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What is the Human Genome Project?

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BIO-INSPIRED STEM TOPICS FOR ENGAGING YOUNG GENERATIONS
THANKS TO THE USE OF AUGMENTED REALITY

Project Number: 2023-1-DE03-KA220-SCH-000126516

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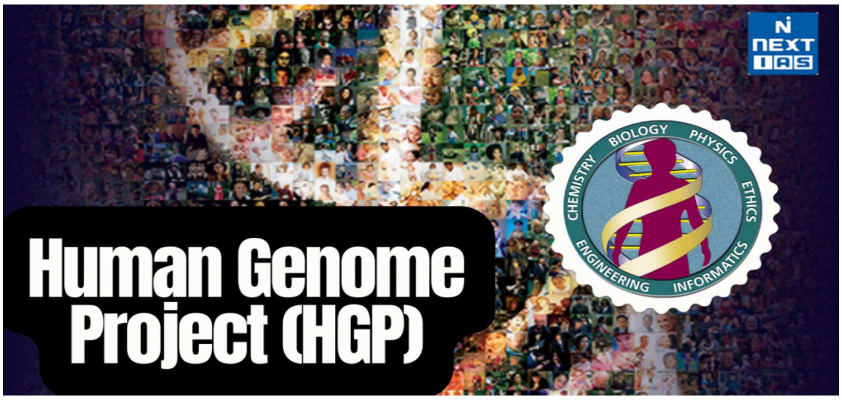

General topic of the learning path	Human Genome Project and Genomic Medicine
Specific name of the learning unit	What is the Human Genome Project?
Age of the target users	14-18 years
Requirements for the learner	Basic knowledge of DNA, genes, and molecular biology; familiarity with scientific inquiry; interest in history of science and biomedical research
Description of the learning unit	This unit introduces students to the Human Genome Project (HGP), a groundbreaking international research initiative that successfully mapped the human genome. Learners will explore its goals, technologies, major contributors, and the social and ethical implications. Through interactive content, including AR experiences and historical case studies, students will understand the scientific significance and lasting legacy of the HGP.
Subject: Parties involved	Science teachers, biology educators, ICT/AR facilitators, students, optional guest from biomedical or genomics research field
Keywords	Human Genome Project, DNA sequencing, genomics, biotechnology, international collaboration, ethics in research, data sharing, biomedical innovation

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Key qualifications, skills and knowledge that can be acquired	Understanding of what the Human Genome Project achieved and how it was conducted Insight into collaborative global science and scientific milestones Awareness of data ethics, privacy, and genomics Familiarity with genome sequencing technologies (e.g. Sanger sequencing) Development of digital literacy through AR tools Critical reflection on societal impact of genomic knowledge
Resources and didactic aids used	NHGRI Human Genome Project archive and fact sheets Visual timelines, photos from NHGRI Photo Archive Augmented Reality app (e.g. MoleculAR or GenomeAR) Interactive worksheets, presentations, and quizzes Group activities simulating HGP planning or ethics committee
Assessment criteria and evaluation	Comprehension of major HGP milestones Ability to describe sequencing methods and outcomes Critical responses to ethical questions Engagement in AR learning modules Group work and class participation

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Introduction:

The Human Genome Project (HGP) was one of the most important scientific projects of the 20th century. It was carried out between 1990 and 2003 and aimed to map and sequence the entire human genome — all the DNA that contains information about how the human body is built and functions. Scientists from many countries, including the United States, the United Kingdom, France, Germany, Japan, and China, worked together on this large international project. Their cooperation laid the foundation for modern genomics and changed how scientists study human biology (National Human Genome Research Institute [NHGRI], 2024).

The Human Genome Project significantly improved scientific understanding of heredity, genetic diseases, and human variation. It also transformed the way scientific research is conducted by promoting open data sharing and collaboration between different scientific disciplines (Collins, Morgan, & Patrinos, 2003). These principles remain essential in modern genomic research and biomedical innovation.

In this learning unit, students explore what the Human Genome Project was, why it was important, and how scientists successfully decoded human DNA. They also examine ethical challenges related to genome research, such as genetic privacy and responsible use of genetic data (Green & Guyer, 2015). By using augmented reality (AR) tools, students interact with DNA models and sequencing processes, which helps them better understand the scientific methods and discoveries that emerged from the Human Genome Project.

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1: Explore

Why Study the Human Genome?

Every living organism has a genome — a complete set of DNA instructions. The human genome can be compared to a very large instruction book that explains how our bodies are built and how they work. It tells cells how to grow, develop, and react to the environment.

In the early 1990s, scientists already had advanced microscopes and genetic tools, but they had never read the full human genome as one complete sequence. This is why the Human Genome Project (HGP) was so important — its main goal was to sequence all human DNA for the first time (NHGRI, 2024).

By studying the human genome, scientists can better understand why some people develop diseases such as cancer, diabetes, or inherited genetic disorders. This knowledge also helps researchers improve treatments and develop new medicines. In addition, genome research helps explain human evolution and why every person is genetically unique (Green & Guyer, 2015).

Big Goals, Big Teamwork

The Human Genome Project officially started in 1990 and had five main goals:

- Identify all the genes in human DNA
- Determine the sequence of approximately 3 billion DNA base pairs
- Store genetic information in public databases
- Improve tools for analyzing genetic data
- Address ethical, legal, and social issues (ELSI) related to genome research (Collins et al., 2003)

The project was a global collaboration. Scientists from the United States, the United Kingdom, France, Germany, Japan, and China worked together. More than 20 research institutions participated, forming the International Human Genome Sequencing

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Consortium. This large-scale cooperation showed how international teamwork can accelerate scientific progress.

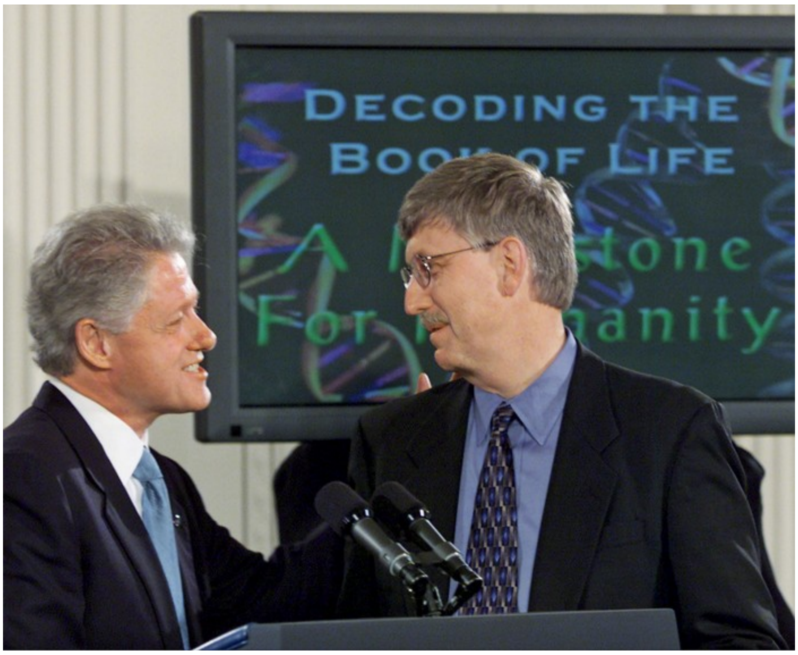

Figure 2. President Bill Clinton and Dr. Francis Collins at the White House in 2000 announcing the human genome draft. Source: NHGRI Photo Archive.

How Did They Sequence DNA?

DNA sequencing can be compared to reading the letters of a very long book. During the Human Genome Project, scientists mainly used a method called Sanger sequencing. This technique works by copying small DNA fragments many times. Special chemicals were added so that each DNA base — A, T, C, or G — produced a signal that could be detected by lasers. Computers then read these signals and reconstructed the DNA sequence (Collins et al., 2003).

Although Sanger sequencing was slow compared to today's methods, scientists managed to sequence more than 90% of the human genome by 2003. Today, thanks to new technologies, the same task can be completed in just a few hours and at a much lower cost — often under $1,000 per genome (T2T Consortium, 2022).

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Where Did the DNA Come From?

To create a human genome "reference," researchers used anonymous DNA samples. Most of the DNA came from volunteers living in Buffalo, New York. Around 70% of the final sequence came from one donor, while the remaining data came from 19 other individuals. All samples were anonymized to protect donor privacy and prevent misuse of personal genetic information (NHGRI, 2024).

Figure 3. DNA sequencing lab setup at the time of the Human Genome Project. Source: NHGRI Photo Archive.

Ethical Considerations

From the beginning, scientists involved in the Human Genome Project understood that genome information could raise serious ethical questions. For example, could genetic data be used to discriminate against people at work or in health insurance? Should genetic testing be allowed for unborn children?

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To address these concerns, the HGP created the ELSI program (Ethical, Legal, and Social Implications) and dedicated about 5% of the project's total budget to ethical research. This was one of the first large scientific projects to include ethics as a core component of its work (Green & Guyer, 2015).

Lasting Legacy

The Human Genome Project did not end in 2003. Its results opened the door to personalized medicine, genetic testing, ancestry research, and many modern biomedical technologies. The project also promoted open science through policies such as the Bermuda Principles, which encouraged scientists to share genetic data quickly and freely instead of keeping it private until publication (Collins et al., 2003).

In 2022, researchers completed the first truly complete human genome sequence using advanced sequencing technologies. This achievement filled in regions that could not be read during the original HGP and demonstrated how far genomic science has progressed since 2003 (T2T Consortium, 2022).

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2: Execute

In this phase, students apply their knowledge about the Human Genome Project through interactive and practice-oriented learning activities designed for use in Delightex. The focus is on understanding how genomic data is explored, explained, and used in real scientific and social contexts, without requiring students to perform complex laboratory tasks.

Using Delightex, students explore three-dimensional models of DNA and chromosomes placed directly in the learning scene. These visual models help learners clearly see the double-helix structure of DNA, base pairing, and chromosome organization. By rotating and zooming in on the models, students strengthen their understanding of genome structure and connect abstract textbook knowledge with visual representations (NHGRI, 2024).

As a visual support, teachers may link to short animated videos such as "DNA Structure and Function" by Khan Academy, which explains DNA components in a clear and age-appropriate way: https://www.khanacademy.org/science/ap-biology/gene-expression-and-regulation/dna-and-rna-structure/v/dna-structure-and-function

To support understanding of how the Human Genome Project sequenced DNA, students watch short explanatory videos embedded or linked within Delightex. These videos introduce the basic idea of Sanger sequencing and show how scientists read DNA fragments and assemble them into a full genome. A recommended example is the NHGRI educational video "How the Human Genome Was Sequenced", which explains the process in simple terms and connects it directly to the HGP (NHGRI, 2024): https://www.genome.gov/education/educational-resources

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After watching the video, students respond to reflection prompts in Delightex, such as why DNA had to be sequenced in small pieces and how computers helped scientists assemble the full genome. This helps learners actively process the information rather than passively watch the content (Collins et al., 2003).

Students then explore the practical use of genome data through interactive gene examples. In Delightex scenes, chromosome images include highlighted gene regions, such as the BRCA1 gene, which is linked to breast cancer risk. By selecting these markers, learners read short explanations about gene function and how genetic mutations can influence disease development. This activity connects the Human Genome Project to modern genomic medicine and shows how genome data supports medical research (Green & Guyer, 2015).
An optional supporting resource is the NHGRI page "What is BRCA?", written for a general audience:
https://www.genome.gov/genetics-glossary/BRCA

Ethical thinking is an important part of the Execute phase. Students are presented with short scenario-based situations related to genomic data use, such as genetic testing, data privacy, or access to medical information. These scenarios appear as information panels in Delightex and ask students to consider questions like who should have access to genetic data and how misuse could lead to discrimination. Each scenario is linked to the Ethical, Legal, and Social Implications (ELSI) program of the Human Genome Project, which dedicated part of its budget to studying these issues (Green & Guyer, 2015). For additional context, students can explore the NHGRI ELSI overview page:
https://www.genome.gov/about-genomics/policy-issues/ELSI

To highlight the importance of collaboration in large-scale science, students participate in a guided role-based discussion inspired by the original Human Genome Project. Learners take simplified roles such as scientist, data manager, or ethicist and discuss challenges related to international cooperation and data sharing. This reflects how scientists from different countries worked together and followed open-data principles like the Bermuda Principles, which promoted rapid data sharing (Collins et al., 2003).

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Throughout the Execute phase, students receive feedback through short quizzes, reflection tasks, and teacher-guided discussions. These activities help consolidate understanding and connect scientific knowledge with ethical and social responsibility. By the end of this phase, learners have actively engaged with real examples, technologies, and challenges linked to the Human Genome Project, preparing them for deeper reflection and enhancement in the next section.

3: Enhance

In this phase, learning is deepened and extended through reflection, visual reinforcement, and meaningful connections to real-world science. Augmented Reality (AR) plays a key role by helping students move from basic understanding to critical thinking and personal interpretation of genomic knowledge.

Using Delightex, students revisit key ideas from the Human Genome Project through interactive 3D models and short media resources. For example, DNA and chromosome models are explored again, but this time with a focus on function and application, not only structure. Students can rotate and examine chromosomes while reflecting on how genome mapping made it possible to identify genes linked to diseases and traits (NHGRI, 2024). This repeated interaction supports long-term retention and conceptual clarity.

To strengthen understanding, learners engage with short, high-quality explanatory videos linked inside the AR environment. One effective example is the video “The Human Genome Project Explained” by TED-Ed, which summarises the goals, challenges, and outcomes of the project in a visually engaging way suitable for secondary students: https://ed.ted.com/lessons/the-human-genome-project-tania-simoncelli
After watching, students answer reflection questions such as how genome knowledge has changed medicine and whether similar large-scale projects should be funded in the future (Collins et al., 2003).

Genome-related AR tasks also help students connect scientific content to modern medicine. For instance, learners explore highlighted genes linked to health conditions and discuss how genome sequencing supports early diagnosis and personalised

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treatment. This directly links the Human Genome Project to genomic medicine, helping students see its relevance beyond history (Green & Guyer, 2015). As enrichment, students may explore the NHGRI page "Genomics and Medicine", which explains real applications in accessible language: https://www.genome.gov/health/genomics-and-medicine

Gamified learning elements further enhance motivation. In Delightex, teachers can design short "genome missions" where students collect information, unlock content, or complete challenges such as identifying the correct role of genome databases or matching sequencing technologies to their purpose. These activities support active learning while keeping cognitive load manageable for B1–B2 learners.

Ethical reflection is also strengthened in this phase. Students revisit ethical questions introduced earlier, such as genetic privacy or access to genome data, and link them to present-day debates. AR panels may include short case examples and guiding questions connected to the ELSI program of the Human Genome Project, encouraging learners to form and justify their own opinions (Green & Guyer, 2015). An additional reference resource is the NHGRI ELSI overview: https://www.genome.gov/about-genomics/policy-issues/ELSI

To demonstrate learning outcomes, students may create short explanations using screenshots from AR scenes or record brief video reflections describing what they learned about genome sequencing or ethical responsibility. These outputs help combine scientific understanding, digital literacy, and communication skills.

Overall, the Enhance phase supports deeper understanding, reflection, and transfer of knowledge. By combining AR exploration, trusted scientific resources, and guided reflection, students strengthen their ability to understand genomics as both a scientific and societal field. This prepares them for future learning in biology, medicine, and biotechnology, while encouraging informed and responsible thinking about genetic data.

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AR Elements for Delightex – Learning Goals and Sources

AR element (Delightex)	Learning goal	Source / link
3D DNA double helix model	Understand the basic structure of DNA and base pairing (A–T, C–G)	Khan Academy. *DNA structure and function*. https://www.khanacademy.org/science/ap-biology/gene-expression-and-regulation/dna-and-rna-structure
3D chromosome model	Understand how DNA is organised into chromosomes and how the genome is structured	National Human Genome Research Institute (NHGRI). *Human Genome Project*. https://www.genome.gov/human-genome-project
Interactive genome map (AR panel)	Identify genes on chromosomes and understand the idea of a reference genome	NHGRI. *Genome basics*. https://www.genome.gov/genetics-glossary/Genome
Short explainer video	Understand the goals, timeline, and importance	TED-Ed. *The Human Genome Project*. https://ed.ted.com/lessons/the-

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3D chromosome model	Understand how DNA is organised into chromosomes and how the genome is structured	National Human Genome Research Institute (NHGRI). *Human Genome Project*. https://www.genome.gov/human-genome-project
(embedded link)	of the Human Genome Project	human-genome-project-tania-simoncelli
Gene example (e.g. BRCA1)	Connect genome sequencing to disease risk and genomic medicine	NHGRI. *BRCA genes*. https://www.genome.gov/genetics-glossary/BRCA
Ethics scenario panel (ELSI)	Reflect on ethical, legal, and social issues of genomic data (privacy, discrimination)	NHGRI. *Ethical, Legal, and Social Implications (ELSI)*. https://www.genome.gov/about-genomics/policy-issues/ELSI

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3D chromosome model	Understand how DNA is organised into chromosomes and how the genome is structured	National Human Genome Research Institute (NHGRI). *Human Genome Project*. https://www.genome.gov/human-genome-project
Gamified AR mission (teacher-created)	Increase motivation and reinforce key HGP concepts through active learning	Teacher-designed task in Delightex
Reflection / self-assessment panel	Develop critical thinking and personal reflection on genomics and society	Based on unit content and classroom discussion

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Conclusion:

The Human Genome Project (HGP) was one of the most important scientific achievements of modern science. It changed how we understand human biology and helped develop new areas such as precision medicine, bioinformatics, and ethical rules for sharing genetic data (Collins et al., 2003). Through this learning unit, students explored not only the main scientific results of the HGP, but also the wider context in which the project was carried out. This included global cooperation between countries, rapid technological progress, and ethical challenges connected to large-scale research.

By using augmented reality tools such as MoleculAR and Genome AR, students were able to explore complex genomic concepts in an interactive way. These tools helped learners visualise DNA structures, understand sequencing processes, and connect theory with real biomedical examples. Activities focused on ethical dilemmas, genome exploration, and international collaboration allowed students to experience the scientific and social challenges faced during the Human Genome Project.

As a result, this unit supported the development of scientific literacy, critical thinking, ethical awareness, and digital skills. Students learned how genomic data is collected, analysed, and shared, and why this information must be used responsibly in modern medicine and biotechnology (Green & Guyer, 2015). The Human Genome Project continues to influence many fields, including healthcare, agriculture, and ancestry research.

At the end of the unit, students are encouraged to reflect on how current topics such as gene editing, data privacy, and equal access to medical technologies are connected to the legacy of the HGP. Understanding this connection helps learners become informed and responsible participants in future discussions about science, technology, and society.

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Phase	Description
Explore	- Research and Discovery: tudents explore the Human Genome Project using NHGRI fact sheets, short educational videos, and visual timelines. These materials introduce the main goals, timeline, and scientific importance of the HGP.
	- Content Development: Teachers guide discussions using interactive timelines and historical examples. Ethical questions related to genome research, privacy, and data use are introduced to prepare students for later reflection.
	- Needs Analysis: Students' prior knowledge of DNA, genes, and genomics is assessed through short discussions or diagnostic questions. This helps teachers identify gaps in understanding and adapt explanations and AR activities accordingly.
Execute	- Curriculum Implementation: Students take part in guided lessons supported by AR modules. Using tools such as MoleculAR and Genome AR, they explore DNA structure, sequencing processes, and genomic regions connected to real-world examples.
	- Interactive Exercises: Learners complete a virtual sequencing lab, take part in ethics debates, and engage in AR-based role-play activities. Gene hunting missions allow students to locate specific genes and link them to traits or diseases, reinforcing key concepts from the Explore phase.
	- Feedback Collection: Understanding is supported through student reflections, peer feedback during group tasks, and teacher feedback after discussions and AR activities.
Enhance	- AR Integration: MoleculAR and Genome AR are used to deepen understanding through interactive 3D exploration of DNA, proteins, and genomic regions. Students can rotate, zoom, and manipulate models to strengthen spatial and conceptual understanding.
	- Interactive Learning: Learners independently explore AR content at their own pace, revisiting complex topics such as sequencing, gene function, and genomic organisation.
	Points and Badges Students earn badges for completing AR tasks, solving challenges, and correctly identifying genomic features. Classroom leaderboards can be used to increase motivation. **Leaderboards** Visual rankings show progress and achievements based on completed AR activities and challenges. **Quests and Levels** Mission-based learning is used, where students unlock new genomic tasks and challenges as they progress through levels. **Rewards for Exploration** Additional AR content or datasets are unlocked when students complete optional exploration or reflection tasks. **Collaborative Gamified Tasks** Students work in teams on genome analysis tasks or simulations, encouraging communication, cooperation, and shared problem-solving.
	Assessment includes AR-based visual walkthroughs, peer-reviewed group projects, and multimedia reflections. These formats allow students to demonstrate understanding through explanation, visual evidence, and discussion rather than memorisation alone.

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References

1. Collins, F. S., Morgan, M., & Patrinos, A. (2003). The Human Genome Project: Lessons from large-scale biology. Science, 300(5617), 286–290. https://doi.org/10.1126/science.1084564
2. Green, E. D., & Guyer, M. S. (2015). Charting a course for genomic medicine from base pairs to bedside. Nature, 470(7333), 204–213. https://doi.org/10.1038/nature09764
3. National Human Genome Research Institute. (2024). Human Genome Project fact sheet. https://www.genome.gov/human-genome-project
4. National Human Genome Research Institute. (2024). Ethical, legal, and social implications (ELSI) research program. https://www.genome.gov/about-nhgri/what-we-do/elsi-research-program
5. T2T (Telomere-to-Telomere) Consortium. (2022). The complete sequence of a human genome. Science, 376(6588), 44–53. https://doi.org/10.1126/science.abj6987
6. Sanger, F., Nicklen, S., & Coulson, A. R. (1977). DNA sequencing with chain-terminating inhibitors. Proceedings of the National Academy of Sciences, 74(12), 5463–5467. https://doi.org/10.1073/pnas.74.12.5463
7. NHGRI Photo Archive. (n.d.). Human Genome Project historical images. National Human Genome Research Institute. https://www.genome.gov/about-nhgri/who-we-are/photo-archive
8. MoleculAR. (n.d.). MoleculAR: Augmented reality for molecular biology. https://molecularweb.org
9. Genome AR. (n.d.). Genome AR educational application. https://genomear.org (Use the exact URL provided by your institution/app store if required.)
10. YouTube. (n.d.). Human Genome Project explained [Video]. Recommended source: National Human Genome Research Institute official channel.
    https://www.youtube.com/@genomegov
    (Teachers should select age-appropriate videos for classroom use.)

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