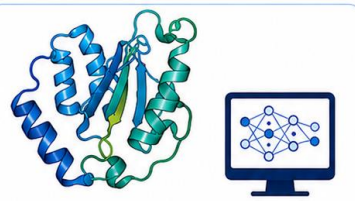
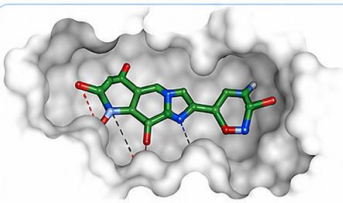
What AI/Computational Competencies Should Be Integrated into Undergraduate Biochemistry Curricula?

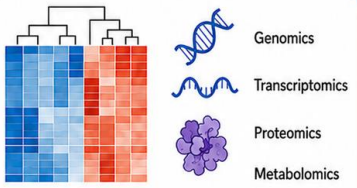
ECR Hub
EDU Core Research

#2526759: BCSER: Building Computational Capacity in Biochemistry Education for the AI+ Era

AI/ML is reshaping biochemical research

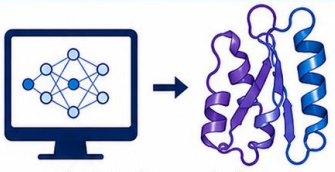

Protein structure prediction

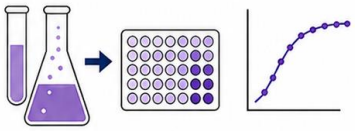

Molecular docking & virtual screening

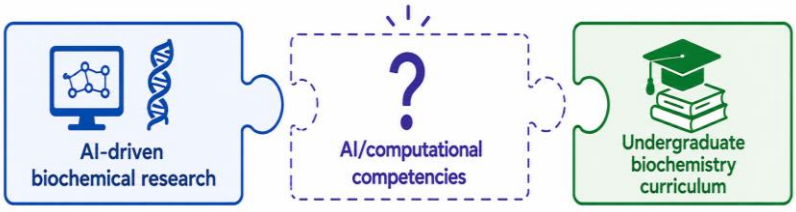


Omics data analysis & integration

Genome mining & annotation


Protein *de novo* design & generation


AI-assisted experimental planning & optimization



The missing piece: AI/computational competencies

Work in Progress

Draft 5-domain AI/computational competency framework

1 AI Literacy
- Scope of AI use in biochemical problems
- Conceptual understanding of AI/ML approaches
- Critical evaluation of predictions
- Responsible use and tool selection

2 Computational Foundations
- Data organization, retrieval, and literacy
- Use of Colab/Jupyter environments
- GitHub repository use
- Basic coding with biochemical data
- Use of computational packages and tools

3 Biochemical Analysis
- AI/ML tool application for biochemical questions
- Input/output and workflow documentation
- Evaluating prediction quality and plausibility
- Output exploration and result extraction

4 Hypothesis & Planning
- Hypothesis development and candidate selection
- Follow-up analysis and experimental planning
- Recognizing the use and limits of AI guidance

5 Communication & Reporting
- Communication of AI/ML-assisted findings
- Transparent reporting
- Responsible interpretation and limitations

Essential? Teachable? Assessable?

Methods

Delphi Study | Modular Activities

Challenge

Deciding level of specificity

1. **Skills vs. subskills:** what level is most useful?
2. **Tool-specific vs. tool-agnostic:** should the framework list specific tools?
3. **AI/ML depth:** how much algorithmic understanding is appropriate?

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