 13.2 prior to coming to class. The ICB etext was not the required text for the course, so many students did not read the section. I would either remove some sections of the case study or cover the content with the whole class to fit the case study in the class period.

* How does this activity fit in your overall course curriculum?

Since the ICB etext was not the text that was used for the course, the inclusion of the quantitative component did feel like an aside, however I felt that the students engaged with the material more than if I had glossed over the math.

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

Throughout the majority of the course, I used a classroom response system to engage students. For this activity, I used worksheets and had students work in groups on their own rather than respond to questions that I posed to the entire class.