Developing An Interactive Simulation Application for Undergraduate Developmental Biology Lab

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OMSCS 6460

Final Presentation

Presentation YouTube Link:
https://youtu.be/HcG2munsOTA

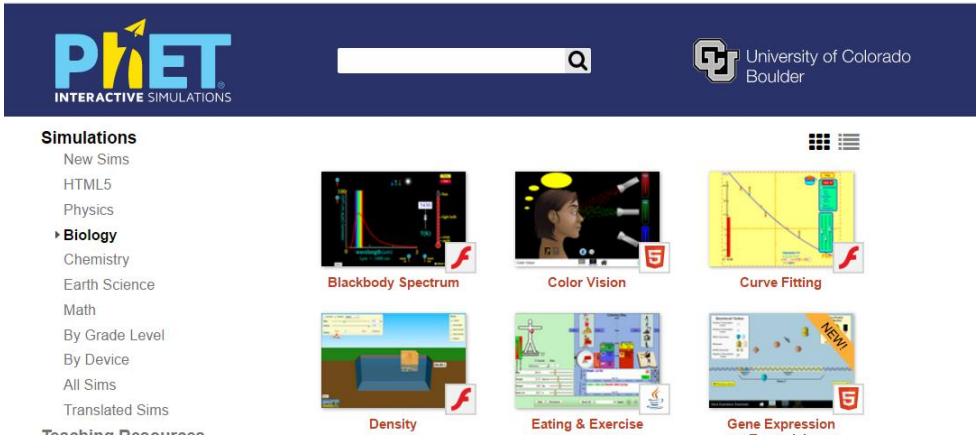
Context

- Undergraduate biology labs are very expensive to run: reagent, equipment, TAs.
- Hypothesis-drive experiment design: it is impossible to write customized lab manual for each group.
- Simulation-based learning could help student better design/perform their experiment and reduce the cost of experiment and the workload for TA.

Advantage of Simulation-based Learning

- 1) students are highly motivated because they are in charge of what they are learning.
- 2) students have the chance to explore or test their hypothesis, which can improve their critical thinking ability.
- 3) simulated-based learning provides an authentic learning environment, this would decrease the cost of education and increase the flexibility of education.

Framework: PhET vs. ReactJS



- Open Source, powerful framework to develop interactive simulation.
- Big community.
- Modern techniques, such as Node, NPM, JavaScript.

- Also Open Source, powerful framework for JavaScript library to develop interactive UI.
- Big community.
- Highly dynamic and responsive to user input.

Software Design - Requirement

- a) The students could select different experiment set-ups in the interactive simulation application
- b) the students can get the recipe of the artificial sea water for the experiment set-up they selected
- c) Visualization of the sea urchin embryo development based on selected experiment parameters.

Software Design – User Interface

CoIP Analysis | Calculator | Simulation

Control Panel

Start Simulate | Reset | Calculate Recipe

Set-up Panel

Species selected: Strongylocentrotus purpuratus | Temperature selected: "15 degree celcius" | Salinity selected: "30 ppt" | Drug selected: "None"

Information Panel

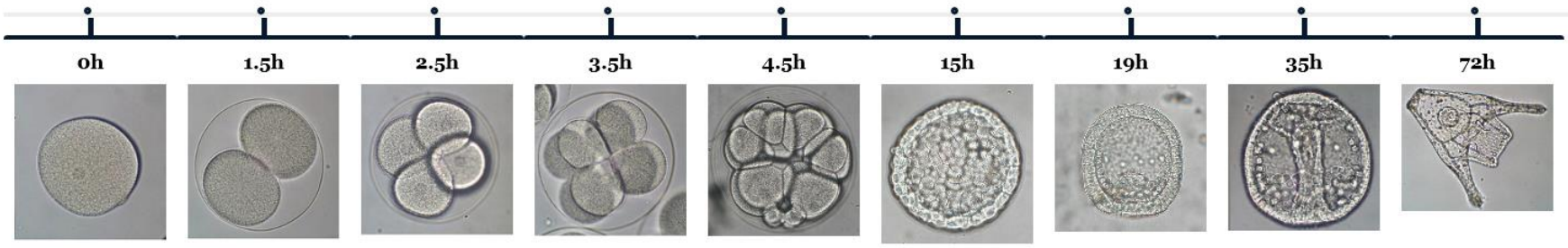
The current selection of species is: **Strongylocentrotus purpuratus**

The current selection of temperature is: **15 degree celcius**

The current selection of salinity is: **30 ppt**

The current selection of drug is: **none**

The development of sea urchin embryo is simulated below based on your experiment set-up:



Demo of the Application

- Please view the demo from the following URL: https://youtu.be/Hrvga5z2snI

Future Direction

- 1) Add more functions in this web application, including more calculators, and data analysis tools.
- 2) Integrate with PhET framework, to add some animations and interactive graph elements.
- 3) Test this app in a real development biology lab, and get feedbacks from the students.

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