



STEMBoost Newsletter

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Officer Confirmations & Dodgen Invitational

Angela Zhang

This month, as officer applications were processed, new officers have been selected to join the STEMBoost team. We welcome Ashish Kashyap as the Marketing Outreach Manager, Anish Bayyapu as the Design/Advertising Manager, Ishanvi Kommula as the Communications and PR Manager, Pranav Annapillai as the Social Events Coordinator, and Justin Lo and Irene Tian as the new Operations/Logistics Managers, and look forward to moving forward.

In addition, the Kennedy Science Olympiad teams participated in their first invitational of the year, the online Dodgen-Walton Invitational, on November 13. We congratulate Kennedy on a well-deserved first place win in the Gold Flight division, and wish them luck at their upcoming invitationals in December and beyond.

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Fun Fact

Is cancer caused mostly by genetic?
(See answer in the back)

The Value of Genetic Databases

Joseph Lee

In the sci-fi film *Gattaca*, the genes an individual is born with determines their societal worth. Hospitals test a newborn's DNA to determine expected lifespan, physical ability, intelligence, and risk of disease. Employers and insurance companies routinely abuse genetic information, and society constantly discriminates against individuals with "lower quality" genes; however, the exaggerated and unrealistic society portrayed in *Gattaca* only exacerbates scientifically unfounded claims. For one thing, modern geneticists agree that DNA is not the sole determinant of a person's traits. The environment a person is raised in is a factor just as, if not more important, and the influence of this external variation makes it impossible to accurately determine a person's characteristics to such an extent as is portrayed in *Gattaca*. Furthermore, genetic data is a powerful tool that can be used for good, to enhance people's lives and improve society. For these reasons, individuals should not own their DNA; instead of giving into unproven fears, increasing the availability of genetic data pushes forward developments in healthcare and strengthens criminal justice to benefit society in countless ways.

DNA data has served an invaluable role in criminal justice, as law enforcement has used it to confirm criminal suspects and reduce crime. There have been countless examples of DNA data being used to uncover the perpetrator of an unsolved case, one being the murder of Christine Jessop over 35 years ago. Recently, in 2020, the police identified the true killer as a man named Calvin Hoover using a DNA sample to identify the culprit along with the help of the genealogy website GEDmatch (1), after previously misidentifying the perpetrator. DNA information collected from a crime scene can be matched to a database to find the culprit or people related to the culprit. In this case, this method helped provide a sense of relief and closure to the victim's family after several decades of uncertainty. DNA evidence contributed to tens of thousands of cases in 2015 alone (7), demonstrating the effectiveness and widespread applications for this tool. In addition to finding criminals in the first place,

studies have also found that adding a convict to a DNA database helps deter crime. One study was done regarding Denmark, after “an expansion of the DNA database in 2005 added anyone charged with a serious offense.” Compared to criminals who were not added to the database, criminals who were added to the database showed a 42% decreased likelihood of another conviction occurring within the following year (2). When a criminal’s name is added to a DNA database, they can be easily identified by law enforcement should they commit future crimes. Punishments also get harsher for each repeat offense, which has a significant effect in dissuading criminals. Despite the potential advantages and public support behind the use of DNA to solve crimes, much of DNA data is still unavailable for usage by law enforcement purposes due to the fears and stigma surrounding genetic privacy. This severely limits the usefulness of genetic databases for criminal justice. Overall, the usefulness of genetic databases consisting of DNA information from millions of individuals for criminal justice emphasizes why giving organizations the right to own DNA information can be hugely beneficial to society.

Besides its role in criminal justice, expanding genetic databases benefits the progression of medical research that could save or improve quality of life in patients. Researchers can use genetic data mapped from thousands of individuals to find “genetic markers” that are associated with a particular disease. They have already been used to identify the presence of genetic disorders and risk of developing diseases, and one notable example is the BRCA1 or BRCA2 gene. Mutations in these genes can increase the chance of developing breast cancer to 50% (6). With the help of genetic databases, people can test their DNA to see if they are at greater risk for developing various health problems. This elevates patients’ self-awareness and increases the chance that they will check up with their doctors and be diagnosed in the early stages of a disease. In particular, early stages of cancer are more treatable and have an exponentially greater chance of survival than later stages, not to mention the differences in cost. Risk identification is also crucial as it motivates patients to change their lifestyle to prevent certain diseases. In addition to disease prediction, increasing the availability of genetic data for hospitals and healthcare providers opens up the potential for the development of personalized medicine. When patients are treated for a disease, “it can be difficult to predict who will benefit from a medication, who will not respond at all, and who will experience negative side effects (7).” Each patient responds differently to a certain drug treatment, and this is partly because each person also has a different genetic code. Despite this, medical professionals today use a “one dose treats all” approach, so some people may receive too much or too little of a drug. This can cause several negative side effects; however, by using DNA data to gauge how a specific person responds to a set of substances, medical professionals can find the most effective treatments for a specific person. In order to develop medical techniques, researchers require data from a vast number of people to use in DNA databases. Unfortunately, there is often a shortage of volunteers in research studies due to people’s unfamiliarity with DNA research that benefits society in the long term by contributing to improving healthcare for everyone. Individual ownership of genetic information would introduce clear barriers to the fields of health and medicine. Altogether, it is essential that organizations have the right to access people’s genetic information for medical development.

Many people fear that genetics companies may not properly protect their data to prevent genetic discrimination, leading to a society akin to the one portrayed in *Gattaca*. However, much of the fear surrounding genetic testing “may be attributed to scientific illiteracy in the general public, misconceptions among various groups of people, and the existence of other sorts of privacy invasions which leave individuals apprehensive about how their genetic privacy will be protected (4).” In reality, even with continued developments in the field of genetics, genetic discrimination has still not yet become a significant concern. From a legal standpoint, this problem has been shrinking over the past few years. From 2013 to 2018, the average number of genetic discrimination cases each year has decreased by over 100, from ~300 in 2013 to ~200 in 2018. Furthermore, none of these lawsuits have even sued an employer for using genetic information against them, but for employers improperly obtaining possession of family medical histories (9). In most cases, already established laws prevent discrimination before it happens. Consequently, it would not make sense to abandon such enormous scientific developments to cater for risks and concerns that are arguably trivial in comparison. Such fears surrounding the new and unknown have also been seen and disproven countless times throughout the past. In 1796, when Edward Jenner developed the first vaccine against the smallpox virus, it faced stark opposition from those who believed this invention seemed too good to be true, or argued that forcing people to vaccinate was a “violation of personal liberty (5).” Today, routine

vaccinations have been completely integrated into the medical system, and vaccines are estimated to have saved hundreds of millions of lives since their development.

Therefore, granting sole ownership of genetic data to individuals entities will serve as a detriment to society. Rather, we must work towards realizing the potential for genetic data to help progress healthcare and improve the criminal justice system while maintaining good policies for treatment of this data. While history has proven that initial mistrust of a new technology is a certainty, overcoming our preliminary fears will allow us to make progress and reap tremendous benefits for the future.

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Answer: The great majority of cancers, some 90-95% of cases, are due to environmental factors. The remaining 5-10% are due to inherited genetics.