CHEM-342 INTRODUCTION TO BIOCHEMISTRY
Assignment for Monday, 20 February 2012

Design an Undergraduate Laboratory Experiment Based on Stokes' Section 11

Imagine that you are writing a laboratory manual for an introductory biochemistry course and you have decided that an experiment described by Stokes (the second paragraph of Section 11) illustrates several fundamental chemistry concepts that students should learn about and know. The problem is that Stokes wrote about his work over a century ago. His archaic terminology and descriptions are difficult to understand and thus inappropriate for an introductory laboratory. Carefully reread the second paragraph of Section 11 in Stokes' paper and translate it into a three or four-page (double-spaced) introduction and procedure appropriate for manual in a modern undergraduate laboratory course. This assignment will be graded. (If you discover things you don't understand, add them to your list of learning issues.)

The purposes of this assignment are:

1. Most importantly, to demonstrate that you understand what Stokes did in terms of procedure and chemistry, but also.
2. To reflect on the style and objectives of undergraduate laboratory exercises you have experienced.
3. To reflect on what makes a laboratory exercise interesting and educationally useful to you.
4. To give you an opportunity to create a laboratory exercise that might be more interesting and thought provoking for students than the stereotypical "cookbook labs" that some students complain about.
5. To practice your writing skills.

You may want to consider the following:

1. What made Stokes interested in doing and reporting this work?
2. What basic chemical principles are illustrated in Section 11?
3. How is Stokes' work relevant to students today?
4. Are there any safety concerns?
5. What illustrations, diagrams, or chemical structures and equations might support your text?
6. Are there modern equipment and methods that should replace some used by Stokes?

Some format issues:

1. Give your experiment an appropriate, interesting title.
2. Include a short introduction that may draw on other parts of Stokes' paper, the background material provided, or anything that you think might provide relevance, context, and interest.
3. Try to make your directions as explicit as possible so that the experiment would be repeatable. (Alternatively, you could design your laboratory in a discovery mode in which the students have to figure some things out.)
4. If you find chemistry laboratory manuals dull, try to make your description and instructions *interesting* without detracting from the purpose of the experiment. Be creative within the confines of the assignment.
5. At this point, **concentrate on the *Introduction* and *Procedures*** and not on chemical interpretations. A list of criteria thought to be important for undergraduate laboratory experiments is attached.

Remember, people are more likely to understand and remember if they are required to observe and think about what they see and do.

Section 11 of Stokes' paper will be demonstrated in class on Monday based on a procedure developed in class after this assignment is turned in. After the demonstration, groups will have the opportunity to discuss the chemical interpretation of the observations.

MADCP[1] CRITERIA FOR SUCCESSFUL DISCOVERY/GUIDED INQUIRY EXPERIMENT

1. Begins with a conceptual question
2. Utilizes the scientific method
3. Tests hypotheses and/or answers questions
4. Uses data or observation before theoretical construction
5. Requires interpretation of data
6. Extracts trends and/or models results
7. Develops, rather than confirms, a concept as a result of exercises
8. Promotes active decision making (in certain contexts)
9. Involve minimal instructor input (in certain contexts)
10. Allows student design of experiments (in certain contexts)
11. Is designed so that students can get reliable data
12. Leads student to desired conclusion
13. Reinforces concept through application
14. Prior to experiment, outcome is known to instructor but not to student
15. Develops an appreciation of what is known and what remains unknown from appropriate questions during and/or after experiments
16. Keeps "background noise" to a minimum

A successful experiment need not meet all of the above criteria.

[1] Middle Atlantic Discovery Chemistry Project. This list distributed at the 10th Annual Meeting of MADCP at Franklin and Marshall College, 2 June 2003.

Portion of Stokes Section 11

This [the decomposition of cruorine and separation of hematin] *may be easily effected on a small scale by adding to the watery extract from blood-clots about an equal volume of ether, and then some glacial acetic acid, and gently mixing, but not violently shaking for fear of forming an emulsion. When enough acetic acid has been added, the acid ether rises charged with nearly the whole of the colouring matter, while the substance which caused the precipitate remains in the acid watery layer below. The acid ether solution shows in perfection the characteristic spectrum fig. 3. When most of the acid is washed out the substance falls, remaining in the ether near the common surface. If after removing the wash-water a solution, even a weak one, of ammonia or carbonate of soda be added, the colouring matter readily dissolves in the alkali.*

G. G. Stokes (1864)