Version: Dec. 2022

The following checklist is to be used to ensure that the Molecular Case Study (MCS) submission to Molecular CaseNet (MCN) is complete.

- Authors must complete the Yes/No columns and include any comments as appropriate. Please leave the MCN Approval column blank.
- MCN reviewers will complete the MCN approval column and where necessary provide additional feedback for the authors using the row number as a reference.

Checklist for Molecular CaseNet Submission

Checklist	Yes	No	Comments	MCN Approval
1. GENERAL				
a. The case should include the following **sections** ● Presentation of case context ● Getting to the structure(s) ● Exploring the structure(s) ● Connecting structure to function ● Assessing student learning (applying skills to new problems) Are all sections of the molecular case study (MCS) included in the submission?				
b. Title: Does the MCS have a clear, engaging title so that instructors and students are drawn to the case study?				
c. Abstract: Does the case study include an overall description of the MCS summarizing its contents?				
d. Original: Is this an original case (i.e., not published in MCN or any other casenet or other active learning resource)?				
e. Adaptation: Is this case inspired by (or based on) another published MCS? Is the other case linked to the previously published MCS?				
2. SUPPORTING MATERIALS				
a. Teaching Notes: Are teaching notes included in the MCS? Do they follow the MCN Teaching notes template? (Answer Yes/Yes; Yes/No; No/No etc.).				
b. References: Are citations to relevant scientific literature and links to data resources with information needed to complete the case, included in the case study?				
c. Answer keys: Are answer keys for all questions asked in the case study included in the MCS?				
d. Figures: Do the teaching notes and/or answer keys contain original or open-source figures, accompanied by target audience level appropriate explanations?				

e. Permissions: If the MCS includes any copyrighted images or data, are appropriate permissions for use of these materials included?				
f. Pilot testing: Does the case study include a summary of at least one classroom implementation of the case study in the teaching notes?				
3. CASE STUDY SECTIONS				
A. Presenting Case Context:				
a. Hook: This may be a story, video, article, image, audio recording etc., to engage audiences and provide a context for the MCS. It should be accessible from within the case materials and not require logging in to or referring to outside resources. Does the case study contain an engaging Hook?				
b. Background (Disciplinary): Does the MCS include background materials - e.g., slides, links to open access review articles, book chapters, or reliable web-resources to learn about key concepts and vocabulary needed to complete the case study?				
c. Preparation (Technical): Does the MCS include learning materials, worksheets (with answer keys) to prepare students so that they can easily navigate through the MCS relevant bioinformatics resources and molecular visualization tools?				
B. Getting to Structure(s):				
a. 3D structure IDs (directly related to MCS): Does the MCS include instructions (in the case and/or teaching notes) to help identify relevant 3D structure(s) in the PDB to explore the research problem?				
b. 3D structure IDs (indirectly related to MCS): If no 3D structure, directly relevant to the research problem is found, are there instructions to help identify structures of homologs from other organisms, related proteins, computed structure models?				
c. Relevance of 3D structure(s): Are there instructions to help assess the quality of the structures identified and their relevance to exploring the MCS research problem? In other words, ● What does the structure identified tell you about the research problem? ● How much can you rely on this information?				
C. Exploring the Structure(s):				
a. Molecular Visualization tool: Does the MCS present instructions to visualize the 3D structures identified in the Getting to Structure section using at least one visualization tool? (e.g., Mol*, iCn3D, PyMol, UCSF Chimera, JSmol)				
b. Explore Biomolecular Structure: Some common explorations include: ● Overall shape and size				

• Composition - is this a single monomeric protein, an oligomer, complex with various other proteins, small molecules/ligands? • Interactions - what are some key interactions at functionally important sites - interaction face, active or binding site etc. Does the MCS guide which aspects of the 3D structure to examine/explore?				
c. Independent Exploration: Does the MCS include at least one scenario that allows students to perform their own exploration without explicit step-by-step instructions.				
D. Connecting Structure and Function				
a. Integrating + Mapping information: Does the MCS include instructions to identify and map information from various Bioinformatics resources and scientific literature to the structure(s) being explored?				
b. Addressing the Research Problem: Does the MCS include at least one scenario that allows deeper exploration of functional implications of structure(s)? For answering questions in the case, this may involve: • specific analysis and comparisons of molecular structures, • use of experimental/observed data, clinical observations/analysis, • mutational studies				
E. Assessing Student Learning				
a. Connection to Course Curriculum (Optional): Does the MCS include one or more scenarios to assess students' ability to connect the case study to some aspect of the course curriculum - e.g., by answering questions in a quiz, participating in a discussion, or making a presentation about a topic that is related to the case-theme?				
b. Applying new knowledge/skills: Does the MCS include at least one scenario that allows deeper exploration of the molecule(s) and/or complex(es) being studied and provides opportunities to predict the functional implications of structure(s) being visualized/analyzed?				
4. LEARNING OBJECTIVES				
A. Please evaluate the MCS and identify which of the following **bioinformatics-related** learning objectives are included in the *Getting to Structure* and/or *Connecting structure to function*). Refer to the NIBLSE Bioinformatics Core Competencies as needed.				
a. Does the MCS use PDB data to answer one or more of the MCS questions?				
b. Does the MCS use various other biological data resources to gather information about the function, interactions, metabolic pathway relations, pathology etc. of the protein(s) of interest (e.g., UniProt, KEGG, Binding DB, DrugBank, Gene Ontology)? List which resources were used in the comments.				

c. Does the MCS include one or more opportunities to compare similar sequences and/or structures to identify and discuss protein properties and functions (e.g., conserved domains, motifs, functionally important amino acids)				
d. Does the MCS use open-source sequence analysis tools (e.g., BLAST, CLUSTALW) to analyze and /or make predictions related to the case.				
e. Are there any other NIBLSE Bioinformatics Core Competencies included in the MCS? List them in the comments.				
B. Please evaluate the MCS and identify which of the following **molecular visualization-related** learning objectives are included in the *Getting to Structure* and/or *Connecting structure to function*). Refer to the BioMolViz Framework as needed **Note:** An MCS designed for intro level students, should include at least three of these objectives, while cases for Advanced level students should include at least five objectives.				
a. Does the MCS provide opportunities to independently identify one or more case-relevant 3D structure(s) in the RCSB PDB (may include experimental structure or CSM)?				
b. Does the MCS provide opportunities to explore and learn about at least one 3D structure from the PDB - either experimental structure or Computed Structure Models (CSM)?				
c. Does the MCS provide opportunities to load coordinates of a specific structure (using a give PDB ID) to a visualization tool of choice (e.g., Mol*, iCn3D, UCSF Chimera, PyMol, JsMol) to display its structure?				
c. Does the MCS include opportunities to describe the overall shape, components, and organization of the protein/complex being explored?				
d. Does the MCS include opportunities to display suitable renderings of the molecule/complex (e.g., surface, cartoon/ribbon, spacefill, sticks) for visualizing, analyzing, and answering the MCS question/observations?				
e. Does the MCS relate protein sequence and structure to ○ Identify N- and C-termini (e.g., show in rainbow color scheme) ○ Color by secondary structure ○ Locate specific functionally relevant landmark features in the structure (e.g., transmembrane domains, post-translational modifications., ligand-binding or active site, conserved domains) in the context of the full structure ?				
f. Does the MCS include analysis of structures - i.e., measure distances, angles etc. ?				
g. Does the MCS include opportunities to compare structures – superposition, pairwise structure alignment based on sequence or structure?				

h. Does the MCS relate protein structure and function – i.e., connect atomic-level observations to explain a phenotype and/or process?				
i. Are there any other BioMolViz Framework learning objectives included in the MCS? List them in the comments.				

MCN Reviewer Feedback
