Spinning into Action:

Helicobacter Pylori's Rotational Mechanics & Community Health

A Teacher-Authored Curriculum Unit

Hutch Fellowship for Excellence in STEM Teaching (HTF)

Fred Hutch Cancer Center

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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: Spinning into Action: Helicobacter Pylori's Rotational Mechanics & Community Health

Unit Author: Elainea Kesler-Horan

Unit Length: 7 lessons including STEAM for Justice project (approx. 5-7 weeks)

Intended Course: HS Physics (adaptable for AP Physics)

Description: Developed through the Hutch Fellowship for Excellence in STEM Teaching and grounded in the author's *H. pylori* research in the lab of Dr. Nina Salama, this 5-week unit explores rotational mechanics through the lens of bacterial motion and community health disparities. Students learn circular motion, centripetal force, and angular velocity while analyzing real health equity data from peer-reviewed studies. They investigate how *H. pylori's* spiral shape enables infection and why infection rates are dramatically higher in BIPOC and low-income communities. Students culminate by designing evidence-based STEAM solutions to address injustices in their own communities. The unit includes full scaffolding for IEP/MLL students and AP extensions. Before participating, students should have completed introductory physics content on forces and motion.

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Lesson	What do students do?	What do students find out?	Activities
Lesson 1*: H. pylori* Context & Health Equity	Create 3-component posters showing *H. pylori* timeline, CER analysis of infection disparities using health equity data, and initial bacterial model.	*H. pylori* infection rates are 1.3-5.4× higher in Black communities and 1.8-4.4× higher in Hispanic communities, with healthcare access varying dramatically by neighborhood.	Poster creation, HRSA mapping tool analysis, CER writing with health equity data, scientific modeling.
Lesson 2: Circular Motion Intro	Build vocabulary flipbooks, complete guided notes, solve practice problems for period/frequency/radius, and add vocabulary terms to *H. pylori* model.	Circular motion vocabulary (radius, period, frequency) describes *H. pylori* movement using the relationship T = 1/f.	Vocabulary flipbooks, guided notes, practice problems, model revision with labels.
Lesson 3: Station Rotation Lab	Rotate through three stations: physically feel centripetal force while walking in circles, analyze *H. pylori* videos and draw spiral paths, and calculate centripetal force at human and bacterial scales.	Centripetal force always points toward center, *H. pylori's* spiral shape enables mucus movement, and the same physics applies at all scales from human to microscopic.	Station 1: Force & Vectors (kinesthetic); Station 2: *H. pylori* video analysis; Station 3: Force calculations with scientific notation; model revision with vectors.
Lesson 4: Centripetal Force	Complete guided notes, work example problems at human and bacterial scales using scientific notation, write CER connecting motion to infection, and add calculated force values to model.	The formula $Fc = mv^2/r$ applies to all circular motion from Earth's orbit to *H. pylori* swimming, connecting bacterial motion to infection ability.	Guided notes, worked examples, practice problems at both scales, CER writing, model revision with calculated values.
Lesson 5: Angular Velocity & Acceleration	Complete guided notes, convert between rpm/Hz/rad/s, calculate ω and α, use v = rω, complete simulation, and add angular motion concepts to complete *H. pylori* model.	Angular velocity ($\omega = \Delta\theta/\Delta t$) and acceleration ($\alpha = \Delta\omega/\Delta t$) relate to linear motion through v = rω, completing the quantitative understanding of *H. pylori's* rotational motion.	Guided notes, unit conversions, simulation, medical device problems, model completion with angular motion.
Lesson 6: Medical Device Applications	Apply all unit concepts to medical device problems (CT, MRI, centrifuges), calculating multiple motion variables and comparing to completed H. pylori model.	Medical devices use the same rotational mechanics principles as *H. pylori* motion, but access to this diagnostic technology varies geographically.	Medical device analysis, multi-step calculations, real-world applications, model comparison, health equity mapping.
Lesson 7: STEAM for Justice	Choose any social justice issue, research using 3-5 scholarly sources, design evidence-based STEAM solution, and present in chosen format.	STEAM principles can address real-world injustice through research, design, and communication, with student voices driving changemaking.	Research, solution design, project creation (full format autonomy), peer feedback, presentations addressing social justice.

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