

# CHEM-667 Biochemical Evolution

## Case Study/PBL Problem Assignment

This course is built around Case Study/PBL problems. This term assignment asks you to select and research a significant topic in biochemical evolution and write a case study problem based on your study. It should have an informative title, reflect substantive independent study, and present a thoughtful synthesis of the primary and secondary literature. A case study problem provides a pedagogical context for presenting and learning information. Because it requires a different presentation format, it necessitates an original synthesis. Creating an original synthesis presents formidable challenges for most students.

What is an **original synthesis**? Original syntheses often play with ideas, provide an informative overview of the subject, critique and evaluate research results, and generally display personal input. In other words, the “**voice**” of the author is evident throughout. Case studies can take many forms, but good ones have intrinsic general interest, tell a story, and often involve a current controversy or dilemma that requires a decision based on incomplete information. Pedagogically, they should involve higher order thinking skills (analysis, evaluation, and judgment), stimulate group discussion, and require collaborative effort.

Perhaps the best way to construct a case study problem is to consider what you have learned about your topic after a sustained study, decide what are the most important and interesting concepts for others to know, and then think about ways you could get your peers to discover, experience, and learn that information using a case study/PBL problem format. You don't have to cover everything you have learned, but you should be able to justify what you include or leave out. What would you want a student to remember five years after working through your case study?

Case studies need a **theme** to connect the different stages and provide a narrative flow; however, the narrative cannot overpower and distract from the content. Case studies are most effective if they are based on real events, observable phenomena, or situations. Creative approaches could include historical themes, relevant current events, illustrative objects, or in-class activities. Different topics lend themselves to different approaches. Appropriate illustrations (original or with cited sources) can stimulate interest.

A case study problem should be well-organized, clearly written, and have **at least** three stages ( $\leq 2$  pages each), i.e. enough to occupy a class for a week or more.

The written document should begin with an overview (**abstract**) of the case study problem that discusses the importance of the topic and puts it in a relevant context for a course in biochemical evolution. Many topics may be obscure but can be made interesting and relevant by the general principles illustrated. Sometimes articles in *Scientific American*, *Discover*, or other sources popular science writing can suggest approaches.

Following the introductory overview, each page/stage of the problem and its associated teaching notes (~2 pages each) should be presented successively. The **teaching notes** need to provide an overview and explain the kind of response expected for each page and include critical references.

It is often appropriate to give a sample of the kind of work you would expect from students. Relevant illustrations, graphs, and/or data are expected.

At least two stages of your case study need to involve **actual data** for analysis from the relevant literature. Ideally, these data should come from classic articles that provided new or critical insights in to the history of study on your topic. These sources of critical data that changed the field can often be identified as the oldest references cited in important review (secondary) articles.

The last stage should include an assignment that depends on the content and skill students should have gained. Among many possibilities, you might consider concept maps, applying and generalizing what was learned to a new situation, or a conceptual individual and group quiz for IFAT scratch-off format.

**References** should be cited in the format of *Biochemistry* or the *Journal of Biological Chemistry*, with the exception that it is often helpful to include titles for the articles. The references can be collected on one page at the end or associated with the teaching notes for particular stages. **Only** references actually accessed and cited in the problem text or teaching notes should be included.

**Two copies** of your case study problem will be due at the beginning of the class in which you are scheduled to make a 15 minute presentation on your topic. One copy will be graded and returned. I will keep the other as an archival copy. If you write a particularly good case study, I may ask for your electronic file so that I can make copies use it as an example for future classes. Also the best case study from juniors in the class likely will be nominated for a Rosenberry Undergraduate Writing Award. Late papers will be assigned lower grades (a  $\pm$  letter grade lost for each late day) and may preclude an "A" in the course!

The biology and human interest elements of a case study provide the "hook" to get students involved in working on a case study. Those elements need to be present for relevance, but should not be the sole focus. Remember, CHEM-667 is a biochemistry course, so do not neglect the biochemistry, i.e. structures, reactions, and molecular diagrams need to be illustrated. A check list of things I consider in grading case study problems is included on the next page. It may help in organizing and writing your paper.

Finally, familiarize yourself with the meaning of plagiarism and the University's policies on academic dishonesty. Your Case study problem should be your synthesis. Don't rely heavily on one or two secondary sources. Read and reference the original sources in your teaching notes.

## CHEM-667 Case Study Evaluation Questions

Because the format for a case study is different than for a term paper, the criteria for evaluation must also be different. Case studies used as problems in the course can be used as models for the format. Professor Clyde "Kipp" Herreid at SUNY Buffalo has a web site for *Case Studies in Science* that also can provide guidance. The following is a check list of questions that I use to evaluate the quality of a case study problem. Not all apply for particular cases and, depending on the audience and purpose intended, other questions would be important.

- Is the **Title** informative, appropriately creative, and/or does it provoke curiosity?
- Does the **Case Summary/Abstract** provide support for the problem structure and content and serve as a useful introduction to the case study?
- Has a **significant topic** in biochemical evolution been selected or has a specific topic been given general significance? (e.g. something worth learning and knowing)
- Has the case study been presented in an **interesting** or creative way? e.g. Does it tell a story? Involve a controversy? Or present a dilemma?
- Are the stages of the problem developed logically and clearly?
- Does the **first stage** draw and build on general knowledge and promote discussion?
- Are the prompting questions and **assignments** realistic? Open-ended?
- Do the questions and assignments **require group participation**? Involve thinking? And promote the use of resources beyond the text and the classroom?
- Does the problem represent an "**original synthesis**" in its identification and presentation of important subtopics represented by each stage?
- Does the problem exhibit an appreciation of the **experimental evidence** on which conclusions are based?
- Are significant **experimental data** (preferably from classic experiments) presented for student analysis in at least two stages?
- Is there a final assignment in which students display what they have learned and can do?
- Is the information presented **accurate**?
- Is the problem **well written**?
- Was the problem **proofread**?
- Are **illustrations** from the literature clear, instructive, appropriate, and properly cited? (Author-created illustrations are especially appreciated.)
- Are the **pedagogical objectives** described in the accompanying Teaching Notes well defined and appropriate?
- Are the **citations** up-to-date? Presented in a **standard format** including **full titles**?
- Do the references display a **thorough study** of the subject? e.g., Are any important references missed?
- Were at **least 10 primary references** used in the project? In particular, are classic articles on the topic included?
- Was the problem handed in **on time**?

**Bottom Line:** What is the pedagogical value of this problem? Could it replace a problem used in the course or be considered for publication?