Stomach Cancer Unit

A Teacher-Authored Curriculum Unit

Hutch Fellowship for Excellence in STEM Teaching (HTF)

Fred Hutch Cancer Center

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Stomach Cancer unit

The Hutch Fellowship for Excellence in STEM Teaching (HTF) is a program for secondary science and STEM educators seeking an in-depth, biomedical research experience at Fred Hutch Cancer Center in Seattle, WA. The Hutch Teacher Fellowship provides support for up to two paid summers of cancer-focused biomedical research experience in a host lab, cancer-focused curriculum design activities, and scientific communication projects, with additional school year follow-up. As part of their Fellowship experience, our teacher-researchers design innovative curriculum materials inspired by their research experience in a Fred Hutch lab. They then pilot these materials with their students over two school years and use student feedback to revise, expand, and polish their curriculum materials with the goal of sharing them with other STEM educators. This unit was shared by its author at our HTF Curriculum Showcase events in May 2026. Final materials will be published to the SEP Curriculum website. The HTF program is part of the Pathways to Cancer Research program supported by a Youth Enjoy Science grant from the National Cancer Institute and philanthropic donations. For more information about the HTF program, please contact Dr. Kristen Bergsman, bergsman@fredhutch.org.

Unit Title: Stomach Cancer (10 lessons)

Intended Course: HS Biotechnology and/or Honors/AP Biology (11th or 12th graders)

This unit was inspired by the author's *H. pylori* research in the lab of Dr. Nina Salama. In this unit, students explore the relationship between *Helicobacter pylori* and stomach cancer by taking on the perspective of an intern helping to run a clinical trial at a gastroenterology clinic. Students are introduced to the unit through a patient with concerning symptoms who also has a family history of stomach cancer. This patient becomes one of the participants in the clinical trial. Students are tasked with gathering and analyzing data from the clinical trial comparing various samples and specimens from three different cohorts: patients with stomach cancer, patients with stomach ulcers, and patients who are otherwise healthy. The unit heavily focuses on lab skills and practices, with students conducting various hands-on lab activities such as pH testing, ELISA, gel electrophoresis, PCR, SDS-PAGE protein gel electrophoresis and salinity testing. This unit is intended for use with 11th or 12th grade students in an advanced Biology class; however, the lessons within the unit are modular and, depending on a class's needs, teachers may use their discretion about which lessons to use therefore making this unit also suitable for introductory high school Biology classes.

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Lesson	What do students do?	What do students find out?	Labs
Lesson 1: Introduction **Introductory Model**	Make an initial model of what factors they think might cause a patient to have stomach cancer. Introduced to the anchoring phenomenon, a patient with a family history of stomach cancer and concerning symptoms.	N/A	N/A
Lesson 2: Demographics	Introduced to the scenario and learn they will be studying a cohort of patients. Statistically analyze demographic data of the patients in the cohort.	Older individuals are more likely to have stomach cancer than younger individuals. BIPOC patients are more likely to have stomach cancer than non-BIPOC patients. Men are more likely to have stomach cancer than women.	N/A
Lesson 3: Stomach Conditions	Test simulated stomach acid to compare the pH between patients.	Healthy subjects should have the lowest pH (most acidic) and cancer patients should have the highest pH (least acidic).	pH Testing
Lesson 4: *H. pylori* Status	Determine which patients in the cohort have an *H. pylori* infection and which patients do not.	Healthy patients tended to be *H. pylori* negative. Ulcer and stomach cancer patients tended to be *H. pylori* positive.	ELISA assay
Lesson 5: Stomach Microbiota	Determine relative amounts of *H. pylori* in infected patients.	Stomach cancer patients have more diversity and healthy patients have less diversity, due to differences in stomach pH. *H. pylori* negative	qPCR testing to determine relative

	Learn about the Shannon Diversity Index as a way to compare microbiota diversity among patients in the cohort	patients likely have more diversity than *H. pylori* positive patients (HP tends to dominate).	amounts of *H. pylori*
Lesson 6: H. pylori Cell Shape	Look at microscope photographs of *H. pylori* from patients in the cohort, to determine how helical the cells are.	*H. pylori* cells that are more helical are better able to "burrow" into the patient's stomach lining and are more likely to cause serious illness compared to cells that are less helical in shape.	N/A
Lesson 7: CagA Status	Test *H. pylori* infected patients to determine if that strain has the Cag A protein, which is a virulence factor.	*H. pylori* patients who test positive for Cag A are more likely to be sicker.	SDS-PAGE gel
Lesson 8: Host Genetic Conditions	Conduct a literature review of two studies looking at the human gene IL-1B, which is associated with stomach cancer. Test the patients in the cohort for this gene.	Most cancer patients genetically had the version of the IL-1B gene that was T/T (versus C/T or C/C).	Gel electrophoresis
Lesson 9: Host Diet	Design/carry out a way to test the salt content of a 24-hour urine sample from patients in the study.	Cancer patients have higher salt levels than non-cancer patients. *H. pylori*-positive patients have higher levels of dietary salt intake.	Self-designed student lab
Lesson 10: Culminating Project	Use their newfound knowledge to flag currently healthy patients who they would like to more aggressively screen in the future, as those patients show early warning signs of stomach cancer	N/A	N/A

Additional Programs & Curriculum Resources from Fred Hutch Cancer Center

Teacher Programs

Fred Hutch Cancer Center offers a variety of programs for Science & STEM teachers:

- Science Education Partnership (SEP)
- Hutch Fellowship for Excellence in STEM Teaching (HTF)
- Partners in Science 2.0 @ Fred Hutch (PS2@FH)

Open-Source Curriculum

At Fred Hutch, we support engaging, challenging and relevant classroom learning experiences for all students by providing access to high-quality instructional materials developed by teachers and scientists. Our *Intro to Cancer: Leukemia & Hina's Story Unit* has received national recognition as a "Quality Example of NGSS Design" by the NextGenScience Peer Review Panel. SEP's free, open-source lessons and units are geared towards high school biotech and biology teachers and focus on giving students opportunities to explore biotechnology and the social dimensions of research science.

- SEP Curriculum

Programs for Students

We offer paid internships and introductory programs for high school and undergraduate students throughout our organization. Each program offers valuable learning opportunities that support academic and career goals.

- High School Programs
- Undergraduate Student Programs