

Medical students may glimpse future in examining their genetic code

June 3 2013, by Lisa M. Krieger

Most students read about genetics in a textbook. Stanford University students are reading something far more intimate: their own DNA code.

In this firsthand view of their blueprint of life, one student discovered he had a different father than he thought. Others found they faced increased odds of developing [brain diseases](#) such as Alzheimer's, but reduced risk of fearsome cancers. Still others learned about their appearances and ancestry, providing new answers to that age-old question: Who am I?

Genetics 210, a provocative class in the School of Medicine, is a pioneer in the growing movement to advance a new era in [modern medicine](#), where genetic information allows us to not only look into our medical futures but also sometimes take action - like actress [Angelina Jolie](#), who underwent a [double mastectomy](#) to prevent hereditary [breast cancer](#).

"Trying to use my own [genetic information](#) as a learning tool - that sounded like something I wanted," said bioscience graduate student Thomas Roos, 28, who learned he and his twin brother, Andrew, have slightly elevated risks of an [Achilles tendon](#) injury and dementia but a reduced risk of heart disease and arthritis.

Some students found they had an overabundance of Neanderthals in their ancient past. Still others detected predispositions to diabetes, [chronic kidney disease](#), cancer or [drug sensitivity](#).

Medical schools increasingly are including genetic education in their curriculums, alarmed by surveys showing few physicians know how to incorporate such data into their patients' medical care.

Stanford is one of a handful of universities that offers the School of Medicine course to nonphysicians, so graduate students and even undergraduates get the chance to read their very own A, C, T and G sequence of nucleotides.

"I am teaching something they need to know," said Stuart Kim, a professor of [developmental biology](#) and genetics who co-founded the course. "These are future scientists who need to understand the underlying concepts behind this exploding field."

"We are preparing them to do cutting-edge biomedicine. This makes it very real."

The testing is confidential and voluntary. They use a cotton swab to get a specimen from inside their cheek, then mail it to the Mountain View company 23andMe for processing. If students don't want to study their own genes, they can use a public reference sequence.

What they learn is not a diagnosis, but an estimate of risk.

It is not a complete sequence of all 3 billion nucleotides in their genome, but a snapshot of 1.1 million better-understood variants linked to thousands of conditions and traits.

It is the statistics behind that analysis - and the interpretation of what the data means - that become the centerpiece of heated classroom debate. Students also discuss classroom trends and surprises.

Other revelations are deeply personal, such as the one a medical student

disclosed to Kim: The test revealed the student's father was not the uneducated alcoholic married to his mother - but a doctor. "He was amazingly OK with this," Kim said.

Some of the information can be upsetting, because there aren't cures. For instance, students might find they carry a variant of the LRRK2 gene that predicts Parkinson's disease, or variants of the apolipoprotein E gene that increase risk of developing Alzheimer's. At least one student has sought counseling.

The Roos twins are using the information to change behaviors. Their data suggested they had an elevated risk of Achilles tendon injury, so they added more strengthening and stretching to their triathlon training.

The curriculum is gaining traction elsewhere. The company 23andMe offers discounts on the testing and course materials to universities, and it has worked with schools such as the University of Iowa, the University of Texas and Duke University.

"We are in the perfect place and the perfect time for this type of educational approach," said Dr. Charles Prober, Stanford's senior associate dean for medical education. "It is critical for our students to develop a deep, rich understanding of the hope and the limitations of personal genomics."

The course introduction two years ago, however, triggered intense controversy at Stanford, leading to the creation of a 29-member task force - lawyers, physicians, ethicists, philosophers and other faculty members - who worried that the findings might trigger student stress.

They feared harm to students "from either what they learned in genetic testing, or in possible breaches of privacy ... if they started chatting about results in class," said Stanford law professor Hank Greely, director

of Stanford's Center for Law and the Biosciences and a member of the task force.

Students now have access to genetic counseling and psychiatric care, and they must attend several "informed consent" sessions about the implications of their findings.

However, there is no ongoing review of the course by the medical school.

"I think this is a potentially very worthwhile medical school course," said bioethicist and attorney George J. Annas of Boston University. "Mostly medical students practice on patients - this gives them an opportunity to practice cutting-edge medicine on themselves, making them ... more understanding of why we have rules for informed consent and privacy."

The Stanford [students](#) said they were willing to accept any emotional angst that comes with the findings and said they had been assured by attorneys that health insurance was not at risk.

"As a scientist, I always value knowledge. Knowledge is power. Even if it is negative, I would want to learn," said Andrew Roos, who along with his brother hopes to build a database that links specific genetic variants to athletic injuries.

Biochemistry student Kateryna Kozyrytska, 25, knows genes aren't destiny. She's a brunette, although her analysis suggested she had a higher chance of being blond. And while she has an elevated risk of heart disease, french fries are still tempting.

"For me, I think it is important to know," she said. "If I had some elevated risk for a funky disease that is not treatable, I could consider investing in research, or develop a career to figure out how to fix it."

"There is a lot more to science if you can actually use it."

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