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 but objectives will vary depending on biology subdiscipline (e.g. genetics, microbiology, botany, evolution, etc.)				
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 e.g., 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.				
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. ***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, PyMOL, etc.)				
Introductory: identify N- and C- termini, specific primary or secondary structures, and/or motifs/domains within the context of the larger 3D structure ***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: locate one or more intermolecular interactions within the 3D structure e.g., hydrogen bonds, ionic bonds, hydrophobic patches, etc. ***Advanced:*** identify and measure one or more intermolecular interactions in the structure				
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.				
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.				

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 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				