

Conceptual Frameworks and Learning Outcomes

- 1) Modern DNA analysis requires the application of computational tools, including sequence analysis methodologies. These tools filter large data sets down to a manageable subset of potentially impactful variants. A critical component of DNA analysis is the selection of appropriate tools.
 - a) Develop and apply a 'working definition' of bioinformatics and computational biology
 - b) Distinguish between bioinformatics/computational biology and computer programming
 - c) Appropriately employ common sequence analysis tools
 - d) Identify the appropriate tool in a novel situation
 - e) Use bioinformatics terminology and vocabulary appropriately
 - f) Select appropriate computational tools to filter variants that are relevant to the biological question
- 2) Bioinformatic tools are used to compare the sequence of closely related organisms, identify DNA variation, and predict the functional impact of specific DNA changes.
 - a) Justify the need for computational tools to analyze genomic data
 - b) Compare genome sequences of closely related organisms to infer evolutionary relationships
 - c) Construct an argument from evidence that changes in DNA impact protein function in predictable ways
 - d) Explain ways that DNA variation may impact susceptibility to disease.
- 3) All living things share genomic patterns that are functionally relevant and reveal the interrelatedness of life on earth. Organisms share many conserved processes that are the result of shared heritage. Variation in genome sequence can have different impacts on an organism's phenotype and provides for the diversity we see in earth's biosphere.
 - a) Identify highly conserved genomic regions
 - b) Interpret DNA conservation in relation to critical biological function
 - c) Utilize DNA conservation to infer the relatedness of organisms
- 4) Human judgment regarding the weight of individual evidence and confidence in the accuracy of the evidence is an integral part of answering complex biological questions. While computational tools can provide answers, it is the work of humans to determine the meaning of those answers.
 - a) Judge the accuracy of genomic data using data quality measures provided
 - b) Select appropriate types of evidence to support a reasonable hypothesis
- 5) The interdisciplinary nature of bioinformatics makes it an interesting career choice for a wide variety of student aptitudes. Students with a wide array of interests, including biology and computer programming, may find bioinformatics an attractive career option.
 - a) Display awareness of bioinformatics careers
 - b) Appraise bioinformatics as a career option