

# 01 Bioinformatics

Content Area: **Science**  
Course(s):  
Time Period: **Full Year**  
Length: **6 days**  
Status: **Published**

## **General Overview, Course Description or Course Philosophy**

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Introduction to Science Research Methods is the first course in a three year sequence of courses. Students learn research methodology in the natural sciences by accessing scientific databases, using online bibliographic search techniques, learning how to analyze and create scientific presentations to be shared in class and during the end of year Symposium. There will be an emphasis for students to obtain a mentor by the end of school year to help further their research studies. Students will have the opportunity to apply basic research methods in the area of Molecular Biology and Bioinformatics

## **OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS**

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Biotechnology research and fundamentals of molecular biology help provide the population with new technologies for genetic advancement in the area of Science, Medicine, and Agriculture. These advancements follow a process of scientific inquiry and investigation based on scientific data and within the constraints of larger ethical, moral and legal issues related to biotechnology research and use in society.

## **CONTENT AREA STANDARDS**

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|--------------------------|---|
| VHEL.9-12.5              | Biotechnology Research & Development  |
| VHEL.9-12.9.4.12.H.(5).2 | Apply biochemistry, cell biology, genetics, mathematics, microbiology, molecular biology, organic chemistry, and statistics concepts to conduct effective biotechnology research and development.   |
| VHEL.9-12.9.4.12.H.(5).3 | Demonstrate basic knowledge of recombinant DNA, genetic engineering, bioprocessing, monoclonal antibody production, nanotechnology, bioinformatics, genomics, proteomics, and transcriptomics that is used to conduct biotechnology research and development. |
| VHEL.9-12.9.4.12.H.(5).4 | Summarize and explain the ethical, moral, and legal issues related to biotech research, product development, and product use in society.  |
| VHEL.9-12.9.4.12.H.(5).5 | Identify and explain processes used for biotechnology product design, development, and production and describe how they work together to demonstrate an understanding of the biotechnology product development process.                                       |
| VHEL.9-12.9.4.12.H.(5).6 | Demonstrate the principles of solution preparation, sterile techniques, contamination control, and measurement and calibration of instruments following biosafety protocols to maintain a safe laboratory environment.  |

**RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)**

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| LA.WHST.9-10.2   | Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.  |
| LA.WHST.9-10.7   | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| LA.WHST.9-10.9   | Draw evidence from informational texts to support analysis, reflection, and research.  |
| TECH.9.4.12.CT.1 | Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).   |
| TECH.9.4.12.DC.6 | Select information to post online that positively impacts personal image and future college and career opportunities.  |
| TECH.9.4.12.TL.1 | Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).   |
| TECH.9.4.12.TL.2 | Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.   |

## **STUDENT LEARNING TARGETS**

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### **Declarative Knowledge**

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Students will know:

1. Students will understand what questions molecular biology can help answer. Students will learn the tools necessary to do molecular research.
2. Students will understand that the data collected by modern research requires a systematic approach to analysis.
3. Students will begin to understand the breadth of data that is possible and will learn how to approach the data they will generate using online genetic databases.

### **Procedural Knowledge**

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Students will be able to:

1. conduct molecular biology experiments (DNA miniprep, polymerase chain reaction experiments and gel electrophoresis)
2. use molecular biology tools (pipet, thermocycler, centrifuge, gel electrophoresis, image capture)
3. record experimental data in a scientific journal
4. interpret gel electrophoresis data
5. Analyze bioinformatic data for errors
6. submit bioinformatic data to a genetics database (BOLD, NCBI)

## **EVIDENCE OF LEARNING**

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### **Formative Assessments**

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Lab notebook

Prelab quizzes

Lab work

### **Summative Assessments**

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- Benchmarks – departmental benchmark given at the end of MP1, MP2, or MP3 & MP4 b(Semester Based Course)
- Alternative Assessments
  - Lab inquiries and investigations
  - Lab Practicals
  - Exploratory activities based on phenomenon
  - Gallery walks of student work
  - Creative Extension Projects
  - Build a model of a proposed solution
  - Let students design their own flashcards to test each other
  - Keynote presentations made by students on a topic
  - Portfolio

## **RESOURCES (Instructional, Supplemental, Intervention Materials)**

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WSSP Online Website

Lab Protocols

Lab equipment (Thermocyclers, centrifuges, incubators, gel rigs, pipettes, disposables, chemicals)

Laptops/Internet

Primary Scientific Literature

## **INTERDISCIPLINARY CONNECTIONS**

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Historical significance of research project

Social Science-Citizen science projects

Computer analysis and databases

## **ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS**

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See link to Accommodations & Modifications document in course folder.