# Box of Lessons: A Toolkit for Introducing Students to Biomolecular Structure and Function

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#### INTRODUCTION

- Faculty piloting Molecular Case Studies (available from <u>https://molecular-casenet.rcsb.org/</u>) presented the need for professional development to prepare themselves to use the case studies confidently.
- Some faculty suggested creation of practice materials to help intro-level students learn how to navigate through the RCSB PDB and other linked bioinformatics data resources that are commonly used in the molecular case studies.

#### WHO and WHEN

- Several faculty participating in the Spring 2022 BioQuest Faculty Mentoring Network shared worksheets that they had written for their own classrooms to this collection.
- Several educators collaboratively created learning materials and lessons on relevant topics for this collection through Summer 2022.
- In Fall 2022, 34 undergraduate educators around the globe, reviewed/revised these materials.
- In Spring 2023, 8 faculty piloted these materials in 11 courses in the US, Canada, and India.

#### **FULL CONTENTS**

Topic	Introductory Video		Learning Materials		Activities with Teaching Notes and Answer Keys	
Biological Macromolecules	Representations of Atoms, Bonds, and Molecules	•	Atoms, Bonds, and Molecules in the PDB Water: Importance in Biology	:	Exploring Atoms and Biomolecules Interrogating the PDB Exploring waters in the PDB	
Proteins	What is a Protein?	•	Amino Acids in the PDB Exploring Levels of Protein Structure in the PDB Handedness and Twist	••••	Exploring Amino acids Protein Sequences Helices and Sheet Insulin Structure and Function Hemoglobin Structure and Function	
Nucleic Acids	Exploring Nucleic Acids	•	Nucleotides in the PDB DNA Conformations: A-, B-, Z-DNA		Exploring Nucleotides Base Pairing DNA Sequence and Structure RNA Sequence and Structure DNA Structure and Function RNA Structure and Function Protein-DNA Binding	
Carbohydrates	Carbohydrates in the PDB	•	Saccharides in the PDB	÷	Exploring Monosaccharides Exploring Polysaccharides Protein-Carbohydrate Binding	
Lipids	Exploring Lipid Structures	·	Lipids in the PDB	:	Exploring Lipids Protein-Lipid Binding	

#### TESTIMONIALS

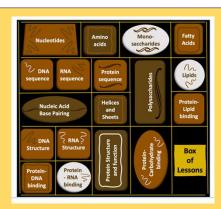
### A student (participating in the Spring 2023 piloting)

"I thought they (Box of Lessons - student activities) were really cool. From the beginning, I never would've known what any of it meant, but I was impressed with how much I learned and applied to those assignments. Seeing the structures and researching everything has made a humongous difference on my life as a student. I feel a part of the science community even more, than I've ever felt before."

#### INVITATION Scan this QR code and enter

your contact info to receive a link to the beta website!





## The Box of Lessons has:

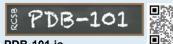
- Learning materials introduce/review shapes, interactions, functions of biological molecules. e.g., proteins, DNA, RNA, carbohydrates, lipids, and more.
- <u>Student activities</u> active learning opportunities to practice effective navigation/use of the RCSB PDB and other public bioinformatics data resources. Activities are mapped to ASBMB learning objectives, yet adaptable to various curricular contexts.
- <u>Teaching notes</u> to save time and <u>answer</u>
  <u>keys</u> for educators new to structure-function discussions.

Have questions? Write to Shuchi (sdutta@rcsb.rutgers.edu)



#### Molecular CaseNet is ...

- A community of educators and scholars
  developing & using Molecular Case Studies (MCS),
- promoting exploration of the molecular basis of biological phenomena,
- $\circ~$  understanding real world problems, and
- developing solutions at the interface of biology & chemistry.
- The home of Molecular Case Studies (MCSs) that provide opportunities for telling molecular stories to engage students in exploring biomolecular structure-function relationships.
- These MCSs are open education resources, modular, adaptable for use in multidisciplinary courses.
- Inviting interested faculty to their Cohort 3 in Fall 2023. Interested? email Shuchi at sdutta@rcsb.rutgers.edu.



#### PDB-101 is ...

- the training and outreach portal of RCSB PDB.
- the home of a variety of learning materials and activities for molecular explorations through biology and medicine.
- a resource for educators, students, and the curious public to learn about the data, tools, and resources available from the Proteins Data Bank (at <u>www.rcsb.org</u>) and a variety of linked bioinformatics resources.

#### ACKNOWLEDGEMENTS

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