

## CHEM-643 Intermediary Metabolism

### Case Study/PBL Problem Assignment

This course is built in part around Case Study/PBL problems. This term assignment asks you to select and research a significant topic in intermediary metabolism 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.

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 or situation. Creative approaches could include historical themes, relevant current events, chemical demonstrations, 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 four or five stages ( $\leq 2$  pages each). The presentation 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 intermediary metabolism. 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 compounds, pathways, and mechanisms need to be illustrated.

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 class the Friday after Thanksgiving Break. 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 the class likely will be nominated for a Rosenberry Undergraduate Writing Award. Late papers will be assigned lower grades (a ± 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-643 is a biochemistry course, so do not neglect the biochemistry, i.e. structures, reactions, and pathways need to be illustrated preferably in a figure you create using ChemDraw. 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-643 Case Study Evaluation Questions

- 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 intermediary metabolism 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 any non-original illustrations clear, instructive, and properly cited?
- Are chemical structures, reactions, and pathways presented in original figures?
- 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?

## Rubrics for Evaluating Case Study PBL Problems

	Author:	Problem Title:		
Criteria	Descriptors			
	3 (ideal)	2	1	
<b>Realism</b>	Based on an actual or fictionalized real-world situation linking topic to learner.	Contrived or contains unrealistic elements that decrease credibility.	Unrealistic, lacking relevant context.	
<b>Content</b>	Addresses significant conceptual issues; directly related to major content goals.	Encourages superficial rather than in-depth understanding concepts.	Relevance of topic peripheral or not apparent.	
<b>Engagement</b>	Stimulates discussion and inquiry through its relevance and presentation.	Generates limited or superficial discussion; provokes little curiosity.	Lacks a “hook”; obscure or pedantic presentation.	
<b>Complexity</b>	Appropriately challenging; group effort and cooperation required; some ambiguity appropriate; integrates multiple concepts.	Difficult but may encourage a “divide and conquer” approach. Concepts not well integrated.	Solution accessible to most students working alone; focused on single concept.	
<b>Resolution</b>	Open to multiple resolutions or multiple pathways to solution, depending on student assumptions and reasoned arguments.	Resolution is more obvious but allows reasonable opportunity for judgment and discussion.	One right answer is expected; limited opportunity for analysis and decision making.	
<b>Structure</b>	Progressive disclosure via multiple stages, builds on existing student knowledge.	Staging does not flow well; transition could be improved.	Too much or too little information provided at once; short cuts thinking/research.	
<b>Questions</b>	Limited in number, short, and open-ended; stimulate probing for deeper understanding.	Most are directive; preempt student-generated learning issues.	Lead to “yes-no” answers rather than thoughtful discussion.	
<b>Research</b>	Promotes substantive research using multiple resources.	Research limited to textbook material.	Limited necessity for research.	

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