



Fairbanks STEM Lab Team: 2018-2019 weekly summaries

Week 1: Visit to New Hampshire Academy of Sciences Lab. Here the students learned proper science lab procedures and streaked plates of bacteria. They brought home plates of *C. elegans* or roundworms to begin studying at the museum.

Week 2: Introduction to the museum's STEM lab space. Students shared out what they are excited about learning and what books they chose to read during the course. We focused on what motivates a scientist, what ethics surround scientific exploration and how bad science can compound problems we are trying to solve. Finally, we had an introduction to our model organisms: roundworms, *C. elegans*, their lifecycle, and how to extract them from the soil.

Week 3: Exploring the Scientific Method as an ongoing, cyclical process and not a linear one. The students tackle a simple question of why on a cold day below freezing a fresh water stream would freeze while the ocean nearby has not frozen. Students learn to start with an observation and then ask questions, to be skeptical, to think about how to separate out variables, and focus their question down to a testable one. Discussion of reductionism, limiting bias, removing confounding variables plus well written out procedures are an important part of setting up an experiment.

Week 4: Students reviewed the parts of the microscope and prepared to observe the model organism of *C. elegans*. Students learned about the various life stages of the roundworm and then attempted to identify each stage. Students then practiced with another tool called a worm pick so that they could transfer worms from one plate to another.

Week 5: Fiona Sweeney, a senior at the St. Johnsbury Academy presented how she came to work with the NHAS lab and her advice to students new to the STEM lab. After the presentation, students began tracking the single worms they had transferred last week under the microscopes.

Week 6: Draft lab reports were submitted and reviewed as a group. This gave students a chance to see a completed lab report and think about what changes they wanted to make before turning theirs in for homework. Students will continue to develop our understanding of lab reports and scientific papers in the coming weeks.

Week 7: Learning the structure of a scientific paper and how to read them. This practice allows students to scan quickly to find relevant papers to give them ideas on their own experiments. It also gets students in the habit of reading mass amounts of information and the format that their papers need to have.

Week 8: Being Halloween the theme today was the darker side of science and scientific experiments that have gone wrong. When in history have scientists used their knowledge for less than honorable

purposes? What were some examples of outright fraud? The discussion was wide-ranging, from eugenics to voltaic piles, from stem cells to padded cells. The students then enjoyed a round of *C. elegans* Jeopardy, teaming up to see how could share out the knowledge they learned faster.

Week 9: Students started with a discussion of mathematical models in science. What are some different kinds of models and how are they used? What is a mathematical model in particular and when is it appropriate to use one? How can you use mathematical models to make predictions and test how different variables affect the system you are modeling? The main lab activity was to construct our own set of worm picks using glass pipettes and platinum wire. We then worked on adjusting our worm wrangling techniques to these finer instruments.

Week 10: Presentations given by students based on scientific books they read this semester:

- *The Immortal Life of Henrietta Lacks* by Rebecca Skloot
- *Napoleon's Buttons* by Penny Le Couteur & Jay Burreson
- *The Girl Who Drew Butterflies* by Joyce Sidman
- *Soonish: Ten Emerging Technologies That Will Improve and/or Ruin Everything* by Kelly & Zach Weinersmith
- *The Disappearing Spoon: And Other True Tales of Maddness, Love, and the History of the World from the Periodic Table of the Elements* by Sam Kean
- *Mrs. Frisbee and the Rats of NIMH* by Robert C. O'Brien
- *The House of the Scorpion* by Nancy Farmer
- *The Evolution of Calpurnia Tate* by Jacqueline Kelly
- *Radium Girls* by Kate Moore
- *Anna to the Infinite Power* by Mildred Ames

Additional: Field Trip to Mobile Medical International Corporation to see STEM in action through their engineering practices right here in St Johnsbury.

Book Assignment for the break: *Frankenstein* by Mary Shelly

End of First Semester.