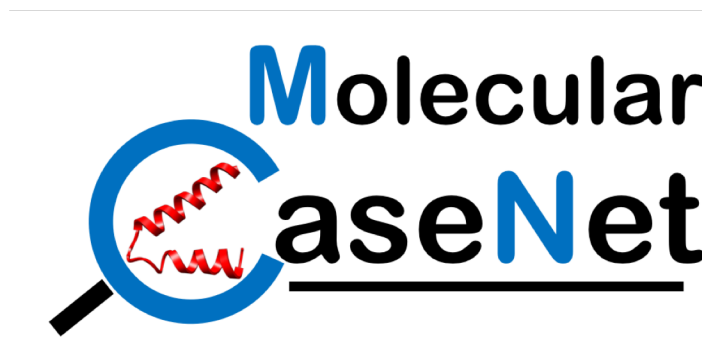# Writing
Molecular Case Studies

Shuchismita Dutta, Ph.D.

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Overview

1. Select topic (Subject/Learning Objectives)

2. Introduction (Hook)

3. Getting to structure (Literature review and Bioinformatics)

4. Molecular Explorations: (Visualization/Analysis → Synthesis)

5. Assessment

Select topic

- What subject are you teaching?

- What are your subject specific learning objectives?

- Are there any cross-cutting principles and scientific practices that can be included in the case study discussions?

- What is the curricular setting – class size, level, time available etc.

- Are there multiple subject learning objectives, curricular levels at which this case can be taught?

- Are there related cases that can be taught/used for assessment?

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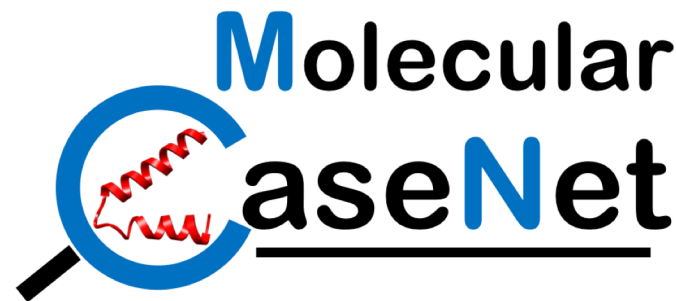
Introduction

- How did you find out about this problem/process?
  - Read article
  - Saw video
  - Personal/shared experience
- What made this problem interesting/relevant?
- Is there an engaging way to present this problem/process/question?
- Are these engaging video, news article, picture available freely (i.e. without any subscription, copyright infringement etc.?
- Is the video/article etc. short enough to be used in a classroom setting and/or as homework assignment?

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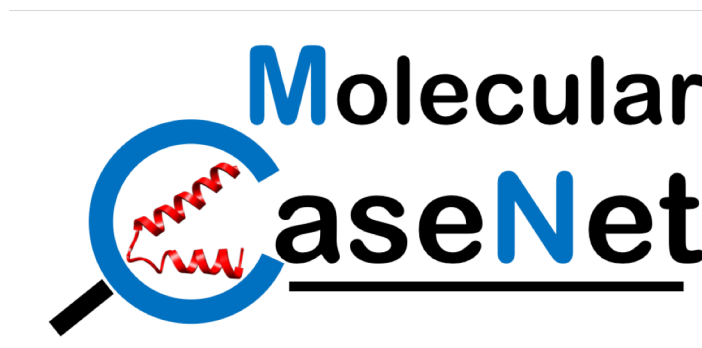
Getting to Structure

- What is the phenomenon/process being studied? Read Literature
- Who (what molecules) are the key players? Read Literature
- What are their roles in the process? Read Literature
- What molecules (specifically which parts of these molecules) should be explored to address the problem/question? Explore bioinformatics resources
- What else can you learn about this/these molecule(s) from bioinformatics resource? Explore bioinformatics resources
- Are the structures of these molecules available? Identify these structures. Visualization, Analysis, Synthesis

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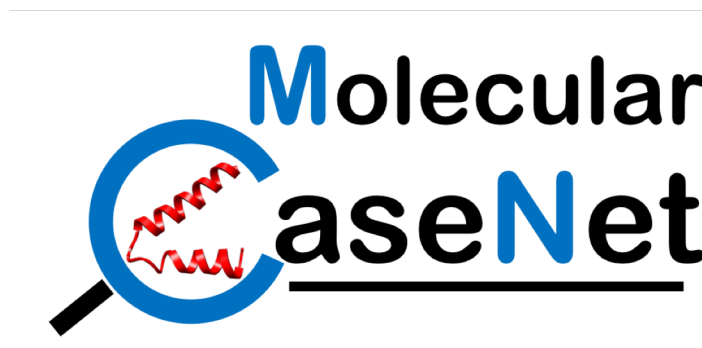5. Assessment
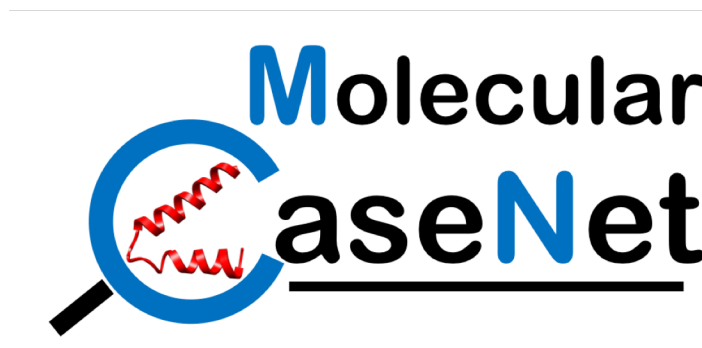
Molecular Explorations

- Identify one or more structures in the PDB relevant to the problem

- Visualize structure

Structure

- Explore molecular interaction within the protein and also with ligands, polymer chains → identify residues critical for function

Interactions

- Examine interactions during biological function. May have to compare structures of unbound and bound ligands/partner proteins, presence of specific environments, physico-chemical conditions etc.

- Rationalize the molecular basis of the problem based on the structure. Synthesize new knowledge about structure to function, design new questions, test hypothesis

Structure to Function

Molecular Exploration Logistics

- What tools to use?

- Are readymade interactive visualization options available? From where?

- What will students do after visualizing/analyzing the structure? - answer questions in a worksheet, do a presentation, make a poster, write a report, etc.

- How can students independently explore the structure(s) to ask additional questions and design solutions.

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Assessment

- Identify a related case that can be assigned to students to test how well they learned from the case study. Make sure that solving the case requires knowledge of biology/chemistry and skills in molecular visualization/ analysis to answer the questions. As necessary this case may be adapted to meet the needs of the course/ curriculum.

  Find and Adapt

- If a related case is not available, write an additional question that relates to the case study topic but requires students to apply their knowledge of biology/chemistry and skills in molecular visualization/ analysis to answer the questions.

  Write

Summary
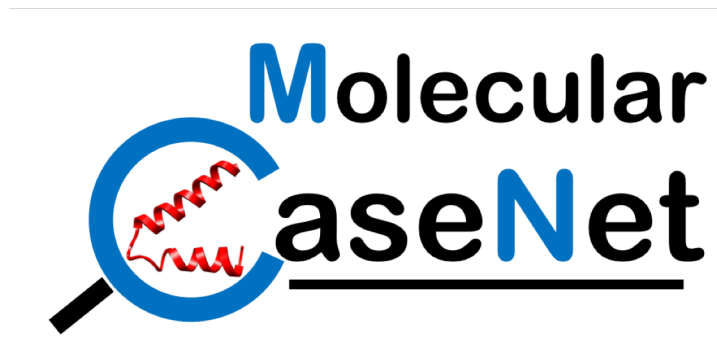
1. **Select topic (Subject/Learning Objectives)**
   - List learning objectives
   - Plan activity/assignments/deliverables

2. **Introduction (Hook)**
   - Find a video/ news item/ article/ picture to engage participants
   - Identify questions to ask and ideas to explore. How will students get to these ideas?

3. **Getting to structure (Literature review and Bioinformatics)**
   - Identify key players in the process
   - Identify molecules to explore
   - Find information about molecules from the scientific literature, bioinformatics resources etc.
   - Identify relevant structures in the PDB

4. **Molecular Explorations: (Visualization/Analysis → Synthesis)**
   - Visualize molecules structure(s) for analysis and comparison
   - Explore molecular interactions relevant to theme
   - Develop arguments for how learning about the shape and interaction of the molecule(s) helps answer the question asked
   - Can you test your argument – evidences from the literature or other structures?

5. **Assessment**
   - Develop a related question that students can explore at a molecular level and explain/design