Title: A semester-long collaborative research based genomics course using a previously unsequenced nematode

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Abstract Page

Undergraduate students in this upper-level course participate in a genomics research project. Providing all students with a independent research experience is challenging, but in this course students participate collaboratively in an original research project to sequence and characterize a previously unsequenced nematode genome. During the first half of the course, students learn basic genome assembly, annotation, and comparative genomics; and discuss a series of relevant research articles. Students then formally propose a comparative genomics question, develop a small project, and then use genomics tools to address their research question, analyze and contextualize their results, and finally present their research findings. We have designed modules of this course so that they can be readily be adapeted by other instructors, so that their students could also contribute to this genomics project and a more complete genome would be ready to publish sooner. Thus, many students across institutions and over a period of several can participate in a collaborative originial research project, to obtain the benefits of the deep learning that comes with research and to experience the collaborative nature of modern science.

Article Context Page: To make the submission process easier, you may want to fill out the following form, (you will be asked to select answers during the submission process). Choose all applicable options that effectively describe the conditions **IN WHICH THE LESSON WAS TAUGHT**. Modifications to expand the usability of the Lesson will be addressed later in the text. **Please delete this page prior to submission. ****Not all categories will pertain to your article, in those cases, please select 'N/A' when submitting on the website.**

- Course
  - Biochemistry
  - Cell Biology
  - Developmental Biology
  - Genetics
  - Microbiology
  - Molecular Biology
  - Introductory Biology
  - ***Bioinformatics***

- Course Level
  - Introductory
  - **Upper Level**
  - Graduate
  - High School
  - Other

- Class Type
  - **Lecture**
  - **Lab**
  - Seminar
  - Discussion Section
  - On-line
  - Other

- Audience
  - **Life Sciences Major**
  - Non-Life Science Major
  - Non-Traditional Student
  - 2-year College
  - 4-year College
  - University
  - Other

- Class Size
  - **1 – 50**
  - 51 – 100
  - 101+

- Lesson Length
  - Portion of one class period
  - One class period
  - Multiple class periods
  - **One term (semester or quarter)**
  - One year
  - Other

- Key Scientific Process Skills
  - **Reading research papers**
  - **Reviewing prior research**
  - **Asking a question**
  - **Formulating hypotheses**
  - **Designing/conducting experiments**
  - **Predicting outcomes**
  - **Gathering data/making observations**
  - **Analyzing data**
  - **Interpreting results/data**
  - **Displaying/modeling results/data**
  - **Communicating results**

- Pedagogical Approaches
  - Think-Pair-Share
  - Brainstorming
  - Case Study
  - Clicker Question
  - **Collaborative Work**
  - One Minute Paper
  - Reflective Writing
  - Concept Maps
  - Strip Sequence
  - Computer Model
  - Physical Model
  - Interactive Lecture
  - Pre/Post Questions
  - Other
  - ***Computational approaches***

- Bloom's Cognitive Level (based on learning objectives & assessments)
  - **Foundational: factual knowledge & comprehension**
  - **Application & Analysis**

- **Synthesis/Evaluation/Creation**

- Principles of how people learn
  - Motivates student to learn material
  - Focuses student on the material to be learned
  - **Develops supportive community of learners**
  - Leverages differences among learners
  - Reveals prior knowledge
  - **Requires student to do the bulk of the work**

- Vision and Change Core Concepts
  - **Evolution**
  - Structure and Function
  - **Information flow, exchange and storage**
  - Pathways and transformations of energy and matter
  - Systems

- Vision and Change Core Competencies
  - **Ability to apply the process of science**
  - **Ability to use quantitative reasoning**
  - Ability to use modeling and simulation
  - **Ability to tap into the interdisciplinary nature of science**
  - **Ability to communicate and collaborate with other disciplines**
  - Ability to understand the relationship between science and society

- Key Words: List 3 – 10 key words that are relevant for the Lesson (e.g. mitosis; meiosis; reproduction; egg; etc.)
  - genome analysis
  - nematode
  - computational biology
  - next-gen sequencing
  - _____
  - _____
  - _____
  - _____
  - _____