Developing biomolecular educators through collaborations, case studies, bioinformatics, and visualizations.

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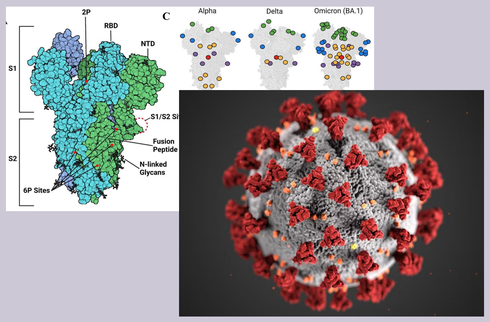


The problem

Teaching about molecular structure and function is difficult.

- Interdisciplinary nature
- Rapid advancements
- Vast availability of structural data
- The educational limitations of visualization technology

Molecular Case Network

The solution

1. A collaborative network of biology and chemistry educators to…

2018 **MCN begins**

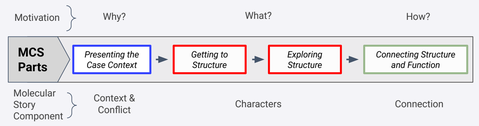
2020 **15 members 1st case studies**

2021 **Adds 18 members**

2023 **10 case studies published**

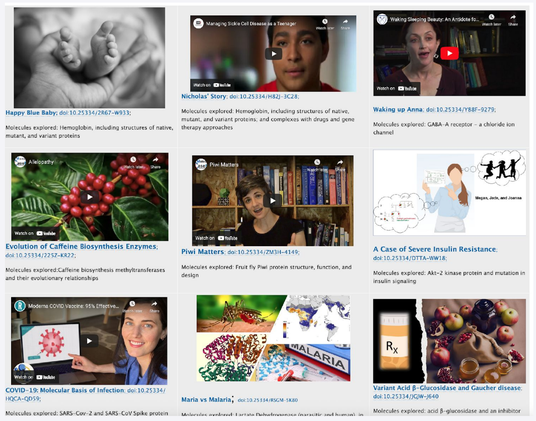
2025 **MCN reaches 60 participants**

2. Develop case studies for teaching biomolecules & …



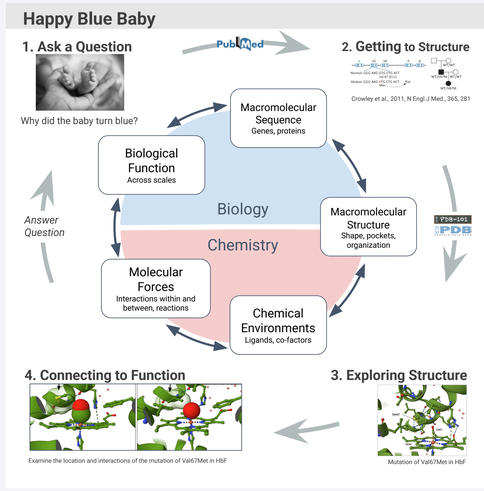
Initial conceptual model

3. Publish open access resources for…



molecular-casenet.rcsb.org

4. Molecular storytelling

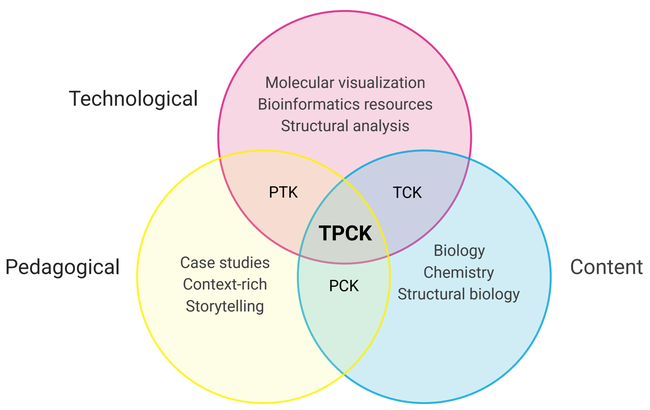


Revised conceptual model

How do participants use visualizations to develop their knowledge for teaching?

TPCK Theory

Technological, pedagogical, and content knowledge

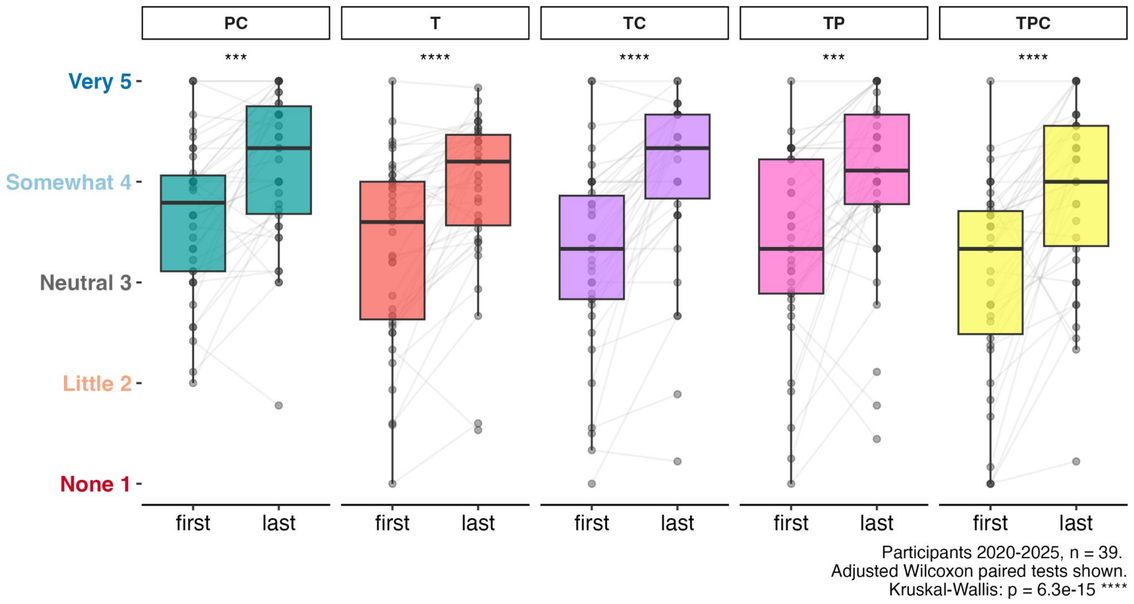


Figures: (Top) TPCK Venn diagram with overlapping areas as a combination. (Right) A boxplot of participants ratings for TPCK questions.

Survey Results

Participants increased and integrated their TPCK

Average self-ratings of knowledge, confidence and experience by first-last measures.



Survey:
Sample questions of the 17 TPC-Likert items.
Please rate your knowledge…

PC *Pedagogy and Content*	T *Technology*	TC *Technology and Content*	TP *Technology and Pedagogy*	TPC *Technology, Pedagogy and Content*
Teaching students structure-function relationships with case studies.	Using visualization tools (e.g., JSmol, iCn3D, UCSF Chimera, PyMOL, Mol*).	Using visualization tools to explain how the molecular interactions between specific parts of a protein, a nucleic acid, or a small molecule (e.g., ions, drugs) facilitate its biological function.	Teaching students to integrate information from the primary literature in PubMed and various bioinformatics resources.	Teaching students to use scientific literature and access information from various bioinformatics data resources (e.g., Protein Data Bank, UniProt, NCBI GenBank, KEGG) to explain the effects a specific mutation may have on a protein's structure and (intra- and intermolecular) interactions.

Interviews

Episodic Narrative Interviews

11 MCN participants

Semi-structured questions focused on…

- Defining molecular storytelling
- Sharing an experience in the MCN
- Unpacking how the experience related to their molecular storytelling

Early themes

- Molecular storytelling benefits participants by improving engagement through real-world relevance.
- Strong molecular science background benefit the most from the work.
- Collaboration to discuss and learn from each other across disciplines.

Discussion

- Low stakes, informal alternative to intensive in-service professional development.
- Offers a look about the intersection between molecular biology education and visualization.

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References: Braet, et al.(2023) *eLife* 12:e82584
Trujillo CM and Dutta S (2024) *Front. Educ.* 9:1379515. doi: 10.3389/feduc.2024.1379515