Vol. 101
Northwestern University Law Review Colloquy

SCIENCE FICTION AND SHED DNA

D.H. Kaye[*]

INTRODUCTION

The year is 2025. The population is 325 million, and the FBI has the DNA profiles of all of them. Unlike fingerprints, these profiles reveal vital medical information. This universal database arrived surreptitiously. First, the Department of Defense's repository of DNA samples from all military personnel, established to identify remains of soldiers missing in action, was given to the FBI. Then local police across the country shadowed individuals, collecting their shed DNA for the databank. On the way, thousands of innocent people were imprisoned because they had the misfortune to have race-based crime genes in their DNA samples. Sadly, it did not have to be this way. If only we had passed laws against collecting and using shed DNA . . . .

This science-fiction story is loosely inspired by an essay on *Reclaiming "Abandoned" DNA*, by Professor Elizabeth Joh. Her article makes "the case for special consideration of abandoned DNA" in view of the nature and "potential uses of this information."[1] Like Joh, I believe that collecting shed DNA deserves scrutiny, as does the prospect of a universal database.[2] Furthermore, I agree that DNA is a uniquely revealing form of trace evidence and that the legal system must recognize its power to expose an individual's genetic secrets. Nonetheless, we part company on the threat posed by collection of "abandoned DNA." First, the notion that abandoned DNA is a viable means for covertly building a population-wide database is implausible. Second, any claim that the DNA profiles currently used for

---

[*] Regents' Professor, Arizona State University Sandra Day O'Connor College of Law; Professor, Arizona State University School of Life Sciences; Fellow, Arizona State University Center for the Study of Law, Science, and Technology. I am grateful to John Butler, Elliott Goldstein, Elizabeth Joh, Haig Kazazian, and Jeffrey Touchman for comments on an early draft of this essay. This research was funded in part by Department of Energy Grant No. DE-FG02-04ER63712.

[1] Elizabeth E. Joh, *Reclaiming "Abandoned" DNA: The Fourth Amendment and Genetic Privacy*, 100 NW. U. L. REV. 857, 874 (2006).

[2] *See* D.H. Kaye & Michael E. Smith, *DNA Identification Databases: Legality, Legitimacy, and the Case for Population-Wide Coverage*, 2003 WIS. L. REV. 413, 414-15; Edward J. Imwinkelried & D.H. Kaye, *DNA Typing: Emerging or Neglected Issues*, 76 WASH. L. REV. 413, 438 (2001) (suggesting that "police collection of inadvertently deposited DNA cannot be justified solely on an abandonment theory").

identification constitute "predictive medical information" is false. Third, the prospect of preventive detention of bearers of "crime genes" lends little support to a warrant requirement. Fourth, the practice of collecting shed DNA has no particular relationship to theories of "race" as a biological reality.

In making these points, I take no position on whether shed DNA deserves Fourth Amendment or other protection. The scope of the Amendment will be addressed in a separate article that will show how some forms of "abandoned DNA"—or the chemical analyses of this molecule—can be brought within the Fourth Amendment. Here, I focus on what Joh calls "the implications of abandoned DNA" as a motivation for the legal reforms she advocates.

I. A SECRET NATIONAL DATABASE

Professor Joh warns that shed DNA "is a backdoor to population-wide data banking"[3] and "the means by which total population DNA data banking might be achieved . . . without general public awareness . . . ."[4] Her preferred solution is a statute requiring a warrant for "targeted" DNA collection.[5] Her second-best solution is "for legislatures to clarify the applicability of DNA database laws . . . to the collection of abandoned DNA,"[6] presumably by explicitly prohibiting the addition of profiles from ordinary citizens to those of convicted offenders. In addition or alternatively, she apparently favors a more expansive construction of the Fourth Amendment and other "safeguards" and "protocols."[7]

These innovations might be good ideas, but not because they are necessary prophylactics to the clandestine creation of a universal database. Will the police stalk millions of people to gather saliva, urine, dandruff, or hair to slip into the offender databases so that, unbeknownst to the public, everyone's DNA will be on file? Will the laboratories already facing backlogs of crime-scene and offender samples have the staff and time to participate in the conspiracy? Will they falsify public reports on the numbers of samples analyzed and profiles added to databases? Will no whistle-blowers emerge? Will the nefarious origins of profiles never be uncovered when prosecutions result from cold hits in the databases? Will the Department of Defense's repository of DNA samples of service personnel be turned over to the FBI (as Joh imagines has occurred already[8])? Shed DNA is a real is-

---

[3] Joh, *supra* note 1, at 874.

[4] *Id*. at 884.

[5] *Id*. at 881.

[6] *Id*.

[7] *Id*. at 881-82.

[8] *Id*. at 879 ("Today all DNA samples collected from the military are included in CODIS."). The

sue. Establishing a population-wide DNA database is a serious issue. The nexus between the two is tenuous.

II. DNA PROFILES AND SAMPLES AS MEDICAL INFORMATION

Having questioned Joh's claim that shed DNA "acutely" raises[9] the prospect of secretly transforming CODIS (the Convicted Offender DNA Index System) into a population-wide database, I turn to her comparison of fingerprints and DNA identification profiles. Joh criticizes the frequent analogy drawn between DNA samples and profiles, on the one hand, and fingerprints on the other.[10] She implies that, unlike fingerprints, the information coded in DNA databases may contain "predictive medical information."[11]

To begin with, Joh's assertion that fingerprints "cannot reveal any more information [than identity] about the person from whom they have been collected"[12] is mistaken. Some features in fingerprints are associated with diseases,[13] and research into this aspect of dermatoglyphics continues to this day.[14]

Apparently, Joh regards the CODIS data as more dangerous because "some markers now thought to be meaningless may be (and have been) found to contain predictive medical information as the science progresses."[15] But which markers? There are various types of non-protein-coding DNA, including pseudogenes (relics of once-functioning genes), viral DNA inserted by retrotransposons, and short tandem repeats (STRs, the type of markers used in forensic identification). Recent discoveries establish that some intergenic DNA (not "markers") is biologically significant, but no forensic STR locus has been found to be predictive.[16]

---

claim is baseless. The only way the Department of Defense samples can be analyzed in a criminal investigation is pursuant to court order in "an investigation or prosecution of a felony, or any sexual offense, for which no other source of DNA information is reasonably available." 10 U.S.C. § 1565a (2000). The only way military samples legally can be placed into a CODIS-related database is through proceedings against specific soldiers for "qualifying military offenses." *Id.*

[9] Joh, *supra* note 1, at 884.

[10] *Id.* at 869-71.

[11] *Id.* at 870.

[12] *Id.*

[13] *E.g.*, Julian Verbov, *Clinical Significance and Genetics of Epidermal Ridges—A Review of Dermatoglyphics*, 54 J. INVESTIGATIVE DERMATOLOGY 261, 261 (1970) ("Study of the patterns of the epidermal ridges of finger, palm, and sole can serve as an aid to the diagnosis of many diseases . . . .").

[14] James T. Chok et al., *Dermatoglyphic Anomalies in Psychometrically Identified Schizotypic Young Adults*, 72 SCHIZOPHRENIA RES. 205 (2005).

[15] Joh, *supra* note 1, at 870.

[16] *See, e.g.*, John M. Butler, *Genetics and Genomics of Core Short Tandem Repeat Loci Used in Human Identity Testing*, 51 J. FORENSIC SCI. 253, 259-60 (2006); D.H. Kaye, *Two Fallacies About DNA Data Banks for Law Enforcement*, 67 BROOK. L. REV. 179, 187–88 (2001).

In addition, emerging theories do not imply that STRs "contain predictive medical information." One theory holds that some intergenic DNA might be valuable in the evolution of new genes or regulatory elements.[17] Even if this theory applied to forensic STRs, which merely arise from slippage in replication, it would not make them "predictive" of human disease. Neither does recent research into the role of micro-RNAs in gene expression[18] implicate forensic STRs. STRs do not code for micro-RNAs, and even if they did, this would not, *ipso facto*, establish "predictive medical" value.[19]

Joh's account sweeps all noncoding DNA under the same rug. She alters the statement of one scientist to read as follows: "I think [junk DNA] will come to be a classic story of orthodoxy derailing objective analysis of the facts . . . . [It] may well go down as one of the biggest mistakes in the history of molecular biology."[20] In actuality, this researcher was not referring to all "junk DNA." He was speaking "particularly" of "the possibility that the intervening noncoding sequences may be transmitting parallel information in the form of RNA molecules."[21] It is a leap from this possibility to the conclusion that the forensic STRs—which do not generate RNA molecules and are not conserved across species—are functional or that their length polymorphisms will prove useful for predicting disease.

That said, we do not need to speculate about the loci used in forensic identification to discern a privacy risk in collecting shed DNA. Today, the police could obtain the equipment and reagents to test for a number of highly penetrant, single-gene diseases. Why they would want to do so is not obvious, but indefinitely retaining all convicted offender samples carries this technological possibility. As such, DNA sampling is potentially more threatening than lifting fingerprints. Both traces carry genetic information, but DNA samples usually contain far more of it. Hence, the anal-

---

[17] Wojciech Makalowski, *Genomics: Not Junk After All*, 300 SCIENCE 1246, 1246 (2003). Makalowski writes:

> [T]ransposable elements are not useless DNA. They interact with the surrounding genomic environment and increase the ability of the organism to evolve. They do this by serving as recombination hotspots, and providing a mechanism for genomic shuffling and a source of "ready-to-use" motifs for new transcriptional regulatory elements, polyadenylation signals, and protein-coding sequences.

Id.

[18] For example, Joh cites journalism such as Clive Cookson, *Regulatory Genes Found in 'Junk DNA'*, FIN. TIMES, June 4, 2004. Joh, *supra* note 1, at 870 n.74. Cookson is describing research into a yeast gene that codes for an RNA transcript that inhibits the expression of an adjacent protein-coding gene. Joseph A. Martens et al., *Intergenic Transcription Is Required to Repress the Saccharomyces Cerevisiae SER3 Gene*, 429 NATURE 571 (2004).

[19] *See* Kaye, *supra* note 16, at 188 nn.37-38.

[20] Joh, *supra* note 1, at 870 n.74 (ellipses and brackets in original).

[21] W. Wayt Gibbs, *The Unseen Genome: Gems Among the Junk*, SCI. AM., Nov. 2003, at 46, 49-50 (quoting John S. Mattick).

ogy between fingerprinting and DNA profiling depends on protections and practices sufficient to limit the extent of genetic probing of the DNA samples collected for identification.[22]

III. THE "CRIME GENE"

Joh is concerned that "DNA . . . may one day be used to identify and segregate those who possess a 'crime gene.'"[23] However, modern researchers believe that the link between genetics and behavior is much more attenuated and complex.[24] Many physical traits and conditions, such as blood pressure, are the product of many additive or interacting genes operating in a given environment. Likewise, for any complex behavior, the contribution of any particular gene is small, perhaps on the order of one percent.[25] Routinely predicting anything as amorphous as "crime" from genetic tests of such "quantitative trait loci" remains a remote possibility. Of course, there may be some rare single-gene mutations associated with "aggression" or "mental illness," but if we enact (and uphold as constitutional) widespread "preventive detention or other means of social control" on the basis of genetic loci that are supposed to predict "criminogenic behaviors,"[26] then we have a lot more to worry about than shed DNA. A warrant requirement will not make much difference to a society that, under the sway of a naive and discredited theory of genetic determinism, is willing to lock people away on the basis of their genes.

Joh also urges that the "use [of DNA evidence] in criminal prediction should be prohibited until the underlying scientific bases and ethical issues are fully resolved."[27] Certainly, punishment for proclivities ascertained from poorly validated genetic tests is intolerable. It should be impermissible—with or without regulation of the collection of abandoned DNA.

---

[22] *See* D.H. Kaye, *The Constitutionality of DNA Sampling on Arrest*, 10 CORNELL J. L. & PUB. POL'Y 455, 481-82 (2001). Joh thinks that "federal law remains silent as to what must be done with the biological samples themselves." Joh, *supra* note 1, at 871. However, the statute cited for this proposition contemplates retention of samples "pursuant to rules that allow disclosure of stored DNA samples and DNA analyses" only for enumerated "identification," "judicial," "criminal defense," and "if personally identifiable information is removed, for a population statistics database, for identification research and protocol development purposes, or for quality control purposes." 42 U.S.C. § 14132(b)(3) (2000).

[23] Joh, *supra* note 1, at 876.

[24] Irving I. Gottesman & Daniel R. Hanson, *Human Development: Biological and Genetic Processes*, 56 ANN. REV. PSYCHOL. 263, 264-68 (2005).

[25] Robert Plomin et al., *Behavioral Genomics*, in BEHAVIORAL GENETICS IN THE POSTGENOMIC ERA 531, 535 (Robert Plomin et al. eds. 2003).

[26] Joh, *supra* note 1, at 877.

[27] *Id.* at 881.

IV. THE BIOLOGY OF RACE

Genes do not define races. People do. However, anthropologists and population geneticists have long known that some genotype frequencies vary across socially defined "racial" groups.[28] Given the history of isolated population groups, the phenomenon of genetic drift, the variations in environmental conditions in different regions, and the correlation between popular conceptions of "race" and ancestral geography, how could it be otherwise?

But what does all this have to do with warrantless collection of DNA? Joh does not explain how any of the proposed reforms will prevent "bolster[ing] race-based genetic classifications"[29] or even what the phrase means. She appears to be worried that the government will use "race-based genetic variation among sex offenders or violent felons" to "identify[] would-be offenders on the basis of their genetic make-up"[30] and that it will scoop up shed DNA for this purpose. I am more optimistic. Someday perhaps researchers will find alleles associated with propensities such as risk-taking that are more common in some groups than others, but such alleles will not be unique to any racial group, they will not ineluctably determine anyone's behavior, and we will not round up "would-be offenders" because we have reverted to a scientifically naive and indefensible understanding of the genetics of behavior. And, even if my optimism is misplaced, will enacting a statute today to protect shed DNA slow the move to a world of "race-based" genetic preventive detention?

CONCLUSION

This essay has argued that the practice of warrantless collection of shed DNA has less momentous consequences than those depicted in *Abandoned DNA*. Nonetheless, shed DNA poses a significant Fourth Amendment puzzle that has implications beyond DNA evidence itself. Professor Joh is to be commended for highlighting an issue that deserves deeper analysis than it has received by courts and commentators to date.

---

[28] *See, e.g.*, Sarah A. Tishkoff & Kenneth K. Kidd, *Implications of Biogeography of Human Populations for "Race" and Medicine*, 36 NATURE GENETICS S21-25 (2004).

[29] Joh, *supra* note 1, at 877.

[30] *Id.* at 878.