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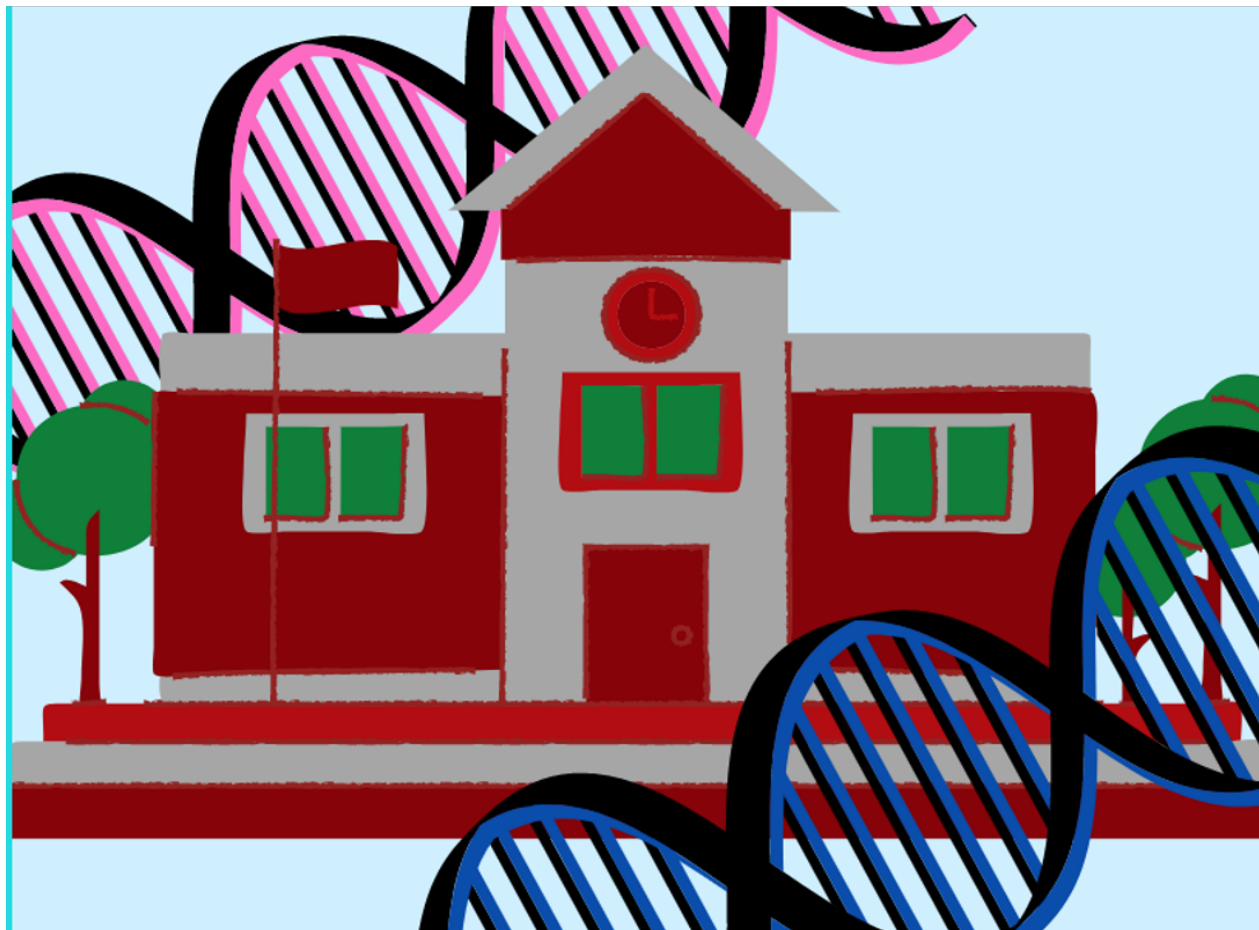
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# Genomic Literacy In High School: Building the Future

 Genomes2People 1 hour ago · 6 min read

by Sachi Badola



The complexity of practicing precision medicine begins in a high school classroom.

*What does genetics mean to me?*

Taking a step back into my seventh-grade life science class, we discussed the concepts of heredity. Genes, alleles, the structure of DNA. The one and only Gregor Mendel and his pea plants. The foundational knowledge of genetics. Freshman year, we dove deeper into the concept of protein synthesis. *How does the central dogma allow genetic information to pass from DNA to RNA to protein?* Sophomore year, we continued our investigation of genetics in AP Biology. Genetic diseases, chromosomal

abnormalities, Punnett square analysis. However, something was clearly missing: the application of this science to human health.

Starting in June 2020, I have had the immersive and incredible experience of virtually interning with the Genomes2People Research Program. Genomes2People, affiliated with Brigham and Women's Hospital, Broad Institute, and Harvard Medical School, works with preventive medicine and implementing genomic information into precision medicine and society at large. For me, this has been a tremendous opportunity for growth: a curious student meets an inquisitive, creative research program.

A personal highlight was working on qualitative data analysis for the MilSeq Project, which examined incorporating genomic sequencing into the United States Air Force. This study showed that military primary healthcare providers were able to effectively explain genomic results to patients, and taught me that genomic sequencing is more than just technology — it is also important to consider how genetic information is explained to a patient.

By attending insightful Socratic sessions, listening in on lab meetings, and reading through engaging papers as a part of this program, I have learned about genomics through ethical and social lenses. Not only have I learned a lot about the field of genomics and genomic sequencing, but I have also learned about the barriers that prevent genomics from being integrated into

clinical care for all, and I continue to grow as a student and future hopeful geneticist. The wealth of knowledge, insight, and inspiration gained from Genomes2People will benefit me, but most of my peers have yet to be inspired by genomics the way I have been.

As I return to learning and growing in the science classroom at my public suburban high school, I am sure, more than ever, that something is missing. My classmates may never fully understand the value of genomics in healthcare or the importance of having a basic knowledge of preventive health. If we do not expose a majority of high school students to the reality of genomic sequencing and the value of understanding one's genome, future generations may not appreciate its importance.

Not all students will take Advanced Placement Biology or remember details from their biology class's genetics unit. This is a problem because constructing a future of preventive health and preventive genomics will require basic levels of trust and literacy, if not curiosity and inspiration. This is why I firmly believe that high school science curriculum developers should offer and require that all students take a genetics elective at school. To build a basic level of scientific literacy, especially in a world transitioning towards preventive genomics and personalized medicine, students must be exposed to genetics from a much earlier age.

What might this elective consist of? For starters, students should learn the basics of DNA and genetics at a molecular level. A solid understanding of genes, the rules and patterns of inheritance, and mutations are a must. However, an elective is often a specialized class that can immerse a student into a particular field or area of study. A genetics elective curriculum should discuss the implications, limitations, and challenges of genomic medicine and precision health in the future. Such issues, including a lack of diversity in genomic data and genetic counseling and privacy concerns over the accessibility of genetic information, can be tackled and discussed in a classroom setting as early as high school.

The elective course should include acknowledging some of the dark history of genomics, addressing its mistakes, and proposing new solutions to develop further trust. Genomics continually faces many challenges, and unfortunately, a lack of diversity correlates with minimal interest and opportunities in the field.

One significant issue, for example, is the lack of diversity within the field of genetic counseling. By having conversations on the impact of genetic results and genomic medicine, a diverse array of students may be more inspired to pursue a genetic counseling career. This is significant, as representation in science is essential to build trust and reflect the population. Moreover, if preventive healthcare becomes routine, it must benefit all patients equally,

not disproportionately.

Another challenge genomic medicine faces is that most of the genetic information available comes from people of European ancestry. Recruiting people from minority backgrounds and lower socioeconomic status into genomic research must be a priority for genomic medicine to improve health equity.

Even if students are not interested in a pre-medicine track, all students deserve the right to effective and personalized healthcare. If healthcare is advancing into an era of precision medicine, future generations should be prepared to appreciate, participate, and challenge genomics. We must readjust our priorities and redefine “scientific literacy” to include a level of “genomic literacy” for the general population. Integrating genomics into medicine also involves efforts from people beyond science and healthcare: we will need policy makers with genomics literacy to help shape stronger laws regarding genetic privacy and software engineers with genomics literacy to understand the challenges of genomic data storage and develop new ways to analyze and use this information.

Why *genomic literacy*? A substantial portion of people have a genetic risk factor, and having a baseline understanding of DNA, genetics, and implications of genetic risks is essential for equitable health. People who are not exposed to the world of genetics may

not benefit from all it has to offer due to misconceptions and distrust of the system itself. If they receive actionable genomic results without an educated attitude, they may struggle to take follow-up steps.

Some may argue that most colleges offer genetics classes and that high school is a time to expose students to more relevant subjects and electives. However, access to a certain level of genomic literacy in college will not benefit those who cannot afford higher education. Keeping this in mind, a baseline genomics elective should be offered (if not required) at high schools across the nation. Many high school students take health electives related to decision making, life management skills, and other proactive skills. Why, then, would genetics not be considered relevant? If we value proactivity when it comes to taking care of mental health, balancing school and extracurriculars, and excelling academically, we should also value proactivity with genomic literacy.

Let us revisit the question: *What does genetics mean to me?* To me, the human genome holds the key to who we are. In the era of precision medicine, it is essential to unlock this key and determine what genetic sequences can reveal about a person and their future. However, a baseline level of genomic literacy must be enforced in high schools across the globe, as genomics' power lies in its ability to predict, inform, and prevent.

When incorporated equitably and in tandem with lifestyle changes, genomics will inspire a new generation of improved health and medicine. As President Joe Biden's elected presidential scientific adviser and top geneticist Eric Lander once said, **“All the beautiful complexity of life had simplicity at its core.”** The complexity of practicing precision medicine begins in a high school classroom: a genetics elective.

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*Genomes2People (G2P) is a program of Brigham and Women's Hospital, the Broad Institute and Harvard Medical School. Visit [genomes2people.org](https://genomes2people.org) for more and follow us on Twitter [@Genomes2People](https://twitter.com/Genomes2People).*

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