# W2 Course Review Form

To complete this form, please type responses below. You will also need to provide supporting documents by adding them to the bottom of this application form or including them as attachments with your proposal.  Email your complete proposal, consisting of the following items, to the Writing Across the Curriculum Coordinator:

1. This W2 Course Review application
2. A syllabus draft that (at minimum) covers the policies, goals, and grade breakdown for the course
3. Documents that illustrate the writing pedagogy, including assignment prompts, grading rubrics, or lesson plans.

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When the Writing Advisory Council reviews your proposal, members will check for the following:

a. **Students are informed that the course is a W2**.  If you are proposing a course for the first time, this detail may be omitted. However, you should add the W2 attribute to the final syllabus once you have been approved for the designation.

b. **Students are informed that developing writing skills is a significant course goal**. The syllabus might articulate the significance of the W2 attribute, and should include something about “developing writing ability” stated globally or as a discrete communication skill in a list of course learning objectives.

c. The grade breakdown for the class shows that **at least 30% of the course grade is based on writing**. This is a requirement for all W2 courses, and students should complete an adequate quantity of writing of sufficient difficulty that they can reasonably be expected to improve their skills. Most writing should be completed by individual students working on their own, although other writing may be collaborative. For any group writing, please take care to show how individual students are assessed. Most W2 classes include a variety of assignments from at least two of the following categories in terms of student time/instructor expectations/weight of grade: low stakes (journals, blog entries, online posts, in-class writing); middle stakes (reading responses, summaries, bibliographies); and high stakes (research papers, final projects, formal presentations, multimedia projects, resumes).

d. Instruction in writing and writing assignments appear to be likely to help students develop their written communication skills. Best practice would be for writing to appear as a planned item for instruction, like other course content, indicated on the weekly or daily course schedule. It is required that all W2 courses include **a minimum of 15% of instructional time spent engaging students in activities that are likely to improve their writing**.

**Please Note: Faculty teaching W2 courses are strongly encouraged to select the IDEA goal about developing skills in written or oral communication as “important” or “essential.”**

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1. Instructor name: Elizabeth Pollock

   Instructor program/school: NAMS/Chemistry

   Course acronym, number, & title: CHEM3550, Advanced Biochemistry

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2. Fill out the table below to break down how at least 30% of the course grade is based on writing.

| Writing assignment | Total grade/stakes | Writing objectives |
| --- | --- | --- |
| Nominate a biochemist | 22% - high with medium stakes intermediate points | Effectively summarize biochemical literature from multiple primary sources.<br>Effectively explain biochemical data |
| Write a molecular case study | 22% - high with medium stakes intermediate points | Effectively engage readers through the use of a storyline<br>Effectively explain biochemical data<br>Effectively present and explain chemical structures and their importance in determining function. |

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3. Briefly explain your overall philosophy of teaching writing, and how that pedagogy is evident in your plan for this class. What specific writing skills do

you want students to acquire in this W2 course, and how will you facilitate these skills?

My philosophy for incorporating writing in science classes starts from the fact that everyone, regardless of their perceived career path, needs to be able to communicate ideas effectively to a range of audiences. Science majors too often deny this truth, seeing writing as a both a burden and a not particularly important skill. It is my responsibility to get my students to students to see the value of learning effective writing and use of the scientific literature.
There are two significant writing assignments in this course, both of which I have used before in either this course or another course. Both require that students read the scientific literature and put current scientific knowledge into context and explain it at a level that a chemist outside the direct field of study would be able to understand.

By the end of this course, they should be better at:
Applying disciplinary genre conventions
Synthesizing information from multiple sources
Analyzing data
Writing effective introductions/conclusions
Integrating visuals

Time will be spent in class discussing effective writing, students will also be required to meet with me to go over their drafts before final submission to discuss strengths and weaknesses in their writing. Time for peer feedback will also be provided.

4. In a W2 course, at least 15% of in-class instructional time should be spent on activities meant to improve students' writing skills. Briefly outline the main writing activities for the course under review. For example, how will you utilize scaffolded writing assignments, essay drafts, paper modeling, in-class workshops, and/or peer review activities?

Assignment 1: Nominate a biochemist for an American Chemical Society Award. The assignment is scaffolded to keep students on track and help them use the scientific literature effectively. Students will present their chosen scientist to the class, providing an opportunity to get feedback prior to submitting a final written nomination file.

Assignment 2: Write a molecular case study: Students will first work through several published case studies, learning how such studies should be structured and what additional resources are available to create a robust biochemistry case study that links specifically to the core goals of this assignment – becoming comfortable using the tools of molecular visualization and explaining the link between macromolecular structure and biochemical function. Working with a partner, they will then write a case study of their own on a protein of their choosing. Students will work through a case study being written by peers, providing feedback to classmates, and getting feedback in return.

I don't have a daily, or even weekly, syllabus for this course. The time on each topic is driven largely by student engagement. A daily topic syllabus implies a rigidity in timing that is not appropriate for this course. This will also be the first time offering the course in a hybrid format, leaving me unsure exactly how long any given topic will take. One lecture day early in the semester will be devoted to discussing writing but much of the time for instructing on writing will happen outside of class, through required meetings with me.

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5. Explain your method for grading student writing. Do you utilize rubrics? What are the main things you look for as you grade or comment on student compositions? How and when will you provide students with this feedback?

I am not a big fan of rubrics, which too often become checklists and prevent a holistic assessment. I do provide detailed assignment guidelines. I look for effective and appropriate grammatical style, the degree to which the writing explains and provides context for data presented.

Both major assignments have several checkpoints at which students will get feedback. One goal of both assignments is to let students explore biochemistry beyond the small portion of the field we can cover in our classes. That can quickly go off the rails, with students choosing topics that are not really biochemistry in focus. Therefore, projects start with students getting the choice of topic approved by me early in the semester. Additional points of intermediate feedback are built into both assignments, though the specifics vary. See the assignment descriptions for specifics.

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6. Which source citation style will you ask students to use in this class? Do you plan to provide instruction in using these specific citation guidelines? Yes
   Other: American Chemical Society

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7. **Optional.** Please note any other information the Advisory Council might find useful.

The molecular case study assignment was developed in collaboration with colleagues at other institutions and has recently been accepted for publication in the journal *Biochemistry and Molecular Biology Education*. Students will have the opportunity to submit their written case studies for publication on the Molecular Case study educational resource site. The rubric provided to my students for completing this assignment is the same as that faculty wishing to submit a case study to the site.

# *Advanced Biochemistry – CHEM 3550*

Office: USC215 Phone: 3573
e-mail: elizabeth.pollock@stockton.edu
Office hours: TBD

Course Overview:
Advanced Biochemistry will look at biochemical processes in significantly more depth than presented in the first semester biochemistry course. Topics will include aspects of metabolism, expanding upon your first semester knowledge of carbohydrates into lipid and protein metabolism, as well as topics in physical biochemistry, such as a more in-depth understanding of the kinetics and thermodynamics of biochemical processes. Time is also set aside to allow you to learn about an area of the field that you find particularly exciting.

You will be expected to actively engage in the material through guided-inquiry exercises, case studies, reading the primary literature and in-class discussions. This class is a hybrid course, with in-class discussions occurring on Monday and Wednesday. We will not meet synchronously on Fridays. Instead, you will be given time to watch lecture videos, work through more complicated data analysis for discussion in class the following Monday and for individual meetings with me on the writing assignments.

Success in this course requires that you come to class having begun the learning process on your own and engage with the material regularly. Deep, long-term learning cannot occur if you engage with concepts only when studying for an exam, or attempting to write a paper that requires synthesizing the literature the night before the paper is due. Learning requires a commitment of intellect and regular time on task.

Prerequisites:
CHEM 3250 – Biochemistry, with a C or better

Essential Learning Outcomes most relevant to this course:
*Program competence* – the ability to use and integrate the concepts and theories of biochemistry
*Information Literacy and Research Skills* – the ability to locate, evaluate, analyze and use information to solve problems or to produce an argument.
*Communication Skills* – The ability to share knowledge effectively through writing.
*Teamwork and Collaboration* – The ability to join with others to achieve a common goal.

Text:
There is no specific textbook required but having a current biochemistry textbook is *highly* recommended. Some recommendations include:
Fundamentals of Biochemistry by Voet, Voet and Pratt, 5th edition (the text for CHEM3250)
Lehninger's Principles of Biochemistry by Nelson and Cox, 6th edition
Any other comprehensive biochemistry text is also acceptable.

Additional resources:

Gone are the days when professors needed to lecture in order for students to see the dense content of a textbook presented orally and succinctly. There are a number of on-line lectures available for much of the content of this course, allowing us the freedom to move beyond passive lecture and rote memorization. Of particular use is the Khan Academy, particularly the MCAT – Biomolecules section, especially the later lectures on bioenergetics and metabolism. If you would benefit from a refresher on some chemistry content, the chemical processes of the MCAT section may also be of interest. The Biology section of Khan academy also has a section on cellular respiration.
https://www.khanacademy.org/science/mcat/biomolecules

Note that I have not watched all of the above lectures in their entirety and their inclusion here is not an endorsement of any of them. Some of the Khan Academy lectures will not apply and much of the material will not be discussed in these videos. They serve as useful introductions to the material but cannot serve as a replacement for engagement in class.

Course Grade:

Your final grade is determined by your ability to demonstrate proficiency in biochemistry through the exams and critical analysis of the primary literature. *There is no extra credit available*. There will be two exams, worth 23% each, homework throughout the semester worth 10% combined, and two literature-based assignments worth 22% each. Any material from class or readings may be covered on an exam. Information on the primary literature assignment and case studies will be provided separately.

Tentative exam dates:

Web and e-mail:

Course material will be available through Blackboard. Please use my Stockton e-mail address rather than sending me e-mail through BlackBoard. I rarely check the BlackBoard system in the evenings; you are likely to receive a response much more promptly through the regular e-mail system. Any e-mail I send to the class will be sent to your Stockton accounts only. I will reply to e-mails sent from non-Stockton accounts.

Late assignment and exam make-up policy:

Late homework will not be accepted. Missed deadlines within the literature assignments will be docked 20% of the grade for that portion for each day or partial day that they are late, starting from the time at which the assignment was due. I must be notified before a scheduled exam or presentation if you must be absent. Students with extenuating circumstances, as defined by University policy, who miss an exam must schedule a make-up exam to be given within one week of the original exam date. I reserve the right to refuse to offer a make-up exam if I do not deem the circumstances for missing the exam sufficient and official written documentation explaining the reason for your absence is not provided in a timely manner.

# ACS Division of Biological Chemistry Awards Nomination Project

The intent of this project is to provide you with the opportunity for an in-depth exploration of an area of biochemistry of your choice by writing a letter of nomination for a candidate for an ACS award, specifically the Eli Lilly Award in Biological Chemistry. Through the completion of this assignment, you will increase your competency in researching and reading the primary literature, mastering content outside of a textbook format, conducting critical analysis of a body of chemical research, scientific writing and oral presentation skills. Your nomination letter should be no less than five full pages, excluding figures or references. Note that it is highly unlikely that a five-page paper will contain sufficient detail to earn an A or B. This assignment consists of several parts, detailed below.

**Identify a biochemist** – in order to write a nomination letter, you will first need to review the literature to identify an appropriate individual. Winners of these awards are highly respected and productive biochemists. Suitable candidates will have published extensively in high impact journals. An incomplete list of such journals is given separately. Deciding upon an appropriate candidate can be approached in many ways. Reading over the author index of appropriate journals will introduce you to productive biochemists working on a wide variety of topics. Alternatively, you could browse recent review articles in areas of biochemistry of particular interest in order to learn who is working in that area of research. I do not recommend a simple search in a scientific database based upon a topic of interest, though such an approach is often useful. It is difficult, however, to phrase a search in such a way as to limit your results to biochemists and you are likely to be distracted by people working outside the scope of this assignment. Your nominee must be working in an area of biochemistry suitable for this award – i.e. doing *in vitro,* not *in vivo,* work in biological chemistry. Clinical biochemists are not appropriate for this assignment. You may not nominate previous winners of the Eli Lilly, Pfizer or Repligen awards. Lists of previous winners and nominees for these awards can be found on Blackboard.

You must confirm the appropriateness of your choice with me, with a one-paragraph explanation of your choice due no later than February 11. Failure to receive confirmation of a suitable candidate by the deadline will result in a 5% deduction from the overall grade for the nomination project.

**Annotated bibliography** – Perform a comprehensive search of the chemical literature in order to develop a basic understanding of the scope of your candidate's research. You will likely also need to read biochemical texts and other sources in order to fully understand the research presented in the papers you find. You may also need to consult with me for clarification on some of the ideas presented in your nominee's work. After reviewing the research your nominee has done over the course of his or her career, identify 7-10 papers that are likely to be used in your nomination. Submit an annotated bibliography of these papers no later than February 28. If you have not done an annotated bibliography recently, remember that they include not simply the bibliographic information for each paper but also a brief paragraph summarizing the significant results described in the paper. The bibliography is worth 10% of the overall project grade.

**Meet with instructor to discuss –** You must schedule a meeting with me to discuss your nominee. Items to bring to this meeting: an outline of the key scientific discoveries you plan to discuss, a minimum of two figures from your nominee's published work that you expect to use to highlight their science. Meetings will be schedule for the week of February 28$^{th}$.

**Presentation of your nominee to the class** – On March 11 you will give a 10-minute oral presentation that will introduce your nominee to the class. A PowerPoint presentation is appropriate here. Your presentation should provide a brief biography of your candidate as well as a summary with some explanation of the key biochemical insights that have come out of your candidate's research lab. You should consult with me as you prepare your presentation. Slides are due to me no later than 6 p.m. the night before your presentation. This presentation is worth 15% of the overall project grade. Failure to attend and engage with your colleagues during their presentations will result in a 10% deduction of the *overall* project grade.

**Complete paper** – The complete paper is due no later than 5:00 pm April 29. The paper will be evaluated on the clarity and completeness with which you present the science behind the work and the significance of your nominee's contribution to furthering our understanding of biochemistry. A one-page abstract of the paper should be turned in with the final draft. The final draft is worth 75% of the overall project grade.

## Overall project goal:

Make a clear link between the structure and function of a protein that plays a critical role for a specific biological function.

## How does this project fit in with biochemistry curricular goals?

Through this project you will have the opportunity to:
1. Apply foundational knowledge about the identity, structure, and function of a protein related to a topic of special interest to you.
2. Find and interpret scientific literature and/or biochemical data related to your protein or system of interest.
3. Study examples of how similar biochemical principles are applied to solve a diverse set of biological and biomedical problems.

## Steps for authoring molecular case study:

### A. Molecular Case Study Examples

Complete and/or critically review a published or late-stage draft of an example molecular case study (MCS). Share your experience with your peers on the available discussion board where you can ask questions, critique what was done well, what should be improved, and what you learned from the way these cases are written.

### B. Project Proposal

1. **Review scientific literature:** Select a biological system of interest or learn about the biological system you are assigned for your case development.

2. **Identify case context:** Outline the specific scientific question(s) you would like to answer within this biological system and identify the protein players that are involved in the chosen biological context.

3. **Identify relevant PDB structures:** Perform preliminary search in the Protein Data Bank (PDB, www.rcsb.org) to determine if adequate structural information is available for the proteins identified in the previous step and determine the main protein structure you want to build your case around.
    - **Explore the PDB**. Look at all the relevant structures for the protein of interest. Which one(s) would be most valuable in answering the functional question at hand? What are additional structures that can be compared/contrasted to the original structure to make a point?

*Consider:*
- What do you want your audience to learn from the 3D structure that cannot be learned by looking at its primary sequence alone?
- Should the audience be able to describe the structural method(s) used to solve the structure so that they can discuss and/or report the strengths and limitations of the method?
- Referencing the paper where the structure was originally published, why did the authors seek the 3D structure? What questions were they trying to answer?
- What are some of the interesting/unique features and spatial organization of the protein molecule (such as domains, motifs, secondary structures, etc) that are relevant to the function investigated?
- What is the quality of the structure? (Examine validation reports where possible)
- What unique information could be obtained or hypothesized about the protein based on the deposited structural information?
- Are there other forms of your protein for which there are additional PDB structures available (e.g., from other species?

- Are there any 3D structures available where the protein is bound to a binding partner (e.g., another protein, nucleic acid, ligands, or drugs) or has mutations?
- Is a comparison of multiple structures helpful?
- What functional state(s) is/are affiliated with the protein, and what leads to this state?
- Are there specific published examples describing these altered states?
- How can examination of the 3D structure of the protein clarify its role in altered functional states?
- How can you lead others through the structure to look and understand it at an amino acid molecular level and draw structural and functional conclusions?

4. **Explore other bioinformatics resources:** Expand your structural search into online databases and tools beyond PDB to supplement your story line. MolCaseNet provides resources to introduce the instructor and student to a variety of resources here. Consider databases that reference DNA/RNA sequences and protein sequences/structures:
   - Gene Sequences: **NCBI Genbank**: https://www.ncbi.nlm.nih.gov/genbank/
   - Protein Sequences: **UniProt**: https://www.uniprot.org/
   - Protein secondary structure prediction **JPred**: https://www.compbio.dundee.ac.uk/jpred
   - Protein family annotations (functions, domains etc.) **Pfam**: http://pfam.xfam.org
   - Metabolic/signaling pathways **KEGG PATHWAY**: https://www.genome.jp/kegg/pathway.html
   - Comparing protein/nucleic acids sequences **BLAST**: https://blast.ncbi.nlm.nih.gov/Blast.cgi
   - Comparing protein sequences **CLUSTAL Omega**: https://www.ebi.ac.uk/Tools/msa/clustalo etc.

*Consider:*

- What can be learned quickly/easily from the primary and/or secondary structure of proteins, and what cannot?
- How can you use the DNA or RNA sequences to learn more about the wild-type or a mutant protein?
- Are there proteins with related/redundant functions? Is your protein part of a metabolic pathway? Signaling pathway? Multi-protein complex?
- How conserved is the protein across species? Does it make sense to do a multi-species alignment in CLUSTAL OMEGA? What can you learn from such an analysis?

5. **Justify choices:** The justification should be supported by primary literature and/or supporting experimental data for the claimed link between the structure and function of the central protein of interest. The structure(s) and bioinformatics data selected should help address the problem or answer questions in the case.

6. **Receive mentor approval**

## C. Case writing

1. **Identify learning objectives:** All major projects should begin and end with the objective of the study. Your learning objectives should be appropriate for the specific audience you are targeting. Each of the sections of your case should have 2-3 learning objectives that all tie to one main overall learning goal for the case. Learning objectives should be matched to existing standards when possible. You can find a simple introduction to writing clear learning objectives in the resources here or by searching for "writing learning objectives" using a web browser of your choice:
   https://www.bu.edu/provost/planning-assessment/program-learning-outcomes-assessment/writing-learning-outcomes/

2. **Define the research problem:**

- **Function and altered function:** Identify a well-defined, specific function and a change in that function that is being investigated. Within the introduction section of the case, there should be a well-articulated question that clearly ties the hook to the investigated functional question. There should be a dedicated section in the case that delivers adequate biological and chemical background to explain the biological system at hand and help appreciate the importance of the question being investigated. Furthermore, this section should clearly describe all the important cellular players within the biological system, how they are related functionally with respect to each other, and how they individually or collectively impact the investigated function. The case should include several specific questions (and answers) about this section that assess the audience's understanding of the functional information related to the case.

- **Structure and altered structure:** There should be a minimal amount of structural information available in the PDB about the protein of interest and its altered form relevant to the functional change being investigated. A dedicated section in the case should deliver adequate background information, protein sequence or primary structure information, as well as specific molecular structural information about the central protein being investigated. This section should clearly describe the structural relationship between the central protein and its interacting partners within the investigated biological system. The case should include several specific questions (and answers) in this section to assess the audience's understanding of the structural information related to the case.

*Consider using literature or online bioinformatics tool to investigate:*

- What biological phenomenon is affiliated with your protein under normal and disease contexts?
- How/why was your protein named as it is?
- What are its substrates, ligands, reaction mechanisms, or binding partners?
- What organism does the protein structure you are exploring come from? How conserved is the protein across species?
- What are the physical stats of the protein (e.g., MW, pI, length of amino acid sequence)?
- How is your protein regulated in the cell? What are the post-translational modifications on the protein (if any), and what roles do they play in its function?

3. **Develop a creative/ engaging storyline:** A context for the molecule that is delivered in a non-scientific language aimed to capture the interest of the audience. This "hook," which can be in the form of an image, a short audio/video or written piece (such as a newspaper article or story), will constitute the introduction to the case and convey the biochemical question to be addressed in the study.

*Consider:*

- Who is your audience and what is the take home message you would like them to have after completing this case study?Are there YouTube videos (or home-made videos) or articles to get a reader hooked into your story?
- Are you going to create a fictional story line or can you use a real life example from a newspaper story or clinical publication?
- If you are developing a fictional storyline, is it scientifically plausible?
- Make sure that any images, videos, stories used for the case are appropriately attributed. All necessary permissions should be obtained if using any copyrighted materials.

4. **Write case and assessment questions:**

- **Decide the number of subsections/modules your case study will have. under each of the five mandatory MCS sections.** Each MCS needs to include the following five sections: Preparation (case context), getting to the structure(s), exploring the structure(s), modeling, and skill assessment. You can have multiple subdivisions or modules under each of these sections
- **List the literature data, bioinformatic tools, and PDB structures** you will use in each section to meet your stated objectives. You must explore molecular interactions within the protein as well as between the protein and a binding partner for the structure/function relation sections of the case.
- **Write the instructions** for how to obtain information.

*Consider:*

- Where and how will readers find information? How can you provide or help them obtain information?
- Some of your information should be described in embedded text, figures, or tables—keep the text short and sweet and custom tailor your figures/tables.
- Can you use some already-written instructions or a YouTube tutorial for finding specific details like a hydrogen bond or coloring an individual residue, etc?
- Are you asking students to do things in a logical order?

- **Write your case questions.** Each learning objective should be measured with 1-2 questions (assessments) to determine if students have met the objective.

<u>*Consider:*</u>
- After the student obtains the structure, what will they do to gain skills in understanding how to interpret the 3D image? (e.g., examine substrate/cofactor inhibitor binding, examine the interactions of a specific amino acid)
- How do your questions require the reader to demonstrate the link between molecular structure and function?
- Do you have variety in the kinds of questions you are asking and the ways in which the student can respond (e.g., by pasting an image, a multiple choice question, a brief essay)?
- Do your questions require the students to engage with the figures or structure, or can they just answer the questions without them (e.g., by reading the supporting literature)?
- Are the questions written with the prior knowledge of the audience in mind?

- **Create a key**. Each team member should read through the case study on their own, make tracked changes as errors are noticed, and answer every question. Then come together to create a single comprehensive key.

- **Write one additional assessment question (and the associated answer key)** that relates to the case study but requires a student to apply knowledge gained from working through the molecular case study to a slightly different scenario that requires molecular visualization to answer the question. This will be used as a post-test to measure student learning.

- **Format your Literature Cited** section at the end.
    - If referencing specific data or images, use the style of ACS journal *Biochemistry*.
    - A rigorously researched case study will have 5-10 citations.

    Example of citation in the text:
    Nitric oxide plays a critical role in inflammation[1].

    Example of Reference at the end of the document:

    [1]Coleman, J. W. (2001) Nitric oxide in immunity and inflammation. *Int. Immunopharmacol*. 1, 1397–1406.

**5. Get and give peer and mentor feedback:**

- **Work as a team to sort out uncertainties.** One of the big advantages to working together is that your team members, who are familiar with your case, can spot inconsistencies/errors and help clarify or answer questions about the case being written. Create a shared working document so your team members and mentor can all access the changes. Use a "track changes/suggesting" feature to ensure that everyone can see what has been changed or contributed. The authorship of this document must be truly collaborative.

- **Touch base with your mentor regularly for small questions.** Insert comments and questions in the margin, and seek assistance when nobody on the team can sort out an answer within a reasonable timeframe. The more specific your questions are, the better (and likely quicker) your feedback will be.
    - Sometimes your mentor will give you additional help but NOT provide a direct answer. It is the team's responsibility to figure out answers, to research questions from the information provided--that's part of the challenge!
    - You may also seek assistance from another team if for example, you want feedback on whether or not your instructions make sense.

- **A formal peer review assignment** will provide an opportunity for you to receive feedback on your MCS as a whole. The guidelines for this review are provided separately at the end of this document. You will be graded on your ability to review another team's case (not on the quality of your own draft). To participate in the review, you must submit a full-length draft inclusive of all assigned parts (see above).

- When you receive your peer review, **you will submit your final MCS with a one-page cover letter** that responds to the questions/concerns presented in the reviews. This letter should describe (briefly) the type of peer feedback you received and highlight how you edited your MCS in response to recommendations/questions. If you disagreed with elements of the peer review, you must respectfully discuss and explain your viewpoint in this letter.

## Peer Review Assignment Questions

Enter brief (<200 word) responses to each question below for the molecular case study (MCS) you have been assigned. Type your general comments for the author here and electronically track shorter comments or brief recommendations on the paper itself. Both items will be turned in as evidence of your review. Save this document in a manner that your name is not included (to keep the peer review confidential).

MCS being reviewed (title, author):

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| |

## The Basics

Check that the length, font, margin, and other basic requirements are met; comment on any issues of structure/formatting. Also note if there are issues with grammar or spelling.

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| |

Discuss the title. Does it succinctly convey the main focus of the case study without giving too much away?

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Comment on the quality of the stated learning objectives.
-Are they stated clearly and succinctly?
-Do they represent a variety of levels in Bloom's Taxonomy?

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How well do the assigned questions align with the stated learning objectives?

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Does the storyline serve first and foremost to support the experimental question? Is sufficient introduction provided to help you understand the experimental question?

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Look at all of the headings. Are they specific, descriptive, succinct, and logical? If not, provide examples here for and suggestions for improvement.

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|---|
| |

Look up a paper in the journal *Cell*, and look specifically at the citation style at the end of it. Now look at the paper. Are there issues of formatting (indentations, spacing), capitalization, or other inconsistencies of style, either in the Reference section or in the in-text citations?

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## The Writing

Does this MCS sustain a single coherent point of view about the storyline throughout the case? Why or why not?

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How could the readability, clarity, or style of this MCS be improved? Comment briefly here on themes you noticed, but also provide extensive editorial notes on the paper directly as needed.

Provide one example of a section where the author's writing is far too "fluffy". Quote the section here, and on the paper, make extensive marks on how to condense or cut the writing into a more technical form without losing the meaning or content.

Identify all of the following: colloquialisms, informality, clichés, redundancy, and wordiness. Words to avoid include references to "research," "researchers," "scientist," "studies have shown…" etc. Instead, the case should point out which study, what experiment/observations show a particular phenomenon etc. Give a few examples of these problems in the box below with suggestions for improvement.

## The Scientific Content

Rate and discuss the strength of this MCS's experimental question and hypotheses explored. Comment on how the authors explore both the function of the wild type protein and altered function (mutation, ligand binding, etc.) Consider language, originality/creativity, scientific legitimacy/logic, justification, and placement within the storyline.

Does each part of the MCS logically progress from the former ones, or are there transitional leaps that are confusing?

Does the logic of this paper's experimental approach [choice of what to look for in the PDB structure and other bioinformatic technique(s)] ever read as incomplete or unsupported? Where? What might be done to correct this?

How smoothly does this MCS integrate specific data from primary literature into its storyline? Does it clearly illustrate connections between the evidence it cites and the ideas they support? Explain.

## Unique Elements of an MCS

Discuss the quality, use, creativity, and complexity of the figure(s) and legend(s). Is there any place that would have benefitted from an additional figure or table?

Try to answer the questions provided in the case study. Do you agree with the authors' key and is it complete? Are the questions clearly meeting the objectives stated, or do they feel like random questions? Do the questions being asked lead you forward in the storyline, or are they just latent observations?

Did the author correctly and clearly explain biochemical approaches where appropriate (not gratuitously)? Name at least one spot where the author should better describe the experimental approach taken.

Work through the molecular visualization part of the MCS. Were you able to obtain images of the structure as you believe the authors intended? Were the instructions clear? Explain.

Who do you see as the target audience for this molecular case study? Could it be completed by first-semester biology students? 300-level biochemists? Advanced students? Explain.

Does the additional assessment assignment logically connect to the initial MCS and assess skills a student should be learning in the course of completing the MCS? Explain.

# Molecular Case Study Rubric

**Instructions to Reviewer:** Rate each listed item as acceptable, requiring minor modifications, or requiring major modifications. For items requiring any modifications, please include specific concerns to be addressed by the author and suggestions for improvement. Note the alignment with introductory or advanced content as indicated by the author's stated design.

| ***Molecular Case Study*** **(MCS) Review Rubric Items** | **Accept-able** | **Minor Mod.** | **Major Mod.** | **Comments** |
|---|---|---|---|---|
| **Learning Objectives (measurable behaviors)** | | | | |
| **Biology**-related learning objectives are clearly stated | | | | |
| This element must be included in all molecular case studies, but the objectives will vary depending on biology subdiscipline (e.g., genetics, microbiology, botany, evolution, etc.) relevant to the case. | | | | |
| **Chemistry**-related learning objectives are clearly stated and minimally include: | | | | |
| Describe the overall shape and properties of the molecule(s) or domain(s) involved - globular, fibrillar, extracellular, etc. | | | | |
| Identify the nature of chemical interactions in a local environment e.g., hydrogen bonds, charge based in interactions (ionic bonds), hydrophobic etc. | | | | |
| Compare multiple differing structures and varying the nature of intermolecular interactions within the structure or with partner proteins/ligands | | | | |
| Create a figure using molecular visualization software to depict a specific element of a biomolecular structure. | | | | |
| **Bioinformatic** learning objectives minimally include the following: | | | | |
| ***Introductory:*** identify, compare, and discuss proteins with similar sequences | | | | |
| ***Advanced:*** use various biological data resources to gather information about the function, interactions, metabolic pathway relations, pathology etc. of the biomolecules of interest. | | | | |
| ***Advanced:*** use sequence analysis tools to analyze and make predictions related to the case | | | | |
| **Molecular visualization**-related learning objectives minimally provide instructions to use a molecular visualization tool to… | | | | |
| ***Introductory:*** relate DNA sequence to primary protein sequence and/or compare two primary protein sequences. | | | | Primary structure comments: |
| ***Introductory:*** identify N- and C- termini, specific primary or secondary structures, and/or motifs/domains within the context of the larger 3D structure | | | | Secondary structure comments: |
| ***Advanced:*** display & color secondary structures, N- and C- termini, specific primary or secondary structures, and/or motifs/domains, with different modes of visualization (space filling, ribbon, etc.) within the context of the larger 3D structure | | | | |
| ***Introductory:*** visualize the tertiary and/or quaternary structure of a specific PDB entry using a ready-made scene and/or provided instructions to find a specific PDB structure. | | | | Tertiary/quaternary structure comments: |
| ***Advanced:*** choose a representative 3D structure for exploration from provided instructions and visualize the tertiary and/or quaternary structure of a specific PDB entry using visualization software of choice (e.g., iCn3D, Mol*, Jmol, Chimera, PyMOL, etc.) | | | | |
| ***Introductory:*** create a figure and legend to depict protein structure | | | | |
| ***Advanced:*** locate one or more functionally relevant landmark features in the structure (transmembrane domains, post-translational mod., ligand-binding or active site, etc. | | | | |
| ***Introductory:*** locate one or more intermolecular interactions within the 3D structure e.g., hydrogen bonds, ionic bonds, hydrophobic patches, etc. | | | | Intermolecular forces comments: |
| ***Advanced:*** identify and measure one or more intermolecular interactions in the structure | | | | |

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| **Structure/function connection** learning objectives minimally include the following: | | | | |
| Use of a molecular visualization tool to connect atomic-level observations to explain a phenotype or treatment. | | | | |
| **Case Content, Storyline, and Scaffolds** | | | | |
| **Case context** | | | | |
| A story, video, article, image, and/or background information provides context and allows the instructor to evaluate the usefulness of the MCS to meet class objectives without referring to extensive outside sources. | | | | |
| Threading of the storyline throughout every part of the MCS. | | | | |
| A storyline that guides the student to answer the original scientific question(s). | | | | |
| **Finding and exploring structure(s)** | | | | |
| Adequate, level-appropriate instructions are included/referenced in the case to guide students in navigating the scientific literature or other reliable biological data resources to identify the molecule/complex relevant to the case being discussed. | | | | |
| Directions are included to help students identify correct structure(s) in the PDB to explore the case. These directions should vary according to the level at which the case is being implemented. If a structure of the specific protein/complex included in the case is not available, there should be directions to identify and use homologs/orthologs/paralogs. | | | | |
| Directions for exploring the structure(s) identified are included in the case (with reference to relevant tutorials/help documentations on the Molecular CaseNet Resources) | | | | |
| Specific, level appropriate directions are provided for examining and analyzing the molecules to answer questions in the case. | | | | |
| At least one or two questions where the students need to perform their own exploration and explicit step-by-step instructions are not provided. | | | | |
| **Modeling chemical structure in relation to biological function** | | | | |
| The specific analysis and comparisons of molecular structures and other experimental/observed data needed to answer questions in the case are clearly stated. | | | | |
| Prerequisite student knowledge and skills required for the students to successfully complete the MCS are clearly stated. Where appropriate, links to resources to learn these skills and gather relevant knowledge are specified. | | | | |
| **Assessment** | | | | |
| The case includes questions that assess student learning throughout the case study. | | | | |
| The questions align with learning objectives. | | | | |
| The questions are specific. | | | | |
| At least one question is provided for each stated learning objective. | | | | |
| A separate assessment is provided to measure student learning after the initial case study is complete. It should be provided as a separate file, be related to the original case, assess major learning objectives, and provide a new context for students to apply knowledge. | | | | |
| (Optional) The MCS includes references to resources that provide the instructor with additional background knowledge/reading and suggestions for posing questions that test student content knowledge and skills in molecular exploration, analysis, and synthesis of knowledge. | | | | |
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| **Supplemental Materials** | | | | |
| **Instructor's Notes file minimally includes well written content with a...** | | | | |
| brief background with scientific context; may reference a PowerPoint or other file | | | | |
| description of the MCS sufficient to enable the instructor to replicate the active learning delivery in their class in the same way as the authors taught it. This may include instructions, a "script" of what the instructor says/does, discussion prompts, typical student responses, instructional transitions, methods for selecting student groups, pacing, and/or optional modifications. | | | | |
| table recommending a reasonable timeline for implementing the MCS. | | | | |
| description of the case's relationship to issues of diversity/inclusion/equity, science and society, and/or social justice. | | | | |
| statement on active learning practices | | | | |
| list of references relevant to the above items | | | | |
| supporting materials contain original work from the author, or if it is from another source, proper permissions and attribution are noted. | | | | |
| **Answer Key** | | | | |
| Includes answers for all questions throughout the MCS and the additional assessment file | | | | |
| Answers are scientifically valid and appropriate for the intended level (intro or advanced) | | | | |
| **General items** | | | | |
| All sections of the MCS, including learning objectives, assessment questions/prompts, figures, and supporting materials, include relevant and accurate scientific content and appropriate vocabulary. | | | | |
| The title should be engaging so that students are drawn to the case. | | | | |
| The grammar and writing style are of high quality with no significant distractions, such as spelling or grammatical errors. | | | | |
| The questions are succinct and direct | | | | |