

Genetic Basis of Cancer

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: Genetic Basis of Cancer unit

Unit Author: Janhavi Gupta, PhD

Unit Length: 3 lessons + activities/pedigree problem set

Intended Course: HS General Biology (could be used in AP Bio)

Description: The discussion of cancer consistently sparks student interest and motivates them to delve into the subject, making it an ideal topic for designing engaging educational units that cover many standards. Designed for High School General Biology and adaptable for AP Biology, *Genetic Basis of Cancer* is a three-lesson unit that explores the genetic basis of cancer through the lens of a patient diagnosed with Lynch Syndrome. Students delve into karyotypes, mutations, and inheritance patterns while acting as genetic counselors to analyze family histories of patients diagnosed with inherited cancer syndromes constructed from published articles. The unit features engaging activities, including a Harry Potter-themed pedigree construction and the use of bioinformatics databases to classify oncogenes and tumor suppressor genes using real-world research data. These lessons can be used as a whole, or parts can be modified for use as student activities. Other SEP units such as *Elephants and Cancer*, *Cancer Fighting Proteins: Illuminating Cancer*, or *Intro to Cancer: Leukemia & Hina's Story* can be used to further extend these lessons.

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Lesson	What do students do? What do students find out?	Activities
<p>Lesson 1:</p> <p>Can Cancer be Inherited?</p> <p>Driving Question(s):</p> <p>-Can cancer be inherited?</p> <p>-How can we study inheritable diseases through generations?</p>	<p>In this instructional lesson, students will be acquainted with the personal account of an individual possessing a familial history of cancer. This narrative serves to present students with a tangible example of the profound impact inherited cancers have on families. Furthermore, the lesson offers a snapshot of the advancements and improvements made in cancer diagnosis and treatment methodologies in contemporary times. Students will delve into the fundamental principles of chromosome structure, human karyotype, and inheritance through a guided presentation. To solidify their comprehension, they will participate in a karyotyping activity, allowing them to visualize and reinforce their understanding. Additionally, students have the option to engage in an activity focused on DNA sequencing. Subsequent lessons will introduce students to the career profile of genetic counselors and explore the analysis of inherited diseases using pedigree charts. Students will be provided with their own pedigree charts for analysis purposes. Virtual learning options are included.</p>	<p>In this lesson, students will ask questions about whether diseases such as cancer can be inherited. Students will understand the correlation between the genetic information stored in the nucleus and the effects of different types of mutations. Students will recognize the need for different types of diagnostic technologies to differentiate between the different types of mutations.</p> <p>-Carol's Story (personal story that introduces Lynch Syndrome, an inherited cancer caused by a mutation in DNA mismatch repair system gene MSH-2)</p> <p>-Karyotyping Activity (paper or virtual options)</p> <p>-Optional DNA Sequencing Activity</p>
<p>Lesson 2:</p> <p>Understanding Inheritance</p> <p>Driving Question(s):</p> <p>-What is the inheritance pattern of Lynch syndrome?</p> <p>-How are pedigree charts used to understand the genetic basis of different traits or diseases?</p>	<p>In this lesson, students will be introduced to a career profile of a genetic counselor who specializes in helping families and individuals assess their risks of inherited disorders. Students will learn about the chromosomal make-up of somatic cells and the process of cell division or mitosis. Students will understand that uncontrolled mitosis in a few cells can lead to the development of tumor cells. This background will help students understand patterns of inheritance by completing an in-class example and other practice problems. Virtual learning options are included.</p>	<p>During this lesson, students will engage in learning activities designed to explore the genetic basis of cancer and how inherited diseases are studied. In this lesson, students will analyze and interpret pedigree charts (models) to explain the patterns of inheritance of traits/genetic mutations.</p> <p>-Career Profile: Genetic Counselor</p> <p>-Introduction to Pedigree Analysis</p> <p>-Pedigree Analysis Problem Set</p>

<p>Lesson 3:</p> <p>Do Inherited Cancers Show Any Patterns?</p> <p>Driving Question(s):</p> <p>-Do inherited cancer pedigrees show any patterns?</p> <p>-What are the functions of genes and their gene products frequently associated with cancer?</p>	<p>In this lesson, students will engage in the process of revisiting the narrative of Carol Findley, which is centered around Lynch Syndrome, and will subsequently construct her family's pedigree chart. Students will gain an understanding that the inheritance of a mutation within specific genes, which are implicated in rare hereditary cancer syndromes, predisposes the individual to develop cancer due to accumulating mutations, sometimes at a younger age, in contrast to the more common sporadic cancers. Subsequently, they will analyze their hereditary cancer problem set, with the aim of understanding the inheritance pattern, and will further delve into the function of the gene utilizing various public databases. The pooling of class data will reveal that many inherited cancers exhibit autosomal dominant inheritance patterns, while a few exhibit autosomal recessive, mixed, and sex-linked recessive patterns. Students will come to understand the three primary types of genes implicated in cancer, namely, oncogenes, tumor suppressor genes, and DNA repair genes. The inheritance of these genes can be tested using cancer panel testing similar to the one used by the genetic specialist in Carol Findley's story.</p>	<p>During this lesson, students will engage in learning activities designed to explore the investigative phenomenon of inheritance patterns to predict and describe the pattern of inheritance in a pedigree chart model, and use NCBI and UniProtKB public databases to discover the related function of the mutated gene.</p> <p>-Constructing an Inherited Cancer Pedigree Chart (using Carol's story)</p> <p>-Analyzing Pedigree Charts for Inherited Cancer (8 charts provided)</p>
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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](#)