**Submitted by Alice Tarun, Alfred State College**

**Final Network Reflections and Implementation Notes on Cancer Genomics**

Course/Course format: BIOL 1104 (General Biology 1)

BioInteractive Module: Genes and Cancer; Cancer and the Cell Cycle

Quantitative skill focus:

1. Categorizing cells in different stages of the cell cycle and construction of a pie chart to summarize the data

2. Systemic analysis of classifying cancer genes based on various criteria (e.g. chromosomal location, function, type of cancer found etc).

Expected dates of implementation: Fall 2016 (October to November 2016)

1. What are the learning objectives (content) did you address in your course using the

selected BioInteractive materials?

My primary goal is to use Cancer Biology as a theme to introduce concepts in the cell cycle, cell biology, genetics and signal transduction

Learning Objectives:

1. Identify the different stages of the cell cycle.
2. Estimate the duration of the different stages of the cell cycle from microscopic examination of onion root tips slides.
3. Relate deficiencies in cell cycle regulation to development of cancer
4. List the names, chromosomal location and functions of genes identified in various types of cancer
5. Describe how mutations in cancer driver genes can result to abnormal cell biology and development of cancer cells

2. Briefly describe the pedagogical techniques you used to facilitate the BioInteractive

activities and reinforce the quantitative reasoning skill.

I presented the lessons and activities on cell cycle and cancer through three interrupted lessons in either lecture or lab.

**PART 1. Lab Exercise: Mitosis, Meiosis and Cancer (3 hrs)**

1. Pre-Lab 3. HHMI: The Eukaryotic Cell Cycle And Cancer: In Depth (Click and Learn)

<http://media.hhmi.org/biointeractive/click/cellcycle/?_ga=1.213072660.1217146373.1468383394>

The students were assigned to go through the click and learn activity and to answer the worksheet

2. Using chromosome bead model to model mitosis and meiosis

3. Microscopic examination of mitosis in onion root tip cells

Lab activity to estimate duration of various stages in the life cycle of onion (adapted from http://w3.marietta.edu/~biol/introlab/Onion%20root%20mitosis.pdf)

You've now seen that cell division is a dynamic event. Once you know the approximate duration of a particular cell cycle, it's possible to calculate the amount of time the cell spends in each phase. You can do this even though you are looking at a slide of cells that have been arrested in the process of division.

Follow these steps to analyze the onion root tip cells in the slide at the left:

a. Determine the approximate duration of the entire cycle for the cells you are studying. In this specimen, the average time for onion root tip cells to complete the cell cycle is 24 hours, or 1440 minutes.
b. Looking at the slide, count and record the number of cells in the field of view that are in each phase. (In lab, you would count at least 200 cells by moving your slide so that you view several fields.) Click on the Lab Notebook to record your observation.
c. Determine the total number of cells counted. Enter this number in your Lab Notebook.
d. Determine the percent of cells that are in each phase. Enter this data in your Lab Notebook.
e. To calculate the time (in minutes) for each phase, multiply the percent of cells in that phase by the number of minutes for the whole cycle. Record the results in your Lab Notebook and answer the Questions.

f. Present your data as a pie chart using Excel

**PART 2. Lecture- Signal Transduction and Cancer (1 hr)**

Focus on the EGFR signal transduction pathway (described in Cell Cycle and Cancer activity) and how mutations in this pathway can result to increase cell survival and proliferation resulting to cancer

Pre-lab assignment: <https://www.hhmi.org/biointeractive/cancer-genetic-disease-video-highlights>

**PART 3. Lecture activity- Cancer Cell Biology Biology and Genomics (1 hr)**

**Multi-step model for cancer**

<http://www.hhmi.org/biointeractive/cancer-and-cell-fate-intestinal-epithelium> (video on colon tumor formation)

<http://www.hhmi.org/biointeractive/angiogenesis> (metastasis and angiogenesis)

<http://www.hhmi.org/biointeractive/vegf> (VEGF and vascularization)

Cancer cell division and telomerase

**PART 4. Lab Activity: Genes and Cancer (1 .5 hr)**

**Pre-lab: Part 1:** Students are assigned to watch *the Cancer as a Genetic Disease* video clip (8:30 minutes) featuring cancer researcher Dr. Charles L. Sawyers. The students have to answer the questions on the worksheet at the end of this document to review the important concepts from the video.

2. Activity 1: Classifying Cancer Genes

A. Classify the function of assigned cancer genes

B. Mark the chromosomal location of assigned cancer genes

3. Activity 2: Examining Cancer Patient Data Activity

A. Classify mutated genes in patient data cards using cancer gene cards

B. Do in-class activity comparing patient data cards for different types of cancer

Answer worksheet and do a 321 analysis after the activity.

3. Did you make adaptations to the BioInteractive materials? If yes, please describe them

here. If no, please indicate why.

I did very minor changes to the BioInteractive materials because I wanted to see how the students perform the activities first. I would probably supplement the latter activity on Genes and Cancer by including an activity on bioinformatics if there is time available.

4. Did you use supplemental materials with this module, please describe them (e.g. where

did you find them?).

I did use supplemental materials from existing lab on Mitosis and Meiosis and the activity on estimating various stages of the cell cycle as described above.

5. What assessments did you use to measure student progress? Please either describe,

attach, or provide a link here.

I graded the worksheets submitted by the students on the HHMI activities on Cell Cycle and Cancer and Genes and Cancer. I also gave exam questions on cancer and cancer genes in their exam for the course.

6. What would you do differently if you were to implement this module again?

I would most likely use these modules again. But I would try to do a better job of discussing the activity in class and not just give the activity as an assignment with worksheets to answer.

7. Overall, how would you describe your experience with the BioInteractive modules?

Please provide any additional teacher notes here.

I really am grateful for the BIoInteractive modules. The quality of the module materials are excellent and very useful and interesting to the students. I found several modules that I will be using not only in this course (BIOL 1104, General Biology 1) but also in other courses I teach like Genetics, Research Methods and Cell Biology.

**Additional Comments on FMN**

1. This third bullet is an ask and is not mandatory for completing the FMN. I am very interested in knowing how you think the FMN went. I would love to know:
* what you thought went well

Attending the Summer Academy and meeting the participants and organizers was a highlight for me. I learned so much from attending the workshops and meeting with various people. I have incorporated so many of what I have learned from the meeting in my classes this Fall semester and for future classes.

The scheduled meetings went well- at least hearing from other HHMI FMN members was useful for giving feedback and ideas on my plans for this module. The QUBES Hub was not too useful because I didn’t really visit the site after the meeting.

* what can be improved (suggestions welcome)

Improving the accessibility and ease of use of the QUBES Hub or at least ensuring that everyone uses the site for exchanging ideas and uploading materials.

* if you would be interested in doing another BioInteractive FMN, working on further product development for the BioInteractive website, or presenting the resource you worked on, on our behalf or if you want to never see us again 

I would be very interested in participating in another BioInteractive FMN. I hope there could be more moduiles on Genetics and Genomics.

* anything else you want to share

Thank you very much for the opportunity to be part of the BioInteractive FMN and most of all for enabling me to attend the Summer Academy on Quantitative Biology. This was really eye-opening experience for me and opened all these opportunities to incorporate authentic research experience in all my classes.