

GENOME UNLOCKING LIFE'S CODE Do-It-Yourself exhibit

The Genomics Revolution is here.

Resource Guide

NATIONAL MUSEUM of NATURAL HISTORY

Smithsonian

DiY EXHIBITS



To Our Community Collaborators,

Thank you for playing an important role in helping make the exhibition *Genome: Unlocking Life's Code* accessible to a worldwide audience. Additional thanks for helping us share information about the growing promise of genomics with your community.

This guide provides details on the components needed to exhibit *Genome: Unlocking Life's Code*. It includes specifications, suggestions for printing and fabrication, ideas for enhancing visitors' experience, and materials to help promote your exhibition. In addition, the guide lists additional resources to increase engagement.

The guide is printable for individual use and may be distributed as needed.

If you have any question about this guide or the Genome DiY, please refer to the Frequently Asked Questions (FAQ) on page 12. Additional question may be directed to NMNH-Exhibits@si.edu or 202.633.1152.



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Introduction to Genome DiY

Genome: Unlocking Life's Code is an exhibition created by the Smithsonian's National Museum of Natural History (NMNH) in Washington, D.C. and the National Institutes of Health's National Human Genome Research Institute.

The exhibit provides a simple introduction to the science of genomics. It also focuses on advances in genomics that are revolutionizing thinking about our biology and health, and humans' place in the natural world.

Genome: Unlocking Life's Code –Do-It-Yourself Exhibition (Genome DiY)

The adaptable Do-It-Yourself exhibit—available for free—is designed to be easily installed in any type of location, such as schools, offices, community centers, libraries, coffee shops, hospitals, transit hubs, museums, and science centers. The exhibition can be a companion to existing museum exhibitions or an addition to meeting spaces, science fairs, classroom activities, and conferences.

Design, Printing, and Fabrication

The information provided in this section explains all of the supplied files and suggested ways to design, print, and fabricate a do-it-yourself *Dig It!* exhibition.

EXHIBIT PANELS

Your organization or venue will be provided with files to produce the 16 pre-designed exhibit panels. While each venue can determine which exhibit panels to include, all installations must include the title panel acknowledging the Smithsonian Institution and the first content panel.

The 16 panels included are:

- Genome: Unlocking Life's Code - Title
- Meet You Genome
- How Does Your Genome Work?
- How Did I Become Me?
- Reading Life's Code
- This Technology May Save Your Life
- Powering Genomics with Big Data
- Genomics and Your Health
- Sequencing Your Other Genomes
- Precision Medicine: Treatment Made for You
- New Hope for Defeating Cancer
- What Do You Think?
- How Are We Related?
- Reading Nature's Code
- Where Do We Come From?
- Finding Our Ancient Relatives

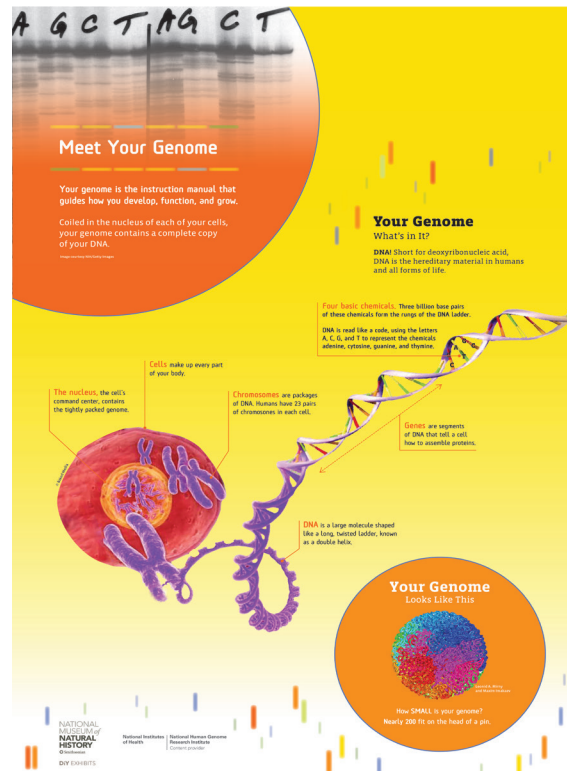


The Genomics Revolution is here.

It is rewriting the story of human evolution, transforming diagnosis and treatment of many diseases, and helping unravel our connections to all life on Earth.

What does it mean for you?

This exhibition was developed and produced by the Smithsonian's Museum of Natural History and the National Institutes of Health's National Human Genome Research Institute, a part of the U.S. Department of Health and Human Services.



LANGUAGES

The pre-designed exhibit panels are available in American English, or as bilingual panels where American English is paired with Spanish.

PHOTO RIGHTS

All images in the design files provided by NMNH are for **exhibition use only** and are credited appropriately. Please refer to the Terms of Agreement for the proper use of exhibition images and design files. You are responsible for securing the proper copyrights and permissions for any additional images you use (e.g., images in customizable templates).

Sequencing Your Other Genomes

Trillions of bacteria, viruses, and fungi live in and on your body. These microbes make up your microbiome.

Most of these microbes play an important role in keeping you healthy. But other microbes can make you sick.

Genomic sequencing shows that changes in the microbiome may be associated with illnesses such as cancer, autism, and gut disorders.

Microbes Everywhere

- In Your Nose**
These microbes may support your immune system.
- In Your Mouth**
Thousands of bacteria species flourish here.
- On Your Skin**
Bacteria moisturize skin and keep unhealthy bacteria out.
- In Your Gut**
These microbes help with digestion.

Defeating a Tough Bug

Sometimes, taking antibiotics can kill the good bacteria in your digestive system. Then potentially life-threatening bacteria called *C. difficile colitis* may take over.

A pill containing feces from a donor with a healthy microbiome—known as a fecal transplant—can help restore the patient's microbiome.

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DIV EXHIBITS

Where Do We Come From?

Genomics gives us a powerful tool to trace our common ancestry.

Until recently, scientists pieced together the story of human origins from fossils and archeological evidence. Genomics lets us follow the tracks of DNA—passed from generation to generation—into the distant past.

Our African Origins

Our species, *Homo sapiens*, evolved in Africa about 300,000 years ago. Beginning at least 60,000 years ago, small groups left Africa for the Middle East. These early migrants spread out to settle the rest of the world.

Homo sapiens

Since modern humans evolved, our genomes have changed in small ways that link our ancestors to specific times and places.

Adapting to New Environments

People in different parts of the world today have some genomic differences. However, genomics shows no sharp divisions of people into distinct races.

Differences in skin color, hair texture, and facial features—even the digestion of milk as an adult—reflect how our genomes have responded over time to the environments where we lived.

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DIV EXHIBITS

SPECIFICATIONS/HOW TO PRINT

The original design files are provided as ready-to-print PDF files. All printing costs are the sole responsibility of the venue.

To access and print the files:

1. Visit diy.naturalhistory.si.edu
2. Follow steps to access selected Do-It-Yourself exhibit
3. Once you gain access to the PDFs, you can print them from an office printer or larger format. The panels are designed for the following print sized, but may be scaled down if needed.
 - o 24" W x 32" H (English-only version)
 - o 35"W x 47"H (bilingual version)

SUGGESTED PRINTING AND FABRICATION

Feel free to be as creative as you wish in displaying exhibition content. Depending on your venue's needs, you may wish to print full-sized posters, mounted panels on foam board or corrugated plastic, free-standing display banners, or letter-sized papers—or display the panels digitally on a screen. Printing and fabrication costs will vary depending on locality, complexity of design, available resources, and shipping charges.





FLOOR PLAN CONSIDERATIONS

The *Genome DiY* exhibition is adaptable and flexible. There is no right or wrong configuration to present the panels, as each panel is independent of the others and can be viewed in any order. However, a few considerations for installing the panels may be useful:

- What is the maximum space available for the exhibition?
- In what order would you like the information on the panels to be presented?
- Can you break up the flow of the panels with objects, art, or media?
- Does it make sense for you to group panels into sections or related topics?
- Do you want visitors to have a break between panels?
- Is there enough space for hands-on activities, facilitated discussions, and small groups?
- Are the panels at a height comfortable for children or visitors in wheelchairs?
- Are the panels lit for easy readability?

For information on how to make your exhibition more accessible to different types of visitors, you are welcome to explore Smithsonian Guidelines for Accessible Exhibition Design, an online resource used by the Smithsonian and many other institutions to facilitate the creation of spaces for museum visitors with special needs – <https://www.si.edu/Accessibility/SGAED>

ENHANCING THE EXHIBIT EXPERIENCE

You do not have to limit the scope of your exhibition to the Smithsonian panels. You may find it useful to contact museums, libraries, universities, and other local organizations for additional objects, artifacts,

specimens, graphics, music, storytelling, photography, and artwork.

Providing programming is another way to personalize the exhibition and enhance local connections. Consider engaging your audience with some of the following:

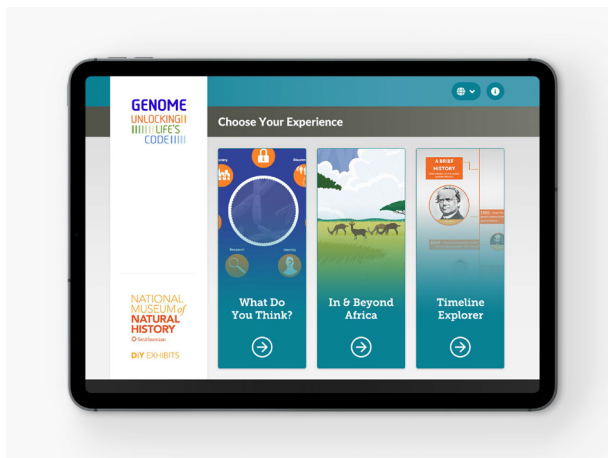
- volunteer staff to answer visitor questions and host activities
- conversations with experts (experts do not have to be scientists, they can be other highly regarded members of the community who are knowledgeable in their field and understand the topics)
- science café events
- film screenings followed by a Q&A
- public forums
- games
- artists and arts-based activities

MULTIMEDIA INTERACTIVES AND VIDEO

Enhance your Genome DiY presentation experience with touchscreen interactives through the free app “Genome DiY”. Visitors can explore human genomic migration, the great scientific strides in understanding our genomes, and what areas of our lives are affected by genomic research through the featured interactives:

- **What Do You Think?** Explore the often ethical and social questions surrounding genomic research.
- **In and Beyond Africa** – explores how homo sapiens evolved in East Africa and across the globe.
- **Human Genome Timelines**

To ensure visitors only play a selected interactive, the DIY administrator can lock the app to allow for this functionality. Locking the app will allow the venue to control visitor access and prevent any device usage outside of the app. Administrator password: GenomeDiY#2020. To stream these interactives and play more games and watch videos go to <https://unlockinglifescode.org>.

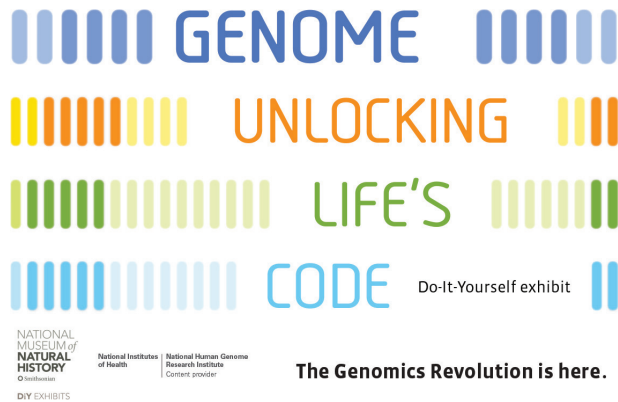


Additional Resources

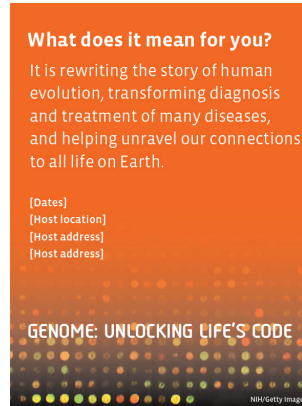
PROMOTIONAL MATERIALS

A template for postcards are available to promote the *Genome* DIY exhibition.

Types of promotional materials available may include: postcard (4" x 6"), poster (24" x 36")



Postcard: Front



Postcard: Back

SOCIAL MEDIA GUIDELINES

Feel free to promote the *Genome* DIY exhibition on your organization's website and social media platforms using the hashtags:

#GenomeDIY

#ULCEdRes

RELATED RESOURCES

For additional resources for *Genome* DIY exhibition, please see appendix.

Frequently Asked Questions (FAQ)

1. What is the Smithsonian Institution?

The Smithsonian Institution is the world's largest museum, education, and research complex, with 19 museums including the National Museum of Natural History (NMNH) located in Washington, D.C., the United States capital. The Smithsonian was founded in 1846 with funds from the Englishman James Smithson (1765–1829) as “an establishment for the increase and diffusion of knowledge.”

2. Why did NMNH decide to develop an exhibition about the Genome ?

The mission of the NMNH is to understand the natural world and the place of humans within it. Genomics offers a new way of documenting and understanding life on Earth and sheds new light on human evolution.

3. Do I have to display the entire exhibit?

No. The great thing about DIY is customization to fit each audience and community.

4. How do I set up an exhibit?

It is up to the participating organization to determine the best way to display the materials. For example, panels can be displayed on foam boards and easels or mounted on custom display boards, or even digitally.

5. How much will it cost to print the Genome DIY exhibition components?

Cost estimates depend on location, materials, and scope of exhibition size. NMNH provides the files free and in a flexible format to allow for a range of budgets.

6. We do not have access to “experts” in our location. Who can we turn to that can act as facilitators for our exhibition?

We often think of traditional “experts” as scientists. However, there are other “experts” who offer unique points of view: public administrators, community leaders, librarians, photographers, filmmakers, journalists. Even parents and children have unique perspectives on the subject. See additional resources section for more guidance.

8. I am having trouble accessing and/or using the Genome DIY files. Who should I contact?

Please contact NMNH-ExhibitsDIY@si.edu or 202-633-1152.



Evaluation

We hope that the *Genome* DIY exhibition has been a successful and worthwhile experience in your community. Thank you for being a collaborator in our efforts to make this exhibition accessible to a worldwide audience. We are grateful for your sharing the important message of soil science with your community.

Your feedback will help us understand your experience with the *Genome* DIY exhibition and help us modify and improve the exhibit materials and resources for future users.

Please [access the web survey/download the evaluation form] here: [URL TBD]

Appendix

PUBLIC OUTREACH & ENGAGEMENT

SCIENCE CAFÉS

[for adults and specifically young professionals]

Public gathering places for adults such as cafes and restaurants can be great venues for attracting a crowd. Science Café, Café Scientifique, and Two Scientists Walk Into A Bar are models for communicating science in public spaces. Audiences listen to a scientist (e.g., geneticist, bioinformatician, veterinarian/zoonotic specialist, entomologist/vector specialist) who playfully and with good humor explains their research followed by audience questions. This is a stress-free learning opportunity in a fun and relaxed atmosphere.

Learn more about these innovative group activities at the following websites:

Café Scientifique – <http://www.cafescientifique.org>

Nerd Nite – <https://nerdnite.com>

Science Café – <http://sciencecafes.org>

Story Collider – <https://www.storycollider.org>

Two Scientists Walk Into A Bar – <https://www.rhfleet.org/events/two-scientists-walk-bar;>

FILM SCREENINGS

[for adults]

Films can be a powerful way to generate a lively discussion about the topics at hand. All proper licenses and permissions must be secured when showing films publicly.

Genome: Unlocking Life's Code DIY Tip: Obtain a copy of a DVD (or video clip from the Internet) and view the film with an audience. Organize a panel of experts to discuss the film from their perspectives, broaden the conversation beyond the film, and invite questions from the audience—whatever is appropriate for your location. Experts can be filmmakers, scientists, doctors, community leaders, health workers, or other local leaders or community participants in the subject of the film.

Suggested Films & Videos:

Documentaries & Docuseries

Ken Burns Presents *The Gene: An Intimate History*

Science, social history and personal stories weave together a historical biography of the human genome while also exploring the stunning breakthroughs in understanding the impact genes play on heredity, disease and behavior. [Three one-hour docuseries]

The Gene Doctors

Every year, over a million babies are born worldwide with a hereditary disease. Many are serious, some fatal. For most of history, doctors could only treat symptoms. Then researchers began to target root causes, but the quest has been long, difficult, and punctuated by tragedy. Now an elite cadre of pioneers—call them gene doctors—is starting to win battles. Through intimate stories of families whose lives are being transformed, *The Gene Doctors* takes viewers to the frontlines of a medical revolution. With early successes and new treatments appearing on the horizon, families battling genetic diseases have never had such good reasons for hope. [00:54 min]

First in Human

First in Human is a documentary capturing the real-life experiences of doctors, researchers, staff, patients and their caregivers, at the National Institutes of Health Clinical Center. For over a year, Discovery, in collaboration with John Hoffman (“Weight of the Nation,” “Sleepless in America”), was embedded in the Clinical Center to capture the challenges faced in diagnosing and treating diseases. Narrated by Jim Parsons (“The Big Bang Theory,” “Hidden Figures”), the three-episode series showcases the innovative work that takes place within NIH’s Building 10 and provides an in-depth look at the reality of experimental medicine in clinical trials.

Short Videos

The Animated Genome

Take an amazing animated journey and explore what a genome is and why it matters to each of us. A perfect 5-minute primer in genetics and genomics. Recommended for students, teachers, and adults. [05:02]: <https://unlockinglifescode.org/media/animations/659#660>

This might be an interactive so it might not be necessary to include

YouTube

The Genome Within Us

Lessons from the Human Genome Project

Prominent scientists involved in the Human Genome Project reflect on the lessons learned. [07:26]: <https://youtu.be/qOW5e4BqEa4>

Richard Resnick, Welcome to the Genome Revolution

Quote: “The price to sequence a base [of the human genome] has fallen 100 million times. That’s the equivalent of you filling up your car with gas in 1998, waiting until 2011, and now you can drive to Jupiter and back twice.” [11:02]: <https://youtu.be/u8bsCiq6hvM>

Human Genome Timeline Animation

View major milestones in the history of the human genome in this animation.

[02:12]: <https://youtu.be/MNFUf8dqk68>

Biomedical Big Data Revolution

Find a cure for cancer from the comfort of your living room while in your PJs. It's more possible today than it was a short time ago. We are currently undergoing a revolution in the field of biomedical research that will enable tailoring preventative strategies and therapies directly for each patient—Precision medicine. Systems Biologist, Stefan Bekiranov talks about what's driving this revolution and how researchers are finding potential cures to diseases such as cancer at a faster rate than ever before.

[10:20]: <https://youtu.be/kyMzPwS88F8>

Genome + Environment = Dance!

[02:45]: https://youtu.be/J5_mjgZ_654

Health

Zarko's Story: Genomic Medicine in Action

Zarko Stanacev experienced years of mysterious debilitating symptoms. He applied to NIH's Undiagnosed Diseases Network (UDN) and had his genome was sequenced and interpreted by a team including Dr. William Gahl at the U.S. National Institutes of Health. They found a mutation in the gene NLRP3, which causes abnormal inflammation throughout the body. After only one treatment with a medicine to dampen this inflammation, Zarko's symptoms improved.

[06:22]: <https://youtu.be/McVwgeHa1Fk>

What is Precision Medicine?

This FDA Oncology Center of Excellence video is designed to help people better understand the need for all Americans to contribute samples to authorized genomic databases. The contributions can potentially help scientists develop better anti-cancer medications, especially for people at greater risk of developing cancer and may traditionally be medically underserved.

[02:53]: <https://youtu.be/ojrW8WeoANQ>

Open-source cancer research

How does cancer know it's cancer? At Jay Bradner's lab, they found a molecule that might hold the answer, JQ1 — and instead of patenting JQ1, they published their findings and mailed samples to 40 other labs to work on. An inspiring look at the open-source future of medical research.

[12:47]: <https://youtu.be/wOiKRVH0nQ8>

Harvey Fineberg, Are we ready for neo-evolution?

Medical ethicist Harvey Fineberg provides three paths forward for the human species: to stop evolving completely; to evolve naturally; or to control the next steps of human evolution, using genetic modification to make ourselves smarter, faster, and better. Neo-evolution is within our grasp. What will we do?

[17:21]: <https://youtu.be/mdT0IGAGECU>

Natural World

The Human Genome: Who Do We Think We Are?

As we learn more about genomic variation in specific populations and groups, more robust tests are being developed to help you decipher your ancestral origins. But, before you take one, you need to be aware that the results of these tests may alter your perception of your family history and even of yourself.

[06:26]: https://youtu.be/lltW_13Nvps

What Neanderthal DNA is Doing to Your Genome

Scientists estimate that about 2% of our DNA is from Neanderthals. In this week, the journal Cell showed what those Neanderthal DNA do to our genome.

[04:17]: <https://youtu.be/xX2iv4SyNHg>

Bringing Back the Woolly Mammoth

Some scientists want to genetically engineer elephants to be more like woolly mammoths. Could this save elephants from extinction-- AND save us from climate change?

[03:20]: <https://youtu.be/CQ078VfQXQI>

GUEST SPEAKERS & PUBLIC FORUMS

[for all audiences]

Skype A Scientist

We want to give students the opportunity to get to know a “real scientist”. This program allows us to reach students from all over the world without having to leave the lab! We have thousands of scientists ready to chat! Teachers can choose the type of scientist that will fit their classroom.

<https://www.skypeascientist.com/>

500 Women Scientists

The Request a Woman in STEMM directory (formerly Request a Woman Scientist) is a public-facing database of women scientists around the world, founded in January 2018 by a cohort of women scientists from 500 Women Scientists. The platform connects our extensive multidisciplinary network of vetted women in science with anyone who needs to consult a scientist for a news story, invite a keynote speaker or panelist for a conference or workshop, find a woman scientist to collaborate on a project, or serve as a subject matter expert in any capacity. <https://500womenscientists.org/request-a-scientist>

The Expert is In

The Expert Is In is a program that places one or more professionals or “experts” from the field, in the exhibition to converse with visitors, answer questions, or present objects, images, and graphics that represent his/her own research or involvement with genomics. Through their interactions with experts, visitors acquire

an appreciation for what experts do in the field, gain awareness of career options, and understand different perspectives in the field. Experts can be geneticists, education specialists, genetic counselors, healthcare providers, pharmacists, and other specialists.

Genome: Unlocking Life’s Code DIY Tip: “Experts” do not have to be scientists or health professionals. They can be other highly regarded members of the community who are knowledgeable in their field and understand our global health.

GAMES

[for middle school and high school students]

Touching Triton

With this engaging online interactive game, participants work together to ensure the health and safety of a deep space crew while learning about the genetics of common disease. Touching Triton teaches the complexity of common disease risk from family history, environment and individual genomic profiles. Players begin to understand how genetics and lifestyle choices affect their health.

<http://triton.hudsonalpha.org/>

Geniventure

Geniventure engages students in exploring heredity, genetics, and the protein-to-trait relationship by breeding and studying virtual dragons. Students play through six levels of challenges, conducting simulated experiments that generate realistic and meaningful genetic data. An integrated intelligent tutoring system (ITS) helps guide student learning and alerts teachers when students are struggling with specific concepts.

<https://concord.org/teaching-genetics/dragons/>

Genes and Traits Science Games

In this series of games, your students will learn about DNA, mutations, and heredity. The Genes and Traits learning objective— based on NGSS and state standards — delivers improved student engagement and academic performance in your classroom, as demonstrated by research.

<https://www.legendsoflearning.com/learning-objectives/genes-and-traits/>

First Farmers

Domesticated species serve as ideal model systems for examining key concepts of evolution because of their relatively short evolutionary history. Additionally, the genomics of domesticated species can be viewed as a tool to track human movements throughout history. This interactive learning activity is especially timely during the autumn, when people in cities and rural areas are deliciously aware of apples, pumpkins, sweet potatoes, and corn, as well as the traditional turkey or ham for the holiday table. Learning where and when these foods originated, and their links to early humans, emphasizes their sources in the natural world as well as the distant past. This activity clearly demonstrates how the skills and knowledge of people long ago – our ancestors around the world – have shaped our lives today.

<https://unlockinglifescode.org/iaba/#domestication-matching>

RELATED ORGANIZATIONS

American Society of Human Genetics (ASHG)

The American Society of Human Genetics envisions a future where people everywhere realize the benefits of human genetics and genomics research. We work to advance human genetics and genomics in science, health, and society through excellence in research, education, and advocacy. <https://www.ashg.org/about/>

Howard Hughes Medical Institute (HHMI)

HHMI is a non-profit organization whose mission is to advance basic biomedical research and science education for the benefit of humanity. HHMI's website provides resources for scientists, science educators, biomedical leaders, scholars, and researchers. Search for hundreds of free science education resources, including teacher guides, videos, films, activities, and professional development courses. Find information on current research programs, faculty programs, international programs, fellowships, and grants.

<http://www.hhmi.org>

National Human Genome Research Institute (NHGRI)

As a leading authority in the field of genomics, the National Human Genome Research Institute's mission is to accelerate scientific and medical breakthroughs that improve human health. NHGRI does this by driving cutting-edge research, developing new technologies, and studying the impact of genomics on society.

<http://genome.gov>

National Society of Genetic Counselors

The National Society of Genetic Counselors (NSGC) promotes the professional interests of genetic counselors and provides a network for professional communications. Access to continuing education opportunities, professional resources, advocacy and the discussion of all issues relevant to human genetics and the genetic counseling profession are an integral part of belonging to the NSGC. <https://www.nsgc.org>

American College of Medical Genetics and Genomics

The ACMG is the only nationally recognized interdisciplinary professional membership organization that represents the interests of the entire medical genetics team including clinical geneticists, clinical laboratory geneticists, and genetic counselors.

Together, the ACMG and its members engage in coordinated efforts to improve patient care, ensure optimal reimbursement for genetic service providers, establish standards of care and laboratory policy, and educate members about advances important to their practices. <https://www.acmg.net/>

American Association for the Advancement of Science

The AAAS seeks to "advance science, engineering, and innovation throughout the world for the benefit of all people." <https://www.aaas.org/>

National Science Foundation

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 “to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense.” NSF supports basic research and people to create knowledge that transforms the future.

<https://www.nsf.gov/>

BOOKS

Mendel in the Kitchen

By Nancy Marie Brown

The Language of Life

By Francis Collins

The Selfish Gene

By Richard Dawkins

A Crack in Creation: The Unthinkable Power to Control Evolution

By Jennifer Doudna and Samuel Sternberg

The Way Life Works

By Mahlon Hoagland and Bert Dodson

The Gene: An Intimate History

By Siddhartha Mukerhjee

The CRISPR Generation

By Kiran Musunuru

The Social Life of DNA

By Alondra Nelson

Genome: The Autobiography of a Species in 23 Chapters

By Matt Ridley

How to Clone a Mammoth

By Beth Shapiro

I Contain Multitudes

By Ed Yong

She Has Her Mother's Laugh

By Carl Zimmer

SOCIAL MEDIA HASHTAGS

#GenomeDIY

#ULCEdRes

WEBSITES

Genome: Unlocking Life's Code, <http://unlockinglifescode.org>

Biointeractive, Howard Hughes Medical Institute, <http://www.hhmi.org/biointeractive/>

DNA Learning Center (DNALC), Cold Spring Harbor Laboratory, <http://www.dnalc.org>

Genome British Columbia, <http://www.genomebc.ca/education/education-overview/>

Genetic Home Reference, National Library of Medicine, <https://ghr.nlm.nih.gov/>

Learn.Genetics, Genetic Science Learning Center, The University of Utah, <http://learn.genetics.utah.edu>

Teach.Genetics, Genetic Science Learning Center, The University of Utah, <http://teach.genetics.utah.edu>

The Jackson Laboratory, <https://www.jax.org/education-and-learning>

Your Genome, Wellcome Trust Sanger Institute, <http://www.yourgenome.org>

PBS Teacher Resources, <http://www.pbslearningmedia.org/search/?q=Genome>

Personal Genetics Education Project, <https://pged.org/>

Teaching Evolution Through Human Examples, Smithsonian National Museum of Natural History, <http://humanorigins.si.edu/education/teaching-evolution-through-human-examples>

Northwest Association for Biomedical Research (NWABR), <http://nwabr.org/teacher-center>

UDACITY, Tales from the Genome, <http://www.udacity.com/course/bio110>

HudsonAlpha, <https://hudsonalpha.org/digital-applications/#>

Science Education Partnership Awards, <https://nihsepa.org/>

National Center for Case Study Teaching in Science, University of Buffalo, <https://sciencecases.lib.buffalo.edu>