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The Inconvenient Science of Racial DNA Profiling

By Melba Newsome 10.05.07 | 11:00 AM

On July 16, 2002, a survey crew from the Department of Transportation found Pam Kinamore's nude, decomposing body in the area along the banks of the Mississippi known as Whiskey Bay, just west of Baton Rouge. The police tested the DNA and quickly realized that they were dealing with a serial killer: the same man who had killed two other white, middle-class women in the area.

The FBI, Louisiana State Police, Baton Rouge Police Department and sheriff's departments soon began a massive search. Based on an FBI profile and a confident eyewitness, the Multi-Agency Homicide Task Force futilely upended South Louisiana in search of a young white man who drove a white pick-up truck. They interrogated possible suspects, knocked on hundreds of doors, held frequent press conferences and sorted through thousands of tips.

In late December, after a fourth murder, police set up a dragnet to obtain DNA from some 1200 white men. Authorities spent months and more than a million dollars running those samples against the killer's. Still nothing.

In early March, 2003, investigators turned to Tony Frudakis, a molecular biologist who said he could determine the killer's race by analyzing his DNA. They were unsure about the science, so, before giving him the go-ahead, the task force sent Frudakis DNA swabs taken from 20 people whose race they knew and asked him to determine their races through blind testing. He nailed every single one.

Still, when they gathered in the Baton Rouge police department for a conference call with Frudakis in mid-March, they were not prepared to hear or accept his conclusions about the killer.

"Your guy has substantial African ancestry," said Frudakis. "He could be Afro-Caribbean or African American but there is no chance that this is a Caucasian. No chance at all."

There was a prolonged, stunned silence, followed by a flurry of questions looking for doubt but Frudakis had none. Would he bet his life on this, they wanted to know? Absolutely. In fact, he was certain that the Baton Rouge serial killer was 85 percent Sub-Saharan African and 15 percent native American.

"This means we're going to turn our investigation in an entirely different direction," Frudakis recalls someone saying. "Are you comfortable with that?"

"Yes. I recommend you do that," he said. And now, rather than later since, in the time it took Frudakis to analyze the sample, the killer had claimed his fifth victim. The task force followed Frudakis' advice and, two months later, the killer was in custody.

Colorblind CODIS, Genetic Drift

Tony Frudakis first heard about the Baton Rouge serial killer just like everyone else outside of Louisiana -- on cable news. As months went by, the body count climbed, Frudakis followed the case, thinking "why on earth can't they catch this guy?"

Several years earlier, Frudakis' father was shot when he confronted a would-be car thief in the driveway of his Long Beach, California, home. The thief escaped but dropped his driver's license at the scene and was apprehended quickly. The serial killer had also left behind his identification in his DNA but, unlike a driver's license, his genetic ID revealed nothing about his physical characteristics -- or at least it revealed nothing the police could use.

The DNA forensic products available at the time could only be used to match DNA specimens in the CODIS, or Combined DNA Index System, database which contains about 5 million DNA profiles. If investigators have a crime scene sample but no suspect, they run it against those in the database to see if it matches a sample already on file.

But while CODIS is good at linking the criminals who are already catalogued from other crimes, the system is useless in identifying physical characteristics. It says nothing about race. It has been specifically set up to

reveal no racial information whatsoever, in part so that the test would be consistently accurate irrespective of race.

But non-scientific considerations also factored into how the system was established. When the national DNA Advisory Board selected the gene markers, or DNA sequences which have a known location on a chromosome, for CODIS, they deliberately chose not to include markers associated with ancestral geographic origins to avoid any political maelstrom.

DNAWitness, the test Frudakis applied in the Baton Rouge case, uses a set of 176 genetic markers selected precisely because they disclose the most information about physical characteristics. Some are found primarily in people of African heritage, while others are found mainly in people of Indo-European, Native American or South Asian heritage.

No one sequence alone can predict ancestral origin. However, by looking collectively at hundreds and analyzing the frequency of the various markers, Frudakis says he could predict genetic ancestry with 99 percent accuracy.

Based on paleoarcheological evidence and other kinds of DNA testing, scientists believe we are all derived from populations that started in Africa and migrated out some 200,000 years ago. They first settled in the Fertile Crescent, the historic region of the Middle East flanked by the Mediterranean on the west and the Euphrates and Tigris rivers on the east.

Various offshoots went in every direction and eventually crossed the Bearing Strait to America and the populations became sexually isolated. This process, known as genetic drift, caused markers to evolve at different frequencies in different populations and gave rise to the ethnic diversity we see today.

"There is tremendous genetic diversity among other species of animals but not among humans because our common history is so recent," he explains. "We're 99.9 percent identical at the level of our DNA. It's the .1 percent that makes us different and about 1 percent of that .1 percent is different as a function of our differing history." Frudakis mines that .001 percent to find distinctive differences that determine genetic ancestry.

Using essentially the same science, DNAPrint helped Oprah Winfrey, Whoopi Goldberg, Quincy Jones and Chris Tucker trace their lineage back to Africa for the four-part PBS series, *African American Lives*. It's also how, days after the body of 26-year-old Carrie Lynn Yoder was found at Whiskey Bay, Frudakis was able to conclude to a statistical certainty that the killer was black.

Racial DNA Profile Leads to Killer

The results from DNAPrint sent the task force scrambling back to earlier tips about non-white suspects. Three days before Pam Kinamore's abduction, a black man had tried to rape and murder Diane Alexander in her home. She survived because her son returned home and interrupted the attack. Alexander sustained cuts, fractures and stab wounds but was able to describe the man in detail. Police never bothered to test the DNA her attacker left behind. Her case could not possibly be linked to the other murders, they reasoned, because the suspect was black.

The police had also refused to listen to the pleadings of Collette Dwyer, who thought she might know the serial killer's identity: Derrick Todd Lee, a 34 year-old black man with an extensive rap sheet for domestic violence, assault, stalking and peeping. Lee had stalked Dwyer for two years after meeting her at the seafood shop where she worked. One day, he pushed his way into her apartment, got a drink of water and told her he wanted to "take care" of her.

Lee was arrested after her two children chased him and noticed he had a gun. He was sent to prison for two years. Dwyer called police after Pace's murder in May, Kinamore's in July and again in September following the release of the FBI profile. The police talked to Lee but didn't bother to take DNA since they were looking for a white man.

But after the conference call with Frudakis, Lee jumped to the top of the suspect list. They got a subpoena for his DNA, collected a cheek swab and a day later, they had their answer: he was their man. Lee skipped town just ahead of the arrest warrant but was tracked down in Atlanta and returned to Baton Rouge within days. "CAUGHT" declared the Baton Rouge Advocate in giant print.

Relatives of the victims described their thrill and relief that a dangerous killer was finally off the streets, but also frustration that it has taken so long. Few people knew that the most crucial piece of evidence was not unearthed by the hapless task force or forensic scientists but by a drug developer some 800 miles away.

DNAWitness Does Forensics

It takes me a while to find DNAPrint Genomics in spite of its address on one of the main thoroughfares in Sarasota. The company is hidden in a small industrial park behind a chain-link fence across from a busy convenience store. The office suite is marked by a sign leaning against one wall and a laminated sheet of paper with the word 'DNAPrint' taped to the glass entry door. The reception area is sparsely furnished, decorated only with certificates and plaques.

I am late for my appointment but Frudakis is later. He is out to lunch and arrives 15 minutes after me. Carrying his lunch bag and dressed in jeans, hiking shoes and a muted floral shirt, he looks more like a grad student than a chief scientific officer responsible for some groundbreaking advancement. While the office is less than I expect, Frudakis is more -- funny, self-effacing and candid about his life and work than I expect.

Frudakis earned a PhD in molecular and cell biology from UC Berkeley in 1995. He spent several years as a research scientist for Corixa Corporation in Seattle before starting his own company to develop genomics-based or targeted drugs. The company's first drug is PT-401, a synthetic version of the hormone produced by the kidney to promote red-blood-cell production. It can be used to treat chemotherapy patients and anemia in people with end-stage renal disease. PT-401 made it through the pre-IND stage, which comes after animal testing and before Phase I trials, before the company ran out of money.

With drug approval years away and a gaggle of impatient investors, Frudakis shifted his focus to forensics in an effort to stay afloat. The same markers used to infer clinical characteristics relevant for drug development could also be used to infer phenotype or physical characteristics that could prove invaluable in forensics.

By the time he approached the Baton Rouge task force, DNAPrint had already performed hundreds of dry runs on the test. Its scientists studied family pedigree to make sure the ancestry traits they were measuring were indeed passed from one generation to the next. They conducted population studies, verified the repeatability of the test, determined the minimum amount of DNA required and completed more than a 1000 blind trials for various police departments.

When the serial killer's DNA sample arrived at the Sarasota lab, technicians isolated and amplified the 176 markers, cleaned them up to remove any primers or other agents, then used the molecular address to study the sequences at each site. The resulting products were then deposited into a micro array and scanned by a Beckman SNPstream. The output was then reviewed and subjected to quality-control checks. Finally, the scores were calculated and compiled into a report for the task force.

Since 2003, DNAWitness has been used in more than 150 criminal cases all across the country and in London. Most remain unresolved. In several others, however, the science played a crucial role in narrowing the suspect field and ultimately led to an arrest. Kansas City, Missouri, police spent four years trying to identify the body of a 3-year-old black girl. Frudakis determined that the child had one white grandparent, a clue that ultimately led to the child's mother, a biracial Oklahoma woman.

When two women were murdered in Napa, California, Frudakis applied a more advanced version of DNAWitness that uses 1349 genetic markers to peg the killer as 97 percent Northern European. "The accuracy of the test was right on," says Napa police commander, Jeff Tromley. "They described the suspect as a blue-eyed, blond-haired, white male. When he walked in to the police station, he was a blue-eyed, blonde-haired white man."

DNA Profiling - Pricey and Dicey

You would think that proven success in solving these types of horrific crimes would make this technology popular with police, scientists, defense attorneys and prosecutors alike. But it hasn't.

The most obvious obstacle is price. Cmdr. Tromley, for example, has a positive opinion of DNAWitness but adds that this does not necessarily mean his department will use it very often. "This is a pretty niche product. An in-depth analysis could run from \$1500 to \$3000. If you don't need that, then you probably won't go that far," he says.

Besides the expense, many people who might benefit from DNAWitness either don't know it exists or are extremely skeptical that it works. William C. Thompson, Chair of the Department of Criminology, Law & Society at UC Irvine is a prominent expert on the use of DNA in criminal trials but was only marginally familiar with this technology. When I tried to describe how it works, he literally screamed at me, calling Frudakis a hack and a charlatan who obviously did not understand statistics.

But even those who believe this can be done are conflicted about whether it *should* be done. History is replete with examples of injustices and inequities that were conscripted into law based on racial classification. The Civil Rights movement of the 1960's succeeded in ending legal racial discrimination, in large measure, by downplaying the significance of race and racial differences. By the mid-1990s prominent academics and sociologists even went so far as to say that race did not exist at all.

"Race is a social construct, not a scientific classification," said an editorial in the May 3, 2001 issue of the *New England Journal of Medicine*, adding that "In medicine, there is only one race -- the human race."

Then, along comes Frudakis with a science that seems to be saying the opposite.

New York University professor Troy Duster is a member of the advisory committee on the Ethical, Legal and Social Issues program at the National Human Genome Research Institute and president of the American Sociological Association. Duster, who has written extensively on race and genetics, including the book *Back Door to Eugenics*, worries about the proverbial slippery slope.

"Once we start talking about predicting racial background from genetics, it's not much of a leap to talking about how people perform based on their DNA -- why they committed that rape or stole that car or scored higher on that IQ test," says Duster. "In this society where race is such a powerful idea, once you head down this path toward predicting race, will the next step be predicting racial behavior?"

Narrowing the Suspect Field

Frudakis, not surprisingly, takes great pains to explain that those concerns are overblown. "Our technology is based on the notion that we all share a common ancestry to Africa from a couple hundred thousand years ago, that we are all part of the same family tree," he says. He also counters critics who say DNAWitness is a high-tech form of racial profiling. "This is analyzing data derived from a crime scene. It's a way for police to narrow down their suspect lists. It isn't used as evidence in trials."

Nevertheless, DNAPrint is still floundering. He says the National Institutes for Justice denied his grant application because it believed that this is work that should be left to the government. It's not clear that the company will be in business a year from now, or even six months.

"Forensics stinks as a business," Frudakis says bluntly. "Most of the testing is done by government labs with very little opportunity for private enterprise. If people valued what we did more, we would have the funds to expand the databases, learn about more phenotypes, develop more genetic screens, build more software systems."

Frudakis still hopes that the company will be able to invest in more research. RETINOME which predicts iris color with 96 percent accuracy is on the market and was used very effectively in the Napa murder case. He has identified the gene sequences associated with height, and has compiled a database of 5000 digital photographs of people with almost every racial ancestry combination -- which, one day, he says could allow him to construct a physical portrait of a DNA donor, including melanin content, skin color or eye color.

But even the people one might think should be his biggest allies aren't supporting that, including Tony Clayton, the special prosecutor who tried one of the Baton Rouge murder cases. Clayton, who is black, admits that he initially dismissed Frudakis as some white guy trying to substantiate his racist views. He no longer believes that and says "had it not been for Frudakis, we would still be looking for the white guy in the white pick-up truck." But then he adds, "We've been taught that we're all the same, that we bleed the same blood. If you subscribe to the (Frudakis) theory, you're saying we are inherently unequal."

He continues: "If I could push a button and make this technology disappear, I would."