

ARTICLES

'PERSONAL' PROPERTY: FOURTH AMENDMENT PROTECTION FOR GENETIC INFORMATION

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Like much of the Constitution, the Fourth Amendment presumes property rights but does not define them. Its text protects individuals against unreasonable government searches and seizures of their “persons, houses, papers, and effects,” but sets no contours for these four categories. Since the Founding, those unfixed boundaries have allowed courts to gradually shift the Fourth Amendment’s property protections to include such modern phenomena as GPS location data and cell phone cloud storage.

Such flexibility is both an aspiration and an inevitability of the common law, which evolves over time via judicial precedent and custom. Indeed, property rights, themselves a creature of common law, are both often founded in privacy interests and have evolved as those interests expand and contract, across contexts and across time.

Advances in genetics, biotechnology, and computing should compel courts to recognize that the common law of property is evolving yet again. Though the Supreme Court has never decided the question, it is widely accepted that individuals retain a substantial expectation of privacy in their genetic data, even if not always in the physical samples from which that information is extracted. Just as expectations of domestic solicitude and private ownership founded the rights underlying longstanding property interests like nuisance and trespass, so too should individuals be able to take refuge from government intrusion within the homes of their own bodies.

Drawing on other property rights that are built upon privacy interests, this Article argues that we have—and the law should recognize—a limited property right in genetic information. This property right would give individuals a sorely-needed right to exclude others from their intimate data, would more accurately reflect the ways in which individuals, private companies, and research institutions transfer and trade in genetic materials, and would help to clarify the scope of various legal protections that turn on both property and privacy interests, such as the Fourth Amendment.

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INTRODUCTION

Before giving a lecture at King’s College in 1951, biochemist Rosalind Franklin reflected on her x-ray crystallography photographs of DNA.¹ While doing so, she underlined the following observations in her notes: “Big helix in several chains, phosphates on outside, phosphate-phosphate inter-helical bonds disrupted by water.”²

Franklin’s photographs were ultimately the key to decoding the helical structure of DNA and subsequently, launched a revolution in biochemistry, molecular biology, and genetics. Today, DNA’s twisted double-helix can be unzipped within hours to reveal a mind-boggling array of highly personal

1 See ANNE SAYRE, ROSALIND FRANKLIN AND DNA 128 (2000).

2 *Id.*

insights, including predisposition to disease, unknown biological relatives, and ethnic heritage.³

Because genetic data is ubiquitous, essentially unalterable, and inherently identifiable, this hypersensitive and uniquely permanent information surely falls within the sacred “privacies of life,”⁴ such as one’s home, that are protected by American law. Or, at minimum, such data’s unanticipated exposure to and exploitation by the government implicates the “right of every individual to the possession and control of his own person.”⁵ Yet, privacy has long proved an elusive right to define, and an even harder one for harmed individuals to defend in court.⁶ This has contributed to the threadbare status of legal protections for genetic information in the United States. At present, no federal law comprehensively guarantees an individual’s genetic privacy.⁷ State laws, where they exist, are vague and patchy.⁸

A road to legal protection for genetic privacy already exists—it just needs to be formalized. Throughout history, the common law has recognized new

3 *International Declaration on Human Genetic Data*, UNITED NATIONS EDUC., SCI. & CULTURAL ORG. (OCT. 16, 2003), http://portal.unesco.org/en/ev.php-URL_ID=17720&URL_DO=DO_TOPIC&URL_SECTION=201.html; *see also Genetic Testing*, MAYO CLINIC, <https://www.mayoclinic.org/tests-procedures/genetic-testing/about/pac-20384827> (last visited Jan. 12, 2019).

4 *Boyd v. United States*, 116 U.S. 616, 630 (1886).

5 *Union Pac. Ry. Co. v. Botsford*, 141 U.S. 250, 251 (1891). Note also that advances in DNA technology have made anonymization—even when an individual abstains from DNA testing—virtually impossible. *See, e.g.*, Kristen V. Brown, *A Researcher Needed Three Hours to Identify Me From My DNA*, BLOOMBERG BUSINESSWEEK (Apr. 12, 2019, 5:00 AM), <https://www.bloomberg.com/news/articles/2019-04-12/a-researcher-needed-three-hours-to-identify-me-from-my-dna> (“Anyone can be exposed, whether or not they’ve made their own DNA public. One family member sharing such personal information can expose multiple generations on their family tree.”).

6 *See generally* DANIEL J. SOLOVE & PAUL M. SCHWARTZ, *INFORMATION PRIVACY LAW* ch. 2A (6th ed. 2018) (describing diverse perspectives on the definitions of “privacy” and corresponding difficulties faced by litigants making privacy claims).

7 *See, e.g.*, Susan M. Wolf, Ellen Wright Clayton & Frances Lawrenz, *LawSeqSM: Building a Sound Legal Foundation for Translating Genomics into Clinical Application*, CONSORTIUM ON L. & VALUES HEALTH, ENV’T & LIFE SCIS., <https://consortium.umn.edu/research/lawseqsm-building-sound-legal-foundation-translating-genomics-clinical-application> (last visited Nov. 1, 2019) (collecting into a searchable public database all federal and state laws, regulations, official guidance, and professional standards that regulate the field of genomics). While the 2008 Genetic Information and Nondiscrimination Act clarified that genetic data could theoretically be subject to the federal Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule, no law “truly protects [genetic] privacy.” *Genetic Information Privacy*, ELEC. FRONTIER FOUND., <https://www EFF.ORG/issues/genetic-information-privacy> (last visited Oct. 18, 2019); *see also* Genetic Information Nondiscrimination Act of 2008, Pub. L. No. 110-233, 122 Stat. 881 (prohibiting discrimination in employment and health insurance on the basis of genetic markers).

8 *See supra* note 7.

property rights that are founded in privacy interests, with the scope of privacy expected defining the limits of a corresponding property right. No less, privacy-informed property rights have long provided individuals with some of the law's sturdiest routes to adjudicated relief. Indeed, "the language of property collapses back into communal perceptions of the boundary to be drawn between liberty and privacy" and, at its heart, "is reducible to a dialogue about moral and personal space, about the mutual frontier between autonomy and vulnerability, between social accommodation and immunity from predation."⁹ Arguably, these deep ties between property rights and privacy interests are exactly why property rights are protected throughout the Constitution.¹⁰

Strong privacy interests in one's genetic information confer a limited property right in that information. Upon recognizing that property right, courts applying the Fourth Amendment's robust protections for personal property can safeguard sensitive DNA data from government misuse. In this way, the reality of how informative genetic information is and how easy it has become to collect and analyze can be reconciled with the fundamental protections guaranteed in the Bill of Rights.

While this Article is not the first to propose a limited property right in genetic information,¹¹ it is the first to argue that industry practices and legal precedent indicate that such a right already essentially exists. As such, this Article is an application of progressive property theory to a particular context, rather than an exhaustive exploration of the theory itself. Part I describes similar instances where courts have recognized property rights stemming from privacy interests; namely, the doctrines of trespass and nuisance. Accordingly, courts can and should update common law understandings of personal property interests to reflect present custom and public conscience regarding

9 See KEVIN GRAY & SUSAN FRANCIS GRAY, *ELEMENTS OF LAND LAW* 89 (5th ed. 2009) (footnote omitted).

10 See U.S. CONST. amend. IV (protecting against warrantless searches and seizures of private property); *id.* amend. V (prohibiting the taking of private property for public use without just compensation); *id.* amend. XIV (prohibiting the deprivation of life, liberty, or property without due process).

11 See, e.g., Jorge L. Contreras, *Genetic Property*, 105 *GEO. L.J.* 1, 7, 10 (2016) (arguing against property rights in genetic data in the context of biomedical research and instead advocating for rules similar to tort liability); Natalie Ram, *DNA by the Entirety*, 115 *COLUM. L. REV.* 873, 877, 879 (2015) (proposing that a property right analogous to tenancy by the entirety may be useful for genetic information because tenancy by the entirety conceptualizes two persons as one and genetic information is likewise shared by multiple individuals due to relatedness); Jessica L. Roberts, *Progressive Genetic Ownership*, 93 *NOTRE DAME L. REV.* 1105, 1111 (2018) (exploring how progressive property theory may address deontological concerns about genetic ownership rights more usefully than neoclassical economic theory does).

genetic information. Part II then sets out the five types of categories that comprise genetic information (original biological samples, purified DNA, raw sequencing data, and inferences drawn from the raw data both for individuals and populations) to establish a taxonomy that courts and advocates might use to prevent analytical confusion. Moreover, as evidenced by contracts governing their use and extant case law, each of the five categories has different attributes and should therefore be ascribed property rights with varying contours. Part III subsequently explores the doctrinal implications of recognizing limited property rights in genetic information, with emphasis on the vigorous Fourth Amendment protections that are afforded to property interests. It also highlights concerns that courts and legislators should be mindful of to prevent a genetic property right from encouraging dehumanization¹² or exerting undue influence on social interactions.

I. PRECEDENT IN PROPERTY LAW

To begin, it is worth asking: “By what authority may a court provide protection to information that legislators have not?” and “Why property law?” Part I provides a brief answer.

The basic contrast between statutory law and common law is one of speed and malleability. Statutory law can be passed or discarded quickly, while the common law is extrapolated gradually from judges’ rulings and juries’ verdicts. The latter’s slow pace of change and accumulation of diverse cases from which to observe changing social norms enables the common law to recognize new rights and “grow[] to the demands of new times and circumstances.”¹³ Thus, it is perfectly proper for a court to formalize new causes of action or modify interests in existing common law rights.

The Fourth Amendment jurisprudence with which this work is concerned reflects the common law’s spirit of evolution. To preserve individuals’ Fourth Amendment protections, the Supreme Court has repeatedly responded to technological advances and corresponding shifts in social views by adapting the rules governing government searches and seizures. While those revisions

12 See Margaret Jane Radin, *Market-Inalienability*, 100 HARV. L. REV. 1849, 1851 (1987) (arguing that healthy personhood and social structuring requires certain aspects of life to be exempt from being priced, bought, and sold).

13 SIR FREDERICK POLLOCK, *THE EXPANSION OF THE COMMON LAW* 124 (1904); see also MICHAEL ARNHEIM, *PRINCIPLES OF THE COMMON LAW* 136 (2004) (setting out common law principles relating to evolving legal rights and obligations, noting that “the concept of rights has been at the centre of legal discourse for centuries”).

did not necessarily create new property rights, for centuries “Fourth Amendment jurisprudence was tied to common-law trespass[.]”¹⁴

This deeply rooted connection to property law,¹⁵ which is itself a creature of common law, and doctrinal haziness resulting from the Court’s move away from property-based understandings of the Fourth Amendment,¹⁶ makes property law a rich and useful way of examining genetic privacy. Moreover, property-based understandings of the Fourth Amendment remain valuable even in the face of technological advances the Founders could have never envisaged. For instance, regarding GPS tracking, the Court clarified in *Jones* that the reasonable expectation of privacy test supplemented trespass-based jurisprudence rather than replaced it.¹⁷ And, in his *Carpenter* dissent, Justice Neil Gorsuch suggested the defendant might have had an “ancient” property interest in the contents of his cell phone data, though he did not elaborate because *Carpenter* did not argue so in the lower courts.¹⁸ Suffice to say, much of the Court’s Fourth Amendment jurisprudence relates to property law, and the current Court may be particularly receptive to arguments that utilize property-based doctrinal foundations.

To illustrate the dynamic nature of property law underlying the Fourth Amendment, Section I.A describes existing privacy-based property rights such as actions for nuisance and trespass. It highlights the adaptable nature of the common law and shows that privacy was a theme in property cases long before this nation existed. In addition, it posits that contemporary debates over the scope of nuisance and trespass likewise reflect the importance of privacy

14 *United States v. Jones*, 565 U.S. 400, 405 (2012); *see also* *Kyllo v. United States*, 533 U.S. 27, 31–32 (2001) (surveying Supreme Court cases that illustrate the influence of common-law trespass on Fourth Amendment jurisprudence).

15 *See, e.g., Jones*, 565 U.S. at 405 (“The text of the Fourth Amendment reflects its close connection to property . . .”).

16 *See, e.g.,* George C. Thomas III, *The Common Law Endures in the Fourth Amendment*, 27 WM. & MARY BILL RTS. J. 85, 85 (2018) (arguing that the Supreme Court’s move away from the common-law understanding of property rights and towards a reasonable expectation of privacy test has created an erratic doctrine); *see also* Paul Ohm, *The Many Revolutions of Carpenter*, 32 HARV. J.L. & TECH. 357, 362, 385 (2019) (observing that the Court’s most recent update to the reasonable expectation of privacy test in *Carpenter v. United States* “reinvents” the test and “turns the third-party doctrine inside out,” in addition to advocating a new rule of “technological equivalence” that may have far-reaching effects).

17 *See Jones*, 565 U.S. at 411–12 (explaining that the *Katz* “reasonable-expectation-of-privacy test” is not “the exclusive test” and would apply to situations not involving trespass).

18 *Carpenter v. United States*, 138 S. Ct. 2206, 2269, 2272 (2018) (Gorsuch, J., dissenting). Gorsuch’s dissent reads more like a concurrence, given that he ultimately agreed with the majority that the seizure of the cell location records violates the Fourth Amendment. *See id.* at 2272 (noting that *Carpenter* relied exclusively on *Katz*’s reasonable expectations argument, instead of invoking common law doctrines, to his detriment).

considerations. Section I.B then examines one of the only major cases to have addressed whether biological material can be considered real property.¹⁹ It notes that while *Moore v. Regents of the University of California* held that Moore did not have property rights in his spleen or pharmaceutical products developed from research on his organs, the case does not preclude recognizing a property right in genetic information. Thus, the Court should view *Moore* as both an invitation to evolve its law governing property in human biological materials and as an outdated case that should not remain the touchstone for related future questions, given the vast changes in genetics and biotechnology that have occurred in the thirty years since *Moore*.

A. Existing Privacy-Oriented Property Rights

At common law, property rights are often founded in privacy interests, with the scope of privacy expected defining the limits of a corresponding property right. Importantly, neither these property rights (discussed below in Subsection 1) nor privacy interests (discussed below in Subsection 2) are static. The nature of property and privacy rights makes clear that it is appropriate for courts to recognize changes in common law property rights, if and when the privacy interests underlying them shift.

Two long-established causes of action illustrate both historical foundations and the way that evolving expectations of privacy have altered the contours of property rights. The first is trespass, which is one of property law's oldest vehicles for ensuring that an individual is left alone by his neighbors. Looking to some of the first recorded trespass cases at English common law as well as current debates over new forms of trespass like light trespass and aerial trespass, the evolution of trespass law shows that privacy interests are what differentiate instances where courts have recognized that a trespass occurred from those where they did not. The same privacy-linked trajectory is even more true of nuisance law, and further evidenced by the seeming convergence of nuisance with the law of trespass. In all, Section I.A proposes that property rights at common law have always been dynamic, that privacy is a traditional element of property law,²⁰ and therefore that courts would not be acting

19 See *Moore v. Regents of the Univ. of Cal.*, 793 P.2d 479, 480-82 (Cal. 1990) (addressing whether plaintiff, whose cancer cells defendants used to develop a lucrative cell line, states a cause of action).

20 *Contra* Sonia M. Suter, *Disentangling Privacy from Property: Toward a Deeper Understanding of Genetic Privacy*, 72 GEO. WASH. L. REV. 737, 737 (2004) (arguing that privacy and property are “fundamentally different concepts” because property connotes control over things that can be “disaggregated or alienable from the self,” while privacy instead focuses on “control over access to

radically if they explicitly recognized privacy's role in the development of property law.

1. Dynamic Property Rights at Common Law

Centuries old, the laws of trespass and of nuisance provide time-tested examples of property rights that exemplify the common law's responsiveness to changing social mores.

First, we turn to trespass, a strict liability cause of action whose origins appear significantly different from modern debates over intangible trespasses, such as those incurred by drones and other aircraft, computer software, and intrusive lights.

From its outset, trespass exemplified the dynamic nature of a property right at common law. Initially, it emerged haphazardly from the historical records of medieval England, where it was one of three civil actions that later subsumed the others.²¹ Intended “from the first [to have] a connotation wide enough to have embraced both the others,”²² common law trespass seems to have been a flexible mechanism used to protect the relatively inflexible English precept that a man's house is his castle.²³ Blackstone's oft-cited eighteenth-century overview of English law, for instance, noted that trespass could broadly include any trespass against “the law of nature, of society, or of the country in which we live[,] whether it relates to a man's person, or his property[,]” even though it was more popularly considered in a “confined sense . . . [that] signifies no more than an entry on another man's ground without a lawful authority, and doing some damage, however inconsiderable, to his real property.”²⁴

But despite its malleable nature, trespass provided robust protection of personal property and dwelling areas: it has always been a strict liability cause

the self”). Suter's views echo those of Margaret Jane Radin's in that they worry about the commodification and quantification of semi-tangible and intangible things that are deeply personal. See *supra* note 12. However, at least in the context of both nuisance and trespass, as well as Fourth Amendment violations, property models exist in part to directly address the kind of dignitary harms Suter discusses when genetic privacy is at risk.

21 See George F. Deiser, *The Development of Principle in Trespass*, 27 YALE L.J. 220, 225 (1917) (noting how, by the reign of Henry II, trespass had absorbed two other civil actions of tort, the assizes of novel disseisin and of nuisance).

22 *Id.* at 277.

23 See 4 WILLIAM BLACKSTONE, COMMENTARIES *223 (expressing that the law of England regards the immunity of a man's house as his castle).

24 3 WILLIAM BLACKSTONE, COMMENTARIES *208-09

of action²⁵ and, in certain circumstances, a crime. Early English cases made clear that while the actual harm caused to the plaintiff may have been difficult to define, so long as the sanctity of private land was violated even in part, the law of trespass would provide staunch protection. *Entick v. Carrington*, an English trespass case from 1765, oft-cited by the Supreme Court in Fourth Amendment cases, illustrates the principle.²⁶ There, the court stated, “No man can set his foot upon my ground without my licence, but he is liable to an action [for trespass], though the damage be nothing.”²⁷ This remained evident during the American colonial period, even as trespass developed into a catchall that enabled legal redress against a host of actions “going beyond what is lawful” with regards to intrusions in and around real property.²⁸

Trespass thus served to protect plaintiffs from unauthorized entry onto their property regardless of the exact form of and justifications for the tort over time. Moreover, the underlying sense that trespass was about something more than mere possession of property matters for two reasons: it illustrates the fluid nature of what is popularly considered to be a bright-line tort, and as the next Subsection will expand upon, that trespass protected real property as a proxy for other social values such as privacy.²⁹

Contemporary trespass law further demonstrates the dynamic nature of trespass at common law. Today, increasingly invasive technologies have forced the doctrine of trespass to evolve again in order to protect landowners’ changing views of how they own land and live upon it. Previously, the invasion of personal space required the intruder’s physical presence; now, that does not necessarily hold true.

Aerial trespass offers one case study. In a seeming contradiction, time and again courts have refused to uphold trespass claims when certain kinds of aircrafts, such as passenger airplanes, have crossed over individuals’

25 See, e.g., *Ellis v. Loftus Iron Co.* [1874] LR 10 CP 10, 12 (Eng.) (noting that “[i]t has been decided over and over again that a trespass cannot be measured; whether it be an inch or an ell, it is a trespass all the same.”).

26 See *Entick v. Carrington* [1765] EWHC (Ch) KB J98, 95 Eng. Rep. 807, 808 (Eng.) (addressing a trespass suit in which defendants ransacked plaintiff’s home and pilfered priceless documents).

27 *Id.* at 817.

28 Thomas, *supra* note 16, at 93 (citing 5 MATTHEW BACON, A NEW ABRIDGMENT OF THE LAW 151 (1766)); see George E. Woodbine, *The Origins of the Action of Trespass*, 33 YALE L.J. 799, 800 (1924) (detailing the early history of trespass actions); see also *Purviance v. Angus*, 1 U.S. (1 Dall.) 180, 183–184 (Pa. High Ct. Errors & App. 1786) (noting that all parties to trespass are liable, whether their actions are negligent, ignorant, or willful).

29 See, e.g., *Loretto v. Teleprompter Manhattan CATV Corp.*, 458 U.S. 419, 436 (1982) (noting that “an owner suffers a special kind of injury when a *stranger* directly invades and occupies the owner’s property”).

properties, though they have found actionable claims when other aircrafts like personal drones do the same.³⁰ As a threshold matter, before holdings such as in *Hinman v. Pacific Air Transport*³¹ and *United States v. Causby*,³² the common law doctrine of *ad coelum*³³ provided landowners with full property rights over both the subterranean areas beneath their land and the sky above it. But, despite discarding the *ad coelum* doctrine, the Court in *Causby* held that overhead flight by military planes at eighty-three feet constituted trespass because “the superadjacent airspace at this low altitude is so close to the land that continuous invasions of it affect the use of the surface of the land itself.”³⁴ Similarly, courts have found that airline flights above 1,000 feet could not constitute a trespass, nor the flight path necessary for attaining and declining from that altitude,³⁵ though the Restatement suggests that over-flights are trespass if: (1) they are in the immediate reaches of the land, and (2) they interfere with the use and enjoyment of the land.³⁶ While “immediate reaches” is yet undefined by statute, “[i]n the ordinary case, flight at 500 feet or more above the surface is not within the ‘immediate reaches,’ while flight within 50 feet, which interferes with actual use, clearly is, and flight within 150 feet, which also so interferes, may present a question of fact.”³⁷ The contours of aerial trespass thus continue to evolve in parallel with changing methods of aerial invasions and uses of land.

Trespass by means of intrusive lights, such as unwanted projection displays and spotlights, pose similar challenges to the letter of trespass law. For centuries, light from “wax candles, and whale-oil lamps, and then kerosene” could not actually do very much damage to another’s property.³⁸ Accordingly, courts’ limiting of trespass to physical invasions went largely unchallenged until

30 That is, excluding contact at a molecular or atomic level, which light and electricity would of course have even if such contact is not visible to the naked eye.

31 See *Hinman v. Pac. Air Transp.*, 84 F.2d 755, 758 (9th Cir. 1936) (declining to recognize a rule for trespass under which landowners may “stake out” the air above their land).

32 See *United States v. Causby*, 328 U.S. 256, 261 (1946) (declaring that the *ad coelum* doctrine “has no place in the modern world” in light of the growth of passenger air travel).

33 From the Latin, “*cujus est solum ejus est usque ad coelum*,” meaning “whoever owns the soil owns also to the sky and to the depths.”

34 *Causby*, 328 U.S. at 264–65.

35 See *Allegheny Airlines, Inc. v. Village of Cedarhurst*, 238 F.2d 812, 814–15 (2d Cir. 1956) (noting an “express exception” for take-off and landing of planes under 1,000 feet).

36 RESTATEMENT (SECOND) OF TORTS § 159 (Am. L. Inst. 1965).

37 *Id.*

38 Int’l Union of Painters & Allied Trades Dist. Council 15 Loc. 159 v. Great Wash Park, LLC, No. 67453, 2016 WL 4499940, at *7 (Nev. Ct. App. Aug. 18, 2016); see Maureen E. Brady, *Property and Projection*, 133 HARV. L. REV. 1143, 1162–65 (2020) (summarizing the finding in the *Great Wash Park* case).

the proliferation of light bulbs in the early 1900s.³⁹ Combined with scientific advances in physics, state courts soon became ensnared in intricate debates to determine whether light could conduct a tangible trespass, and if not, how to justify a hitherto unrecognized intangible trespass.⁴⁰ Courts' eventual reliance on the latter⁴¹ again highlights the dynamic nature of the common law, even in a realm as seemingly inert as trespass.

Nuisance, another well-established property right at common law, has similarly dynamic qualities. While the origins of nuisance are also murky,⁴² “the underlying problem of the bad neighbour” has carried legal consequences since at least the twelfth century.⁴³ As best we can tell, at its outset, the assize of novel disseisin was a means for England’s King Henry II to prevent violence accompanying the “spasmodic upheaval and unjust results of private quarrels” that often occurred between medieval neighbors.⁴⁴ Over time, this writ evolved such that, “[t]o be actionable, a nuisance had to result in both *injuria* (legal injury) and *damnum* (material damage).”⁴⁵ Importantly, “[a] necessary element of *injuria* was *omne id quod non iure fit* (‘anything wrongfully done’),” a term which seems to have covered all interferences that affected the “natural rights” of the property owner or possessor.⁴⁶ Those natural rights were tethered directly to possession of property, and “could not be taken away by express grant or prescription.”⁴⁷ Thus, from its early days, nuisance law had in mind fundamental human rights that were, in the case of private nuisance, often tied to the same kind of rights of exclusion, personal autonomy, and privacy that trespass was.

Further demonstrating its adaptable nature, local sensibilities sometimes mattered more in assessing nuisance cases than even other legal frameworks when courts were assembling a hierarchy of customs for purposes of the reasonableness calculus. *Butter v. Heathby*, for example, a 1766 nuisance

39 See Brady, *supra* note 38, at 1150–1154 (detailing early light-related nuisance suits).

40 See *id.* at 1156–1158 (describing efforts of courts to determine whether light could conduct trespass).

41 See, e.g., 169 E. 69th St. Corp. v. Leland, 594 N.Y.S.2d 531, 533 (N.Y. Civ. Ct. 1992) (“A source of light can be the basis of a cause of action in trespass.” (citing *Amphitheaters, Inc. v. Portland Meadows*, 198 P.2d 847 (Or. 1948)).

42 See Daniel R. Coquillette, *Mosses from an Old Manse: Another Look at Some Historic Property Cases About the Environment*, 64 CORNELL L. REV. 761, 766 (1979) (noting that nuisances began as a term for “annoyances [that] were probably remedied on an ad hoc basis by the many local courts of medieval England”).

43 Janet Loengard, *The Assize of Nuisance: Origins of An Action at Common Law*, 37 CAMBRIDGE L.J. 144, 144 (1978).

44 *Id.* at 144–45.

45 Coquillette, *supra* note 42, at 769.

46 *Id.*

47 *Id.* at 769–70.

case regarding tithe notices, presented the issue of how local parish customs stacked up against both the common law and general ecclesiastical law.⁴⁸ Speaking for the court, Lord Justice Mansfield placed local customs above other considerations, stating that it did not matter “[w]hether this custom be good in law, or not”—only that, “it is the law of the land, here in this parish.”⁴⁹ Accordingly, tithe payment notices were to continue being posted as they had been previously, despite the practice being in direct contradiction to prevailing national law at the time.⁵⁰

Today, nuisance takes two forms: public nuisance and private nuisance. The former is “an unreasonable interference with a right common to the general public.”⁵¹ Examples include access to roads and waterways, as well as to grazing pastures and clean air. Private nuisance, on the other hand, covers unreasonable interference with an individual’s private interest in the use and enjoyment of land.⁵² But, what kinds of actions are unreasonable depends on a number of different factors, and there is no single test for nuisance despite wide acceptance of the Restatement (Second) of Torts approach. However, the various approaches share three traits. First, the “guiding principle is *sic utere tuo ut alienum non laedas*, meaning that one should use one’s own property in such a way as not to injure the property of another.”⁵³ Second, “the harm done is the chief element,” and third, that harm is done indirectly.⁵⁴ Finally, and perhaps most notably, nuisance “is always a tort against land, and the plaintiff’s action must always be founded upon his interest in the land.”⁵⁵ In this way, nuisance provides an even more flexible means than trespass to account for changing social attitudes and uses of property, though both torts’ dynamic natures exemplify the common law’s ability to evolve over time.

2. *Dynamic Privacy Interests, Protected by Property Rights*

Notably, the doctrines of trespass and nuisance evolved along two parallel axes of change: one is the slow, but ever-changing body of common law of which they are part, and the other reflects the dynamic nature of the privacy interests these two common law doctrines protect. This Subsection again

48 *Butter v. Heathby* (1766) 97 Eng. Rep. 1154.

49 *Id.* at 1154–1155.

50 *See id.* (finding that the challenged custom was reasonable and should be enforced).

51 RESTATEMENT (SECOND) OF TORTS § 821B (Am. L. Inst. 1965).

52 *Id.* at § 821D.

53 Martin A. Hogg, *The Very Private Life of the Right to Privacy*, in HECTOR L. MACQUEEN, 2 PRIVACY AND PROPERTY (HUME PAPERS ON PUBLIC POLICY), NO. 3, at 18 (1994).

54 *Id.* at 2.

55 RESTATEMENT (SECOND) OF TORTS ch. 40, topic 1, intro. note.

revisits trespass and nuisance in order to show that privacy interests are a core value of these property rights, and that shifts in the scope of those rights likely corresponds to changing social views regarding privacy.

Beginning once more with trespass, it is crucial to note that trespass doctrine has always protected privacy interests by nature of the personal security that in rem property confers upon its possessors. Because “possession of land confers, at common law, an entitlement to dictate the terms on which access may be enjoyed (if at all) by others,”⁵⁶ trespass shares a common ancestor of personal autonomy with basic notions of individual self-determination and privacy. Members of the Supreme Court have recognized this.⁵⁷ And, supporting this is the fact that “trespass to land is ‘essentially a wrong against possession, not against ownership.’”⁵⁸ The tort could therefore attach, in theory, to any person who possessed anything or any place—its legal protection followed the individual, not ownership of title.⁵⁹ Moreover, “not every unauthorized entry of another’s property is actionable.”⁶⁰ As an example, courts have upheld what would otherwise be a trespass even when permission to enter is obtained by fraud.⁶¹ This suggests that to some degree, permission is dispositive; that once an individual has allowed someone into their personal space, their property rights ensuring solicitude there are less actionable.

But, modern courts’ willingness to embrace the dynamic nature of common law property law rights in order to recognize intangible trespasses, despite continuing reliance on the unchanged language of the law (i.e. which requires “entry” onto property),⁶² has created its own issues. Indeed, courts

56 See GRAY & GRAY, *supra* note 9, at 1260.

57 See, e.g., *Oliver v. United States*, 466 U.S. 170, 190 n.10 (1984) (Marshall, J., dissenting) (“[O]ne of the purposes of the law of real property . . . is to define and enforce privacy interests . . .”); see also *Florida v. Jardines*, 569 U.S. 1, 13 (2013) (Kagan, J., concurring) (noting that the law of property influences our “shared social expectations” about privacy).

58 See GRAY & GRAY, *supra* note 9, at 1261 (discussing entitlement to sue in trespass).

59 See *id.* at 1260.

60 Abraham Bell & Gideon Parchomovsky, *The Privacy Interest in Property*, 167 U. PENN. L. REV. 869, 905 (2019).

61 See *id.* at 905–06 (“[C]ourts have sanctioned physical entry into other persons’ property when permission to enter was gained by fraud.”).

62 See Brady, *supra* note 38, at 1184–93 (arguing that the increasingly economic focus of trespass and nuisance law has left a gap in the legal protection of real property); see also *Loretto v. Teleprompter Manhattan CATV Corp.*, 458 U.S. 419, 450 (1982) (“Literally read, the Court’s test opens the door to endless metaphysical struggles over whether or not an individual’s property has been ‘physically’ touched. It was precisely to avoid ‘permit[ing] technicalities of form to dictate consequences of substance,’ that the Court abandoned a ‘physical contacts’ test in the first place.” (alterations in original) (citation omitted)).

have made a flurry of seemingly inconsistent rulings when confronted with invasive technologies that have no physical contact⁶³ with real property; namely aerial drones, computer software, and intrusive lights. This Article argues that the privacy interests that have always undergirded trespass law are once again surging to the surface as courts make rulings based on social policy and unwritten norms about invasiveness, in light of the unhelpful letter of the law and its emphasis on physical intrusions.

Take aerial trespass; while it is not immediately apparent why some flight heights are trespasses but not others, the Restatement's direct borrowing from nuisance law (i.e. "the use and enjoyment of land") in an attempt to clarify when aerial trespass occurs suggests that privacy interests may be a key factor. Flights by jumbo jets at high altitudes are thus unlikely to constitute trespass: to have so many passengers look upon so many potential plaintiffs somehow seems less invasive and intimate than flights flown closer to the ground (that presumably have clearer visibility of land), or flights by smaller aircraft (which would fly lower, and have fewer occupants). But, because the sphere of protection given to personal property has uncertain physical dimensions, it is unclear whether flights by small, unmanned drones could indeed constitute trespass. After all, drones, which are capable of incredible video storage and high image resolution, would seem to be both intrusive in the same manner as smaller aircraft and invasive in a new way given its novel surveillance capabilities.⁶⁴

A deluge of new and draft laws banning drones in certain areas for privacy reasons⁶⁵ suggests that privacy interests should prohibit invasive drone overflight. Arkansas and Louisiana, for example, have several laws addressing drones, including one that criminalizes the use of drones to invade spaces where an individual has a reasonable expectation of privacy.⁶⁶ The language of such laws against drone voyeurism echoes that of trespass doctrine generally—it does not appear to matter whether the intended victim was aware

63 That is, excluding contact at a molecular or atomic level, which light and electricity would of course have even if such contact is not visible to the naked eye.

64 See generally Hillary B. Farber, *Keep Out! The Efficacy of Trespass, Nuisance and Privacy Torts as Applied to Drones*, 33 GA. ST. U. L. REV. 359 (2017) (considering new legal questions posed by drones).

65 See *id.* at 365 ("[L]awmakers are feverishly proposing drone specific legislation."); Brian Farkas, *What to Do When Your Neighbor Has a Drone*, NOLO, <https://www.nolo.com/legal-encyclopedia/what-do-when-your-neighbor-has-drone.html#:~:text=Contact%20Your%20Neighbor&text=Reach%20out%20by%20phone%20or,his%20or%20her%20own%20backyard> (last visited Mar. 18, 2021) (providing an overview on current law governing drones).

66 ARK. CODE ANN. § 5-16-101(b) (West 2019); LA. STAT. ANN. § 14:283 (2020).

of the intrusion.⁶⁷ So long as privacy is knowingly violated by the offender, he would be criminally liable in much the same manner that trespassers are liable regardless of their intent in entering another's land. Relatedly, Florida's Freedom from Unwarranted Surveillance Act of 2019 prohibits the use of drones to observe "an owner, tenant, occupant, invitee, or licensee of privately owned real property . . . to obtain information about their identity, habits, conduct, movements, or whereabouts," as well as the mere observation of "unique identifying features or . . . occupancy" of any "privately owned real property."⁶⁸ Here, the nexus between privacy and property is evident, and the limits of each inform the other.

Other forms of intangible trespass also indicate that privacy interests can and do help define the scope of established property rights. In fact, a recent case of light trespass via computer fiber optics cables expressly noted that while "[t]he transmission of light signals across the Plaintiffs' land is an intangible invasion. . . . [I]t is not the basis for the alleged trespass; it is the cable's use that the Plaintiffs have put at issue."⁶⁹ Indeed, the repeated edging of trespass towards the language of nuisance law⁷⁰ suggests again that privacy interests underlying protection of people upon their property is what is truly at issue. Similar issues arise when dealing with "digital trespasses" that occur in augmented reality ("AR"). In such cases, courts have, to date, focused on relief for the physical side effects of actions taken in AR, even as they and commentators simultaneously acknowledge that messages conveyed by digital projections in AR may intrude upon privacy upon one's real property or right to control how that property is perceived by others.⁷¹

Finally, the burgeoning action of computer trespass illustrates that less "tangible" trespasses often boil down to a privacy-related issue: distinguishing between authorized and unauthorized access to another's personal spaces. With computer trespass, as with non-home physical spaces such as a store, not all computer spaces seem as private as others.⁷² Thus, the statutes concerning this form of trespass are somewhat hazily written to get at the crux of the tort

67 See sources cited *supra* note 66.

68 FLA. STAT. ANN. § 934.50(2)(e) (West 2020).

69 In re WorldCom, Inc., 320 B.R. 772, 780 (Bankr. S.D.N.Y. 2005) (citation omitted).

70 See Brady, *supra* note 38, at 17 (discussing how *Martin* suggests that light can be the subject of trespass if it causes "significant or substantial and unreasonable" interference with the use of one's land).

71 See Declan T. Conroy, *Property Rights in Augmented Reality*, 24 MICH. TELECOMM. & TECH. L. REV. 17, 25 (2017) (discussing the Holocaust's Museum's concern that appearance of a "poison-gas type Pokémon" within the museum via the Pokémon Go app undermined the Museum's ability to "solemnize and honor [Holocaust victims'] history").

72 See Orin Kerr, *Norms of Computer Trespass*, 116 COLUM. L. REV. 1143, 1152 (2016) (considering trespass norms of commercial stores).

or crime, which is to prevent hackers crossing “cyberproperty” boundaries⁷³ rather than wayward neighbors ignoring physical fences or property lines. For example, the Washington state statute on computer trespass, which like the federal Computer Fraud and Abuse Act of 1986, states that a trespass occurs “if the person, without authorization, intentionally gains access to a computer system or electronic database of another.”⁷⁴ The statute reflects the difficulty common across all forms of trespass regarding what may entail authorization, but otherwise, stresses access in the same way that the strict liability of physical trespass always has. Though there has not been much litigation to help courts define computer trespass norms yet,⁷⁵ it seems reasonably likely that intuitions about which types of computers and computer networks are intended by their owners to be kept most private will inform the way the doctrine gets shaped.

The development of the tort of nuisance even more readily demonstrates that privacy has always been an element of property law. Several early English cases make clear that the actions at issue were often pushed into unreasonableness (thus becoming a nuisance) when privacy and security in personal spaces was at stake. Take, for instance, *Aldred’s Case*, a case from 1610 wherein William Aldred claimed that his neighbor Thomas Benton had built and maintained a pig sty too close to his home.⁷⁶ The court found for Aldred, holding that the smell from the sty was enough to deprive Aldred of his property and personal dignity.⁷⁷ Specifically, the court set down a sweeping rule that emphasized an individual’s right to be safe, secure, and comfortable in his own personal space.⁷⁸

Considered collectively, the common factors between various tests for nuisance show that “use and enjoyment” implies more than mere possession of land: it speaks directly to an individual’s right to exist in a personal area as he sees fit, without the direct judgment or disruption of others—in a word, his privacy. The open-ended nature of nuisance’s multi-factor inquiry has thus long allowed nuisance doctrine to accommodate a variety of circumstances as

73 See Conroy, *supra* note 71, at 37–38 (describing various ways in which courts have recognized real property rights in cyberspace, including but not limited to certain kinds of computer networks, drives, and servers).

74 WASH. REV. CODE § 9A.90.040(1) (2016); Computer Fraud and Abuse Act, 18 U.S.C. § 1030 (2018).

75 See Kerr, *supra* note 72, at 1155 (“Computer trespass norms remain uncertain.”).

76 William Aldred’s Case (1610) 77 Eng. Rep. 1558; 4 CO. REP. 57a, 57b.

77 *Id.*

78 See *id.* (stating that a man has “no right to maintain a structure upon his own land, which, by reason of disgusting smells, loud or unusual noises, thick smoke, noxious vapors, the jarring of machinery, or the unwarrantable collection of flies, renders the occupancy of adjoining property dangerous, intolerable, or even uncomfortable to its tenants”).

they arise, or to encompass existing acts and items that are used in newly interfering ways. Because of this, courts have remarked that nuisance claims are not uncommonly brought simultaneously with direct actions in privacy law such as intrusion upon seclusion and invasion of privacy.⁷⁹

Perhaps for this reason, courts and scholars alike have been more receptive to nuisance than trespass to remedy what might otherwise be called invasions of privacy caused by new technologies. As a first example, in 2016 a Nevada court examining a trespass claim based upon unwanted light projections rejected the trespass claim but suggested that had it been brought as a nuisance suit, the claim may have survived appellate review.⁸⁰ Similarly, though it settled and thus left open its legal questions, a consolidated set of class action lawsuits were filed in the Northern District of California alleging that placing virtual objects (i.e. Pokéstops within the AR game Pokémon Go) on or near private property without permission directed players to trespass, thus creating a nuisance.⁸¹ Along the same lines, Mark Lemley and Eugene Volokh have posited that if nuisance law is modified to “[treat] VR ‘places’ as tantamount to ‘uses of land’ which nuisance law protects[,]” tort liability would be plausible.⁸²

B. An Invitation to Evolve: Moore v. Regents of California

Though it is nearly thirty years old, *Moore v. Regents of California* remains the foundational case for considering property rights in genetic materials.⁸³ However, *Moore* is outdated, binding only in California, and does not

79 See, e.g., *Van Patten v. Vertical Fitness Grp., LLC*, 847 F.3d 1037, 1040 (9th Cir. 2017) (observing that a nuisance claim may be available to a plaintiff alleging unconsented telemarketing via text message).

80 See *Int’l Union of Painters & Allied Trades Dist. Council 15 Local 159 v. Great Wash Park, LLC*, No. 67453, 2016 WL 4499940, at *9 (Nev. App. Ct. July 29, 2016) (Tao, J., concurring) (“In some cases, projecting artificial light onto someone else’s property might constitute an actionable private nuisance. The district court’s order contains no factual findings regarding whether such a nuisance occurred in this case, and so that question is not before us.”)

81 See *Consol. Amended Class Action Complaint at 3–4, In re Pokémon Go Nuisance Litig.*, No. 3:16-cv-04300-JD (N.D. Cal. filed Nov. 25, 2016); Matt Shields & Susannah Benjamin, *Pokémon Go Class Action Settles as Augmented Reality Legal Questions Remain*, HARV. J. SPORTS & ENT. L. (Apr. 12, 2019), <https://harvardjse.com/2019/04/pokemon-go-class-action-settles-as-augmented-reality-legal-questions-remain> (explaining that the trespass and nuisance issues surrounding apps like Pokémon Go remain uncertain following the settlement).

82 Mark A. Lemley & Eugene Volokh, *Law, Virtual Reality, and Augmented Reality*, 166 U. PA. L. REV. 1051, 1101 (2018).

83 See, e.g., *Greenberg v. Mia. Child.’s Hosp. Rsch. Inst., Inc.*, 264 F. Supp. 2d 1064, 1074 (S.D. Fla. 2003) (echoing *Moore* by holding that property interests in one’s tissues are lost upon donation to medical research, thus barring claims of conversion).

preclude recognizing a limited property right in genetic information. Moreover, it applies to an entirely different context, i.e., the buying and selling of body parts and human cells for commercial development, rather than law enforcement collection and use of genetic materials under the Fourth Amendment. Though a handful of subsequent cases have addressed claims regarding property ownership in human biological materials, none save *Moore* has engaged at length with the underlying property theory, and all appear to cite *Moore* merely as shorthand for courts' reticence to extend property rights.

In *Moore*, the California Supreme Court refused to uphold Moore's claimed property rights in his excised spleen. Moore suffered from hairy-cell leukemia, and had consented to surgical removal of his spleen. But prior to the procedure, doctors did not tell him that cells from his spleen would provide lucrative "competitive, commercial, and scientific advantages."⁸⁴

Moore sued the defendants under thirteen causes of action, including conversion. Because conversion is a tort that "protects against interference with possessory and ownership interests in personal property": Moore thus argued that he "continued to own his cells following their removal from his body, at least for the purpose of directing their use."⁸⁵ The court flatly rejected that argument based upon two core reflections. First, in their estimation, legislation in California had weakened a patient's right of control over his excised tissues so greatly that any remaining rights in that tissue were no longer "property" rights.⁸⁶ Second, public policy demanded Moore's property rights remain unrecognized. The court worried that if biological materials could be bought and sold, human dignity would be harmed and life would become further⁸⁷ commoditized, in addition to imposing potentially crushing confusion over title and legal liability upon academic research institutions and an "infant biotechnology industry."⁸⁸ Excluding intellectual property cases debating the extent to which cellular and genetic materials can be patented, no cases seem

84 See *Moore v. Regents of the Univ. of Cal.*, 793 P.2d 479, 481-82 (Cal. 1990) (observing that those cells were later patented and sold to commercial development for roughly \$1 million).

85 *Id.* at 487.

86 *Id.* at 491-92.

87 See, e.g., Radin, *supra* note 12, at 1851-52 (arguing that healthy personhood and social structuring requires certain aspects of life to be exempt from being priced, bought, and sold). Body parts are also, obviously, bought and sold regularly on the black market, and priced as part of insurance and worker's compensation plans. The going black market price of a spleen in 2012 was estimated to be \$508. See Casey Chan, *Here's How Much Body Parts Cost on the Black Market*, GIZMODO (Apr. 23, 2012, 9:00 PM), <https://www.gizmodo.com.au/2012/04/heres-how-much-body-parts-cost-on-the-black-market/>.

88 See *Moore*, 793 P.2d at 493.

to have revisited these property issues in detail since *Moore* was decided in 1990.⁸⁹

Moore should no longer be viewed as an impediment to recognizing a limited genetic property right. Turning first to the court's policy arguments, there does seem to be a general fear that recognizing property rights of any sort in cell and tissue materials enables a flood of extensive litigation, wherein plaintiffs seek monetary compensation for research and innovation based in part upon their bodily substances.⁹⁰ But on the timescale of technological advances in the biosciences, *Moore* is grounded in a bygone era. The "infant biotechnology industry" the Court was so keen to protect is now well positioned to defend its own interests: the medical biotechnology sector alone is worth at least \$150 billion a year,⁹¹ and technologies such as CRISPR that were enabled by the completion of the Human Genome Project in 2003⁹² have made research exponentially cheaper and faster than could have been imagined when *Moore* was decided three decades ago.⁹³ Looking solely at

89 One ongoing case in Florida state court may change this, though it seems unlikely given that the case is entering its second decade of litigation and shows no signs of imminent resolution on the merits. *See generally* Peerenboom v. Perlmutter, No. 502013CA015257, 2014 WL 713133 (Fla. Cir. Ct. Feb. 24, 2014) (describing the aforementioned case). Growing out of a bizarre tennis court spat between billionaires, in *Peerenboom*, attorneys for the Perlmutteres have expanded their conversion claim to include not just the collection of Perlmutter's DNA, but importantly, the "analyzing and testing" of it. *Id.* The court in that case agreed to let the case continue past Peerenboom's motion to dismiss, though it did not clarify what kind of property interests sufficient to support conversion were present in the "intangible rights to their genetic information" that the "Perlmutteres plainly retain." *Id.* Thus, so far, the case only serves to highlight that there is a strong privacy interest in genetic information, and how difficult it is to use conversion (which is a strict liability tort) to resolve ownership disputes for material as complex as genetic information. Several other cases have also discussed ownership interests in whole human biological materials (i.e., not genetic information directly), albeit cursorily. *See, e.g.,* Wash. Univ. v. Catalona, 490 F.3d 667 (8th Cir. 2007) (deeming analysis of ownership interests in prostate cancer research samples as unnecessary in the context of their "gift" to the university).

90 *See, e.g.,* Mary Taylor Danforth, *Cells, Sales, and Royalties: The Patient's Right to a Portion of the Profits*, 6 YALE L. & POL'Y REV. 179, 181-82 (1988) (proposing a legal approach to patients' property rights in their cells that does not stifle research by threat of litigation).

91 *Moore*, 793 P.2d at 493; Troy Segal, *Biotech vs. Pharmaceuticals: What's the Difference?*, INVESTOPEDIA (June 25, 2019), <https://www.investopedia.com/ask/answers/033115/what-difference-between-biotechnology-company-and-pharmaceutical-company.asp> (discussing the industry).

92 The Project fully sequenced the human genome for the first time, and had taken over a decade of concerted international effort to complete. *See A Brief Guide to Genomics*, NAT'L HUM. GENOME RSCH. INST., <https://www.genome.gov/about-genomics/fact-sheets/A-Brief-Guide-to-Genomics> (last visited June 4, 2021).

93 *See* Brad Plumer, Eliza Barclay, Julia Belluz & Umair Irfan, *A Simple Guide to CRISPR, One of the Biggest Science Stories of the Decade*, VOX (Dec. 27, 2018, 2:45 PM), <https://www.vox.com/2018/7/23/17594864/crispr-cas9-gene-editing> (stating that the *Cas9* enzyme the CRISPR technique uses to edit genes at the single base pair level can be had for as little as \$75 and may only take a few hours to use).

CRISPR, for example, in 2008 there were fewer than one hundred papers on the topic; ten years later, in 2018, there are more than 17,000 published papers expanding on and applying the gene editing technique.⁹⁴ Moreover, modern technology makes tracking participant consent much easier and faster than it did when *Moore* was decided, thus significantly lessening uncertainty about possible future litigants over title.

The court's concerns about human dignity, however, remain relevant, especially in the context of the Fourth Amendment's protections against unreasonable government search and seizure. But where the court worried that to hold that patients do not have the ultimate power to control the destiny of their tissues "would open the door to a massive invasion of human privacy and dignity in the name of medical progress[,]"⁹⁵ its fears came to pass anyway. Now, arguably, the inability under law for individuals to slow corporate exploitation of their bodily materials has led to an utter lack of genetic privacy.⁹⁶ Moreover, the court's distress about commoditizing and disrespecting human life echoes recurring debates that run through the whole tapestry of the history of medicine, maybe most obviously in the cases they allude to that evaluate the propriety of using human cadavers for anatomical and surgical study.

Above all, the court's discussion of the many cases recognizing rights of dominion over one's own body and the interests one has therein suggest that legal protection of a limited property right in genetic material is not precluded. The lower court had noted "these rights and interests are so akin to property interests that it would be a subterfuge to call them something else."⁹⁷ But nowhere did reviewing court engage with that observation, or clearly explain what those property rights were beyond noting that "some limited right to control the use of excised cells" perhaps survived even after the applicable California statute established use and deletion requirements.⁹⁸ Therefore the stumbling blocks appear to have been extant legislation and the demands of a burgeoning biotechnology industry, which, taken together, prioritized economic development over the autonomy interests and corresponding sense of ownership one has in their own body.

94 *See id.* (quoting Jennifer Doudna of the University of California, Berkeley, one of the scientists who discovered the CRISPR/Cas9 system, as saying, "This has become such a fast-moving field that I even have trouble keeping up now").

95 *Moore*, 793 P.2d at 491 (citation omitted).

96 *See Genetic Information Privacy*, *supra* note 7 ("So what can protect the privacy of genetic data in such a world? Not much, actually. Some laws limit how the information can be used, but none truly protects privacy.").

97 *See Moore v. Regents of the Univ. of Cal.*, 249 Cal. Rptr. 494, 505 (Cal. Ct. App. 1988).

98 *Moore*, 793 P.2d at 492.

II. GENETIC PROPERTY RIGHTS

Under extant American tort, criminal, and contract law regimes, true genetic privacy looks elusive. And so, we turn to the dynamic nature of common law property rights to protect what they cannot. Indeed, industry usage already implies property interests in genetic information and courts would be doing no more than their traditional duty in recognizing that.

The leading theory of property conceives of property as a “bundle of sticks,” wherein the sticks represent distinct rights that individuals assert in relation to things against one another, and which may be divided among owners.⁹⁹ Originated by Wesley Hohfeld and other legal realists of the early twentieth century,¹⁰⁰ the “bundle of rights” that may be exercised with respect to an object principally include the “rights to possess the property, to use the property, to exclude others from the property, and to dispose of the property by sale or by gift.”¹⁰¹ And, the list of theoretical sticks can be expanded, including rights of personal use and enjoyment, rights to the income from use by others, rights to security, a duty to refrain from using the object in ways that harm others, and residual rights on the reversion of lapsed ownership rights held by others.¹⁰²

Other rights may also exist, but the crucial thing is that different property objects can be accompanied by different selections of rights sets, and the weighting of those rights relative to one another is likewise malleable. While traditionally, the right to exclude has been the one most treasured at common law when real property is involved, it is by no means the only or most important of the abovementioned rights. In his dissent in *Moore*, California Supreme Court Justice Stanley Mosk mentioned the bundle of sticks approach by name, and noted that, “[f]or a variety of policy reasons, the law limits or even forbids the exercise of certain rights over certain forms of property.”¹⁰³ In this way, the *Moore* Court could have held the cells to be Moore’s property, but instead used the cited legislation and policy arguments to shape how that property may or may not be alienable.

This speaks to a more central question regarding novel types of property: to assign an appropriate set of rights to an object, that object must be clearly

99 See generally Robert C. Ellickson, *Two Cheers for the Bundle-of-Sticks Metaphor, Three Cheers for Merrill and Smith*, 8 *ECON. J. WATCH* 215, 216 (2011) (explaining the benefits and limitations of the “bundle of sticks” metaphor).

100 Denise R. Johnson, *Reflections on the Bundle of Rights*, 32 *Vt. L. Rev.* 247, 251 (2007).

101 *Moore*, 793 P.2d at 509 (Mosk, J., dissenting).

102 See JASPER A. BOVENBERG, *PROPERTY RIGHTS IN BLOOD, GENES & DATA: NATURALLY YOURS?* 127 (2006) (listing the rights included in the core “bundle”).

103 *Moore*, 793 P.2d at 509 (Mosk, J., dissenting).

defined. In this Part, Section II.A highlights that there *is* no such unitary thing as “genetic information,” though this Article has itself used that term. Rather, the term encompasses five distinct objects, each tier of which Section II.B will argue requires a different set of property rights sticks in its bundle so as to avoid doctrinal confusion and self-sabotaging privacy laws.

A. A Taxonomy of “Genetic Information”

While he does not seem to have fully realized it, part of the challenge of applying Justice Mosk’s bundle-of-sticks approach in *Moore* was Moore’s overbroad definition of his property. Moore grounded his conversion claim in a dispute over his “Blood and Bodily Substances,” which included inter alia his blood, his bodily tissues, his cells, and the cell lines derived therefrom.¹⁰⁴ Such a sweeping definition set Moore up to fail. Most notably, the commercial and research byproducts produced from his cells had fundamentally different qualities and required additional effort in their distillation; to lump those in with his baser materials, so to speak, impaired any real ability of the Court to recognize that Moore may have had a limited property interest because the object defined included too much.

The same is true for “genetic information” as the term is currently used. Thus, this Section provides a sorely needed taxonomy of different types of “information” likely involved when “genetic information” is referenced. To protect individual privacy and ensure constitutional government searches, it is essential for courts, advocates, and the lay public to understand the distinct limitations and physical contours of each type, and examine what that might mean for making legal arguments. Hopefully, this effort to clarify how genetic concepts relate to each other will also encourage lawyers and courts to not assume background knowledge in advanced biology, and spell out clearly in arguments and orders what it is they are actually discussing.

I propose five core classifications, the first two of which can probably be collapsed together under most circumstances for purposes of Fourth Amendment search doctrine. I list them in order of least to most scientifically “processed,” which also tracks the order in which they are collected from human beings. This means that a later category cannot exist without having at some point been processed through preceding ones.

The five categories are as follows: (1) source biological materials, including saliva, blood, and whole tissues; (2) extracted and purified DNA; (3) sequenced DNA, in whole or in part; and information gleaned from

104 *Id.* at 506.

sequenced DNA at both an (4) individual level and (5) at aggregate, i.e. population-wide.

1. *Biological Source Materials*

This category consists of all possible origin sources from which to extract DNA directly from an individual.

It is in some ways the broadest, because it would include anything from entire limbs or whole organs down to samples of whole cells. Blood and saliva are usually the most common source materials for genomic study, but hair and urine are also viable sources of DNA for genomic analysis.¹⁰⁵

It is notable that the trend is towards literally microscopic amounts of biological materials needed for collection. Large amounts of source biological material are no longer necessary for extracting DNA that can be used for genetic studies. In fact, high-quality DNA can be extracted from as little as half of one mL of fresh or frozen human blood.¹⁰⁶ For scale, police in the field currently collect about 20 mL when drawing blood for a DUI test,¹⁰⁷ and the popular genetic testing kits sold by 23andMe require about 2 mL of saliva to be collected.¹⁰⁸ And, albeit still limited in utility, marked improvements are in the works for even single cell genome analysis.¹⁰⁹ Such advances suggest that property in such objects cannot be defined purely by size, and that courts and scholars must instead look to the properties of the object—here, that it can enable further genetic analysis—when scrutinizing arguments.

Nor must these materials be harvested from the living. Though DNA begins to degrade upon a person’s death and quickly becomes unusable for gene sequencing, advances in Next Generation Sequencing have enabled scientists to extract DNA “from preserved tissue (in most cases bone and

105 Souvik Ghatak, Rajendra Bose Muthukumar & Senthil Kumar Nachimuthu, *A Simple Method of Genomic DNA Extraction from Human Samples for PCR-RFLP Analysis*, 24 J. BIOMOLECULAR TECHS. 224, 227 (2013).

106 See Pokhraj Guha, Avishek Das, Somit Dutta & Tapas Kumar Chaudhuri, *A Rapid and Efficient DNA Extraction Protocol from Fresh and Frozen Human Blood Samples*, 32 J. CLINICAL LAB’Y ANALYSIS 1, 1 (2017) (detailing a method to extract DNA from small samples of blood).

107 See, e.g., COLO. CODE REGS. § 1005-2(6.1.1.6) (2019) (noting that blood specimen must be collected directly into two 10ml sterile tubes).

108 *Providing Saliva Sample for DNA Test Kit*, 23ANDME, <https://customer-care.23andme.com/hc/en-us/articles/202904530> (last visited Nov. 29, 2019).

109 See Christiane Bäumer, Evelyn Fisch, Holger Wedler, Frank Reinecke & Christian Korfhage, *Exploring DNA Quality of Single Cells for Genome Analysis with Simultaneous Whole-Genome Amplification*, 8 SCL. REPS. 1, 2 (2018) (discussing the possibility of genome amplification from small samples including single cells).

teeth) that is recovered from either ancient or semi-ancient” remains.¹¹⁰ Corresponding advances in the means of preserving tissues and cell cultures may also increase the amount of time after death during which gene sequencing can be done.¹¹¹ Thus, post-mortem property rights may become more of an issue as the science in this area continues to advance.

2. *Extracted DNA*

Once biological source materials are removed from an individual, all further categories require some degree of additional human effort to come into creation.

The next stage after sample collection, and what this Article classifies as category two, comprises DNA that has been extracted from cells in the source material and purified. DNA in this category is thus ready for sequencing and further analysis, but like the materials in category one, does not reveal sensitive personal information without further processing.

3. *Sequenced DNA*

Once DNA has been purified and processed, it can be sequenced by many different methods, all of which ultimately produce a raw data file of a person’s unique sequence of nucleotide bases (A, C, G, T).

Before surveying the most common types of DNA sequencing, additional background information on genetic science may be helpful. The human genome is encoded in double-stranded DNA molecules consisting of complementary nucleotide chains. Though the human genome contains about six billion nucleotide bases, approximately 99% of any two human genomes are the same. What remains constitutes the “genetic variation” that makes an individual human unique. The most common type of genetic variant is a single nucleotide polymorphism (“SNP”).¹¹² Each SNP represents a difference in a single DNA building block; for example, a SNP may replace the nucleotide cytosine (C) with the nucleotide thymine (T) in a certain stretch

110 Daniel Fernandes et al., *The Identification of a 1916 Irish Rebel: New Approach for Estimating Relatedness from Low Coverage Homozygous Genomes*, 7 *SCI. REPS.* 1, 1 (2017).

111 See Sebastian Giwa et al., *The Promise of Organ and Tissue Preservation to Transform Medicine*, 35 *NATURE BIOTECHNOLOGY* 530, 531 (2017) (“By overcoming these institutional barriers and facilitating coordinated and cross-disciplinary research, it is now possible to dramatically accelerate progress in organ and tissue preservation using existing knowledge from a diverse array of fields.”).

112 When spoken, a SNP is commonly pronounced “snip.”

of DNA.¹¹³ SNPs thus serve as genetic markers that help researchers locate genes.

Because SNPs “have a direct influence on our physical attributes (e.g., hair color, eye color, blood type) . . . [and] predispositions to various diseases,”¹¹⁴ SNP testing is the most common form of genetic test that an individual may take. Largely, this is because direct-to-consumer genetic testing companies like 23andMe and Ancestry load saliva samples onto SNP chips to quickly and cheaply “spot-check” a person’s sample against a preset collection of SNPs known to be involved in certain traits.¹¹⁵ In this way, the entirety of an individual’s DNA is not sequenced; only the SNP regions of greatest interest to whomever is doing the sequencing.

Whole-genome sequencing, on the other hand, is exactly what it sounds like. These tests aim to sequence an individual’s complete genetic sequence, and accordingly produce much larger data files that can be studied in greater depth. Though these tests used to be prohibitively expensive for average consumers, Veritas, the market leader for whole genome sequencing, recently dropped the cost of its tests to \$599 and anticipates soon pricing tests between \$100-200 so as to compete directly with 23andMe and Ancestry.¹¹⁶

A plethora of other types of genetic tests also exist,¹¹⁷ not of all which require DNA sequencing and most of which are relatively less popular amongst the lay public than the tests described above. Some, like newborn screening for genetic disorders that is required for all children born in the United States, generally look for the presence or absence of various compounds in the blood or of entire chromosomes rather than sequencing

113 *What Are Single Nucleotide Polymorphisms (SNPs)?*, MEDLINE PLUS, <https://ghr.nlm.nih.gov/primer/genomicresearch/snp> (last updated Sept. 18, 2020).

114 *See id.* at 101. By the time of publication, the number of known SNPs will likely be outdated, the number of research community-validated SNPs on the NCBI webpage has grown from approximately 50 million in 2015 to over 335 million at the time of this writing in Sept. 26, 2018. That webpage is located at https://www.ncbi.nlm.nih.gov/SNP/snp_summary.cgi.

115 Tina Hesman Saey, *An Open Book*, SCI. NEWS, May 26, 2018, at 20, 22.

116 Joe Andrews, *23andMe Competitor Veritas Genetics Slashes Price of Whole Genome Sequencing 40% to \$600*, CNBC (July 1, 2019, 9:30 AM), <https://www.cnbc.com/2019/07/01/for-600-veritas-genetics-sequences-6point4-billion-letters-of-your-dna.html>. As of December 2019, Veritas has halted its U.S. operations due to investors’ fears of increased oversight from the Committee on Foreign Investment in the United States. While it looks for potential buyers, however, its international services remain open. Christina Farr, *Veritas Genetics, The Start-Up That Can Sequence a Human Genome for Less Than \$600, Ceases US Operations and is in Talks with Potential Buyers*, CNBC (Dec. 5, 2019, 4:57 PM), <https://www.cnbc.com/2019/12/05/veritas-genetics-to-cess-us-operations-talks-with-buyers.html>.

117 Some other tests include: testing of just the X or Y chromosome, mitochondrial testing (sequencing of mitochondrial DNA alone, usually done to trace maternal ancestry), and whole exome sequencing (i.e. sequencing of only the coding portions of the genome, rather than the whole genome).

DNA in detail.¹¹⁸ However, these kinds of tests may soon be supplemented or replaced by more invasive sequencing tests. For instance, the United States Department of Health and Human Services now funds research that specifically aims to sequence newborns' genomes, and its long-running newborn genetic screening program counts among its goals, "to know all" and develop "long-term data collection and surveillance."¹¹⁹

4. *Insights Gleaned from Sequenced DNA (Individual and Aggregate)*

This category of genetic information no longer involves biologic data, but rather inferences gleaned *from* that biologic data. That is, once an individual's DNA has been transferred into a computer file listing out their A's, T's, C's, and G's, various statistical tests are run on the sequence to produce the inferential results most people are most familiar with (e.g. You do not have the e4 variant [of the *APOE* gene, the most common genetic variant associated with late-onset Alzheimer's disease] we tested or your genetics make you unlikely to detect certain bitter tastes¹²⁰). Most tests rely upon the fact that an individual's DNA is inherited, and draw their conclusions based on similarity or dissimilarity to either known relatives or samples intended to represent a larger (or, the whole) human population.¹²¹

The type of statistical methodology varies according to the genetic data at hand, the desired insight to be gleaned, and the level of mathematical complexity chosen by analysts.¹²² No regulations appear to be in place that mandates that particular methodologies be used or levels of statistical

118 *How Many Newborns Are Screened in the United States?*, NAT'L INSTS. HEALTH, U.S. DEPT HEALTH & HUM. SERVS., <https://www.nichd.nih.gov/health/topics/newborn/conditioninfo/infants-screened> (last updated Sept. 1, 2017).

119 ADVISORY COMMITTEE ON HERITABLE DISORDERS IN NEWBORNS AND CHILDREN, NEWBORN SCREENING: TOWARDS A UNIFORM SCREENING PANEL AND SYSTEM 11 (2006), <https://www.hrsa.gov/sites/default/files/hrsa/advisory-committees/heritable-disorders/newborn-uniform-screening-panel.pdf>; see also *NIH Program Explores the Use of Genomic Sequencing in Newborn Healthcare*, NAT'L INSTS. HEALTH (Sept 4, 2013), <https://www.nih.gov/news-events/news-releases/nih-program-explores-use-genomic-sequencing-newborn-healthcare> (describing an initial set of newborn genomic sequencing studies funded by HHS).

120 *Sample Trait Report*, 23ANDME, https://permalinks.23andme.com/pdf/samplerreport_traits.pdf (last visited Nov. 30, 2019).

121 See Jerome Kelleher et al., *Inferring Whole-Genome Histories in Large Population Datasets*, 51 NATURE GENETICS 1330, 1333 (2019) ("DNA sequences can be considered mosaics of sequence fragments that have been inherited from recent ancestors through an error-prone copying process. Similarly, these ancestors are themselves mosaics, copied imperfectly from yet older ancestors.")

122 See, e.g., Giovanni Montana, *Statistical Methods in Genetics*, 7 BRIEFINGS IN BIOINFORMATICS 297, 297 (2006) (describing basic statistical tests in genetic testing); Ingrid Lobo, *Genetics & Statistical Analysis*, 1 NATURE EDUC. 109, 109 (2008) (explaining that "'significance' has a very particular meaning in biology due to statistics").

significance reported prior to publication for tests not mandated by law (e.g. direct-to-consumer genetic tests, research studies).

Accordingly, while some genetic variants have become widely accepted, genetic “insights” in this category can represent a roulette game of unconfirmed genetic associations and poorly translated statistical analysis.¹²³ Yet, the seemingly functional predictions in this category tend to be the most talked about, and are of greatest interest to those seeking to use genetic testing for applied purposes. It is of vital importance that non-scientists seeking to use the results of genetic testing understand the limitations of the specific tests at issue, and more generally, to realize that there is wide diversity of applicable tests and potential results for any given “insight” generated.

B. Different Bundles, Different Sticks

Differences between the five categories of genetic information require that a different set and weighting of property rights attach to each. Since individuals must be able to understand what data is being gathered about them and why, and be able to opt out of the product or service in order to feel in control of their data, this Section attempts to highlight “sticks” in the various bundles of rights that would promote those two preconditions.¹²⁴ That said, achieving any kind of anonymity or opt-out is rapidly becoming impossible given the relational nature of genetic sequencing data. To that end, this Article focuses more heavily on rights that confer use constraints like data minimization because they more closely track the kind of ways other privacy-based property interests like nuisance operate.

123 See, e.g., Robert L. Klitzman, *Misunderstandings Concerning Genetics Among Patients Confronting Genetic Disease*, 19 J. GENETIC COUNSELING 430, 430 (2010) (“Misunderstandings about statistics and genetics often fueled each other, and reflected denial, and desires for hope and control”); Sharon Begley, *Consumers Aren’t Wild About Genetic Testing – Nor Are Doctors*, STAT NEWS (Feb. 12, 2016), <https://www.statnews.com/2016/02/12/consumers-arent-wild-genetic-testing-doctors> (explaining that “[w]hen doctors in the Sermo survey were asked why they would not recommend genome sequencing, the responses ranged from ‘It is not evidence-based,’ and ‘I am not sure what the clinical benefit would be,’ to ‘What does one do with [information indicating] you will eventually have a heart attack?’” (alteration in original)); Christie Aschwanden, *We’re All ‘P-Hacking’ Now*, WIRED (Nov. 26, 2019, 9:00 AM), <https://www.wired.com/story/were-all-p-hacking-now> (“Results from a study can be analyzed in a variety of ways, and p-hacking refers to a practice where researchers select the analysis that yields a pleasing result. The *p* refers to the p-value, a ridiculously complicated statistical entity that’s essentially a measure of how surprising the results of a study would be if the effect you’re looking for wasn’t there.”).

124 See DANA MCKAY ET AL., STATE OF THE ART IN DATA TRACKING TECHNOLOGY 10 (2019), http://cprc.org.au/wp-content/uploads/State-of-the-Art-in-Data-Tracking-Technology_UoM_FINAL_01112019.pdf (outlining the technologies used to track consumers data).

This Article does not question the adequacy or necessity of obtaining informed consent before removing biological materials to be used in research. Evidently, though both the Food and Drug Administration and the Department of Health and Human Services require it,¹²⁵ procedures for procuring informed consent require reform, and do not clearly apply to entirely private research entities that receive no government funding. But that is a separate nest of hornets. Nor does this Article tackle the economic tangle of how and when individuals might receive monetary compensation for their biological materials. Thus, it largely bypasses related literature on biotechnology patent law, organ transplant regulation,¹²⁶ harvesting of non-cellular, non-organ body parts such as bones,¹²⁷ and life insurance and worker's compensation.¹²⁸ Indeed, debate in these areas and genetic research is often interrelated, causing considerable confusion for companies, courts, and consumers.¹²⁹

Before diving into each category in turn, a few observations. First, observers should not assume that the potential for privacy invasions advances in the same linear fashion as the collection and data processing process. For instance, while whole organs or limbs that would fall into category one seem intuitively seem to be most personal or proximate to an individual's body,

125 See, e.g., Jeffrey R. Botkin, *Informed Consent for the Collection of Biological Samples in Household Surveys*, in CELLS AND SURVEYS: SHOULD BIOLOGICAL MEASURES BE INCLUDED IN SOCIAL SCIENCE RESEARCH? 276, 276 (Caleb E. Finch et al. eds., 2001) (describing how tissue repositories have come under considerable fire regarding the propriety of their use, given that "(1) contemporary genetic technology permits a detailed analysis of small tissue samples; (2) a wide variety of mutations . . . are associated with serious health problems; (3) there is substantial concern . . . over genetic discrimination in insurance and employment; and (4) many samples have been collected without informed consent").

126 See National Organ Transplant Act, 42 U.S.C. § 274e (2018) (prohibiting the sale of human organs and authorizing the Department of Health and Human Services to create and regulate what has now become the Organ Procurement and Transplantation Network); *Timeline of Historical Events and Significant Milestones*, ORGANDONOR.GOV, <https://www.organdonor.gov/about/facts-terms/history.html> (last visited Mar. 23, 2021) (outlining the timeline of historical events regarding donating organs).

127 See, e.g., Melody Petersen, *In the Rush to Harvest Body Parts, Death Investigations Have Been Upended*, L.A. TIMES (Oct. 13, 2019, 3:00 AM), <https://www.latimes.com/business/story/2019-10-13/body-parts-harvesting-hinders-coroner-autopsies> (discussing the harvesting of body parts from people in Los Angeles County).

128 See, e.g., Lena Groeger, Michael Grabell & Cynthia Cotts, *Workers' Comp Benefits: How Much is a Limb Worth?*, PROPUBLICA (Mar. 5, 2015), <https://projects.propublica.org/graphics/workers-compensation-benefits-by-limb> (showing the results of calculations of limb worth for workers' compensation purposes).

129 See, e.g., *Greenberg v. Mia. Child.'s Hosp. Rsch. Inst., Inc.*, 264 F. Supp. 2d 1064, 1066 (S.D. Fla. 2003) (granting defendant researcher, hospital, and research institute's motion to dismiss in part in a case involving, among others, claims of breach of fiduciary duty, conversion, and patent rights).

without further processing, this category yields the least genetic information. However, all downstream genetic information first requires source biological material. Therein lies one of the dilemmas of genetic information, and of big data projects in general: objects from upstream categories can enable collection of information from most or all of the categories that follow. Thus, property rights in upstream categories of objects must be mindful of inevitable function creep, and of the fact that laboratory processing is rapidly becoming faster, cheaper, and more accessible to the lay public. Finally, the private nature of many genetic research and production partnerships and the difficulties of pricing what a person's data is worth¹³⁰ make it unclear what categories are truly of greatest value to researchers and industry. This Article assumes that the raw sequencing data in category three and the purified DNA from category two are of most utility, given that it is of greatest research flexibility and takes perhaps the most physical effort to create, respectively. Those categories, however, likely do not align with the categories of greatest value to the average American. This Article assumes that those categories will instead be categories one (for reasons abovementioned) and four (the "end product" insights that are the most digestible to consumers without training in genetics or bioinformatics). Accordingly, the particular focuses of property rights in categories two and three should weight towards consumer privacy protections, while those in the other categories should prioritize traditional property-privacy rights that bolster personal autonomy and independence.

Turning to category one (source biological materials), as others have noted, there undoubtedly is something inherently sacrosanct about human bodily materials, even after their removal.¹³¹ Accordingly, people are able to treat their bodies as objects of property in some ways (e.g. bequeathing it for research purposes or donating organs to specific family members) but not others (e.g. selling one's self into servitude). As Justice Mosk noted in his *Moore* dissent,

"Since property or title is a complex bundle of rights, duties, powers and immunities, the pruning away of some or a great many of these elements does not entirely destroy the title[.]" . . . [Thus] even if we assume that [California law] limited the use and disposition of his excised tissue . . . [Moore] at least

130 See Marie C. Baca, *What You Do on the Internet is Worth a Lot. Exactly How Much, Nobody Knows*, WASH. POST (Oct. 14, 2019, 7:00 AM), <https://www.washingtonpost.com/technology/2019/10/14/what-you-do-internet-is-worth-lot-exactly-how-much-nobody-knows> (describing the challenges faced by academics, policymakers, and consumers in arriving at an accurate estimate of how much one's internet presence is worth).

131 See, e.g., Danforth, *supra* note 90, at 191 (1988) (quoting ethicist Thomas Murray's analysis of *Moore v. Regents of California*, wherein Murray noted that even after removal, humans appear to retain moral interests in human organs and tissues "so that at least they are not misused or treated in an undignified manner").

had *the right to do with his own tissue whatever the defendants did with it*: i.e. he could have contracted with researchers and pharmaceutical companies to develop and exploit the vast commercial potential of his tissue and its products.¹³²

Combining Mosk's apt observation that human tissues are regularly subject to contractual relations with a strong desire to preserve human dignity, category one might best be described as carrying with it: (1) rights of exclusive possession and personal use whilst living¹³³ (2) at least a partial right to manage use by others; and (3) a right to confidentiality. Indeed, a number of major industry players in this space recognize these limited property rights already. 23andMe customers, for example, may choose to let the company store their saliva samples and by doing so, explicitly grant consent for it to access and analyze that stored sample for between one and ten years.¹³⁴ And, prominently placed on its Privacy Center homepage, the company states, "you . . . decide how your information is used and with whom it is shared."¹³⁵ Likewise, Ancestry, another genetic testing giant, stores customers' saliva and DNA after initial processing, but allows requests for destruction of biological materials at any time because "[y]ou always maintain ownership of your DNA and DNA Data[.]"¹³⁶ In this way, major genetic testing players seem to be coalescing around a norm of limited personal control over biological samples and contractual agreement regarding their use, both of which give rise to property-like or property rights. All of the same arguments likewise apply to extracted DNA in category two, to the extent that companies imply that the physical DNA extracted from saliva samples is functionally the same as the saliva itself for their purposes. And at least one state, Alaska, has passed legislation stating, "a DNA sample [is] . . . the exclusive property of the person sampled or analyzed" and awarding individuals both a private cause of action and the prospect of pressing criminal misdemeanor charges against alleged wrongdoers.¹³⁷ Courts assigning a limited property right to this category of

132 *Moore v. Regents of the Univ. of Cal.*, 793 P.2d 479, 510 (Cal. 1990) (Mosk, J., dissenting) (quoting *People v. Walker*, 33 Cal. App. 2d 18, 20 (1939)) (emphasis in original).

133 *Id.*; see also *Hecht v. Super. Ct. of L.A. Cnty.*, 20 Cal. Rptr. 2d 275, 246 (Cal. Ct. App. 1993) (holding that a sperm donor may have a property-like interest in his stored semen "to the extent that he had decisionmaking authority as to the sperm within the scope of policy set by law.").

134 See *Biobanking Consent Document*, 23ANDME, <https://www.23andme.com/about/biobanking> (last visited Nov. 18, 2019) (spelling out the terms to which 23AndMe users consent).

135 *Privacy Center*, 23ANDME, <https://www.23andme.com/privacy/?vip=true> (last visited Nov. 18, 2019). While saliva samples cannot be returned to consumers because 23andMe processes them in an irreversible manner, presumably this assurance extends to unprocessed and leftover saliva samples.

136 *Privacy Statement*, ANCESTRY, <https://www.ancestry.com/cs/legal/privacystatement> (last visited Nov. 18, 2019).

137 ALASKA STAT. § 18.13.010(a)(2) (2019).

genetic information, then, would merely be recognizing extant industry practices and shifts in state laws.

These rights are even stronger in the context of sequenced DNA (category three) due to the intimate details that data may reveal about an individual and its increased commercial and research value. First, it is here that many companies' privacy statements, new privacy laws, and consumer protection groups are focused, as can be evidenced by their definitions of genetic information. For instance, Nevada law defines it as "any information that is obtained from a genetic test."¹³⁸ Alaska's genetic privacy law refers to the "DNA sample and the results of a DNA analysis."¹³⁹ Neither definition has clear contours yet, but at minimum would seem to cover the sequencing data that is the initial output of a genetic test.

Private actors, however, seem to use definitions of genetic information that would include category three but also overlap two or more other categories. 23andMe's most recent Privacy Statement, for example, defines Personal Information to include both "information regarding your genotypes . . . generated through processing of your saliva by 23andMe or by its contractors, successors, or assignees; or otherwise processed by and/or contributed to 23andMe" and information about site usage and other behaviors used

[t]o analyze and improve our Services[,] . . . [t]o process, analyze and deliver your genetic testing results[,] . . . [t]o allow you to share your Personal Information with others[,] . . . [t]o allow you to share your Personal Information for 23andMe Research purposes[,] . . . [t]o recruit you for external research[,] . . . [t]o provide customer support[,] . . . [t]o conduct surveys or polls, and obtain testimonials . . . [and] to provide you with marketing communications.¹⁴⁰

Ancestry, only somewhat more clearly, separates what it analyses into saliva, DNA and DNA Data. The latter, however, includes both a customer's individual data file as well as family tree data and "derivative Genetic Information (ethnicity estimates, genetic relative matches, etc.)."¹⁴¹ While the overlap can lead to complicated contractual rights, courts should recognize that most genetic testing companies appear to refer to genetic information as

138 NEV. REV. STAT. § 629.111 (2019).

139 ALASKA STAT. § 18.13.010(a)(2) (2020).

140 See *Privacy Policy*, 23ANDME, <https://www.23andme.com/about/privacy> (last updated Oct. 30, 2020) [hereinafter 23andMe Privacy Policy] (noting that the definition of "genetic information" includes "[i]nformation . . . as outlined in Section 3," which includes the additional data here mentioned).

141 *Privacy Statement*, *supra* note 136.

at least including an individual's sequenced DNA data or similar marker presence reports.

Second, companies use the genetic information in this category as a valuable, fungible commodity that, while it may not be bought and sold, is regularly traded for other things of value via commercial arrangements. As of 2015, 23andMe has signed a total of fourteen partnerships¹⁴² with private companies and universities, all of which trade access to its database of genetic data in return for both specified (a \$300 million stake in its company from pharmaceutical giant GlaxoSmithKline in 2018 in return for access;¹⁴³ \$10 million upfront and \$50 million pending milestones reached by Genentech in return for access¹⁴⁴) and unspecified (pharmaceutical company Pfizer has kept its deal terms secret¹⁴⁵) consideration. In fact, because many large genetic data sets are privately owned and increasingly used by even academic researchers in order to publish major research papers,¹⁴⁶ such exchanges of database access for either commercially valuable company or product stakes or prestige-granting credit in resulting publications may become even more commonplace with time.

Taken together, it is little wonder that category three is the focus of most "rights talk" in this emerging area of privacy and property law. 23andMe, for example, with respect to genetic information, offers customers a: "[r]ight to withdraw consent . . . at any time," "[r]ight of access to and rectification of your Personal Information," "[r]ight to be [f]orgotten," "[r]ight to data portability," "[r]ight to restriction of our processing," "[n]otification of erasure, rectification

142 See Mark Sullivan, *23andMe Has Signed 12 Other Genetic Data Partnerships Beyond Pfizer and Genentech*, VENTUREBEAT (Jan. 14, 2015, 7:00 PM), <https://venturebeat.com/2015/01/14/23andme-has-signed-12-other-genetic-data-partnerships-beyond-pfizer-and-genentech> ("Wojcicki said her company has actually signed a total of 14 partnerships with private companies and universities").

143 See Sarah Zhang, *Big Pharma Would Like Your DNA*, ATLANTIC (July 27, 2018), <https://www.theatlantic.com/science/archive/2018/07/big-pharma-dna/566240> (discussing these access transactions).

144 See Nick Paul Taylor, *23andMe Strikes \$60M Genentech Deal to Continue Pivot to Database-Driven R&D*, FIERCE BIOTECH (Jan. 12, 2015, 7:50 AM), <https://www.fiercebiotech.com/r-d/23andme-strikes-60m-genentech-deal-to-continue-pivot-to-database-driven-r-d> (highlighting the Genentech deal).

145 See James Vincent, *23andMe to Offer Users' Medical Data to Pfizer for Research*, VERGE (Jan. 13, 2015, 7:52 AM), <https://www.theverge.com/2015/1/13/7536635/23andme-pfizer-deal-sharing-genetic-data> ("[T]he value of this latest deal with Pfizer has not been disclosed . . .").

146 See Kayte Spector-Bagdady, Amanda Fakihi, Chris Krenz, Erica E. Marsh & J. Scott Roberts, *Genetic Data Partnerships: Academic Publications With Privately Owned or Generated Genetic Data*, 21 GENETICS MEDICINE 2827 (2019) (finding that the number of publications using private genetic data sets has increased from four in 2011 to fifty-seven in 2017, and the type of contributor consent is unclear or undisclosed in the resulting scientific publication 43% of the time).

and restriction,” “[r]ight to object to processing,” and the “right to not be subject to a decision based solely on automated processing.”¹⁴⁷ But, as appears to be an industry standard, customers “should not expect any financial benefit” from their tests’ processing and “acquire no rights in any research or commercial products that may be developed.”¹⁴⁸ 23andMe also retains a customer’s Personal Information until he deletes his account. And, no guidance explains whether accounts delete automatically upon a customer’s death, or whether 23andMe instead gains perpetual access to a deceased customer’s genetic information.¹⁴⁹ Ancestry, on the other hand, gives consumers explicit ownership rights in their DNA sample and data file, but retains use rights.¹⁵⁰

Thus, individuals appear to have strong control rights over this category of genetic information as it relates to personal privacy, even as they simultaneously lose the right to monitor onward transfer of their information and the right to profit from it. This is not unlike how established property interests such as affirmative easements may ensure a right of way remains across one’s land even after the owner of the burdened land has transferred the land to another. This may make sense, however, given the familial nature of DNA. Genetic relatedness is predictable: an individual’s DNA is unique overall, but large sections of their genetic code are shared. In this way, just one family member sharing their genetic information exposes the information of all their known and unknown relatives and ancestors, as well as future descendants.¹⁵¹ At this stage, then, it maybe makes less sense to speak of

147 23andMe Privacy Policy, *supra* note 140. That this language seems to directly echo the human rights prescribed by the General Data Protection Regulation that went into effect in 2018 is likely no coincidence. But to what extent the European Union’s view of privacy will proliferate in practice, particularly in 23andMe’s transactions with American consumers, is yet unclear.

148 *Terms of Service*, 23ANDME, <https://www.23andme.com/about/tos> (last updated Sept. 30, 2019).

149 *See id.* (eschewing any discussion of automatic account deletion).

150 *See Terms and Conditions (US)*, ANCESTRY, <https://www.ancestry.com/cs/legal/health-terms> (last accessed Nov. 19, 2019) (“You always maintain ownership of your data, but we need the ability to use your data for the purposes set out in our Privacy Statement and these Terms, and, if you agree to it, in our Informed Consent to Research. . . . Also, by submitting User Provided Content through any of the Services, you grant Ancestry a sublicensable, worldwide, royalty-free license to host, store, copy, publish, distribute, provide access to, create derivative works of, and otherwise use such User Provided Content This includes the right for Ancestry to copy, display, and index your User Provided Content. Ancestry will own the indexes it creates. We will also have the right to continue to use your User Provided Content, even if you stop using the Services, but only as necessary for us to provide and improve the Services.”) (effective Oct. 15, 2019).

151 *See, e.g.*, Drake Bennett & Kristen V. Brown, *Your DNA Is Out There. Do You Want Law Enforcement Using It?*, BLOOMBERG: BUSINESSWEEK (Oct. 27, 2018, 5:00 AM), <https://www.bloomberg.com/news/features/2018-10-27/your-dna-is-out-there-do-you-want-law->

commercial ownership rights or strong onward use limitations due to the impracticability of accounting for relatives.

In a similar vein, the information in category four seems to signal a place in the processing chain at which the object at issue ceases to be viewed as physical biological material that came from a unique individual and begins to take on a more abstract, medical data-like quality. Notably, once DNA is sequenced as part of a genetic test, it becomes a “lab result” that the federal regulations associated with the Health Insurance Portability and Accountability Act provide a right to directly access.¹⁵² This shift thus ensures some kind of a right to supervise, or at least remain informed, of what one’s DNA sequence contains at any time in addition to the usual panoply of rights afforded to medical information. That said, these kinds of rights might only apply so long as the insights gleaned from the DNA are targeted towards a particular individual.

Category five information, on the other hand, offers inferential insights and research conclusions at a population-wide level that may at first appear sufficiently de-anonymized to merit the evaporation of user controls over information at this stage. But, while customers are explicitly told their data cannot be deleted from studies it has already been incorporated into, or that they have no rights or expected profits in any products or services developed from their information, there is a growing body of evidence that shows such anonymity is a fiction.¹⁵³ In that case, it would make sense to give category five information the same consumer protection and medical privacy rights that accompany categories three and four, depending on the type of conclusion being drawn from the information at hand. Because property rights are flexible, specific carve-outs could also be made exempting intellectual property rights.

enforcement-using-it (discussing how an individual’s DNA is easily identifiable and could be used by law enforcement).

152 See Jessica L. Roberts, Genetic Conversion 9 (Mar. 15, 2019) (unpublished manuscript) (on file at <https://ssrn.com/abstract=3357566>) (discussing how DNA is regulated in regard to HIPAA).

153 See Brown, *supra* note 5 (explaining that, whether or not genetic information is deliberately made public, “anyone can be exposed”). See generally Mathias Humbert, Kévin Huguenin, Joachim Hugonot, Erman Ayday & Jean-Pierre Hubaux, *De-anonymizing Genomic Databases Using Phenotypic Traits*, 2 PROC. ON PRIV. ENHANCING TECHS. 99 (2015) (discussing how anonymity of genetic material is a fiction even if identifying information is removed).

III. FOURTH AMENDMENT IMPLICATIONS OF RECOGNIZING GENETIC PROPERTY RIGHTS

Strong privacy interests in genetic information give rise to norms of limited property rights across a number of sources of authority that the common law looks to.¹⁵⁴ Recognition of those property rights has consequences—including, for example, far more robust Fourth Amendment protections.

The Fourth Amendment, above all, recognizes and respects individuals' property rights because of their fundamental privacy interests in their bodies and personal spaces. The Amendment protects the "right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures."¹⁵⁵ Per the Amendment, a police search of items within the four enumerated categories is presumptively unreasonable absent a warrant, unless the government can state a valid exception to the warrant requirement.¹⁵⁶

Part of the reason why genetic information seems unlikely to receive Fourth Amendment protection under current law is because it is hard to tell which enumerated category it fits into. A person's liver, removed for purposes of genetic testing, would seem to implicate a search of his "person." The same, however, may not be true of his fully sequenced DNA. That DNA encodes his liver (indeed, is the reason his liver exists!) and may allow highly sensitive inferences about his medical condition or lifestyle, but, having been transformed from biological material into a computer file composed of four letters, may be a digital "paper" or even an "effect."¹⁵⁷ The genetic information taxonomy set out in Part II aims to help courts parse this question with greater nuance, and to encourage law enforcement agents to request clearer, more responsible warrants that specify what category of genetic "thing" is to be collected or surveilled. But even so, it is impossible to escape the fact even highly processed, digitized genetic information invariably describes unique individuals in great personal detail.

154 That is, sources such as state law, shifts in social customs and public opinion, and common industry practices.

155 U.S. CONST. amend. IV.

156 *Id.*

157 See generally Maureen E. Brady, *The Lost "Effects" of the Fourth Amendment: Giving Personal Property Due Protection*, 125 YALE L.J. 946 (2016) (investigating the absence of a coherent doctrinal approach for finding Fourth Amendment "effects" and issues arising from the Supreme Court's recent reintroduction of the term without defining it).

Section II.A argues that, while courts may be undecided about which Fourth Amendment protected category to place genetic information under,¹⁵⁸ many of the same property rights and privacy interests at the heart of the trespass branch of search doctrine are implicated in searches of most, if not all, forms of genetic information. Accordingly, genetic information is deserving of far more robust Fourth Amendment protections than it currently receives.¹⁵⁹ Section II.B then revisits Part II's five categories of genetic information and estimates, based on the privacy interests at stake for each, the strength of corresponding Fourth Amendment protections that should accompany them.

A. Fourth Amendment Privacy Interests and Property

Though the Court in *Carpenter v. United States* (2018) sought in part to reconcile Fourth Amendment search doctrine with modern surveillance technology capabilities,¹⁶⁰ its holding neither resolved existing doctrinal confusions nor set out a new, superseding test for determining a police search. Thus, there now appear to be three tests in play when looking to decide whether law enforcement has violated an individual's Fourth Amendment rights: (1) the common law trespass test revived in 2005 by *Jones* that had previously dominated until 1967;¹⁶¹ (2) the *Katz* reasonable expectation of

158 Though the Court in *Florida v. Jardines* suggested that the trespass-based analysis applies only when the trespass occurs in one of the four places or things listed in the Fourth Amendment (thereby exempting "open fields"), it has also said that historical understandings of the Fourth Amendment are key to securing "the privacies of life" against "arbitrary power." *Florida v. Jardines*, 569 U.S. 1, 6 (2013); *Carpenter v. United States*, 138 S. Ct. 2206, 2214 (2018).

159 See *Maryland v. King*, 569 U.S. 435, 461–62 (2013) (upholding a warrantless collection of DNA samples from arrestees because collecting a cheek swab was minimally invasive and arrestees have a diminished expectation of privacy). Importantly, this case focused solely on the use of DNA for identification (for information on how flawed a process that is, see ERIN E. MURPHY, *INSIDE THE CELL: THE DARK SIDE OF FORENSIC DNA* (2015)) and held that the search at issue was the initial collection of DNA from the cheek via swab collection, rather than further analysis of that DNA. See *id.*

160 See *Carpenter*, 138 S. Ct. at 2217–23 (discussing how modern formats for surveillance do not negate Fourth Amendment protections).

161 See *United States v. Jones*, 565 U.S. 400 (2012) (noting that despite the dominance of *Katz*'s reasonable expectation of privacy test, the Fourth Amendment at minimum grants individuals the protections afforded at its adoption, therefore deeming instances of common law trespass by the police without a warrant to constitute an unreasonable search).

privacy test set out in 1967;¹⁶² and (3) the new multi-factor “test” set out in *Carpenter*.¹⁶³

Each of the three tests has clear limitations. The first, as *Katz*, noted, risks eroding Fourth Amendment privacy protections because surveillance technologies no longer need to physically trespass in order to conduct highly invasive surveillance.¹⁶⁴ The *Katz* test, however, has been noted by many to be a circular test that does not present a clear set of criteria by which courts can determine which expectations of privacy are “reasonable.”¹⁶⁵ And while *Carpenter*’s impact in lower courts is only beginning to be felt, courts and commentators have varied in their weighting and definition of the various factors the *Carpenter* Court alluded to.¹⁶⁶ Of the three tests, when satisfied, trespass confers by far the most robust Fourth Amendment protections because it sets out a bright-line rule. If the police commit a physical trespass into one of the four constitutionally protected categories (persons, houses, papers, and effects) without a warrant, they commit an unreasonable search in violation of the Fourth Amendment.

Though the Court has struggled to connect different strands of search doctrine, property law-based understandings remain the tests’ common denominator. In an early, and perhaps the Court’s only, attempt to resolve the circularity of the *Katz* test, the Court stated in a footnote in the 1978 case *Rakas v. Illinois* that “expectations of privacy by law must have a source outside of the Fourth Amendment, either by reference to concepts of real or personal property law or to understandings that are recognized and permitted by society.”¹⁶⁷ We thus have two cross-test guideposts for examining whether and

162 See *Katz v. United States*, 389 U.S. 347 (1967) (replacing the trespassory search test because the Fourth Amendment “protects people, not places” and holding that it is unconstitutional for police to search any area without a warrant wherein a person has a reasonable expectation of privacy).

163 See *Carpenter*, 138 S. Ct. at 2234 (Kennedy, J., dissenting) (referring to the Majority’s approach as a “multifactor analysis—considering intimacy, comprehensiveness, expense, retrospectivity, and voluntariness”). See also Ohm, *supra* note 16 (discussing the new reasonable expectation of privacy test under *Carpenter*).

164 See *Katz*, 389 U.S. at 352–53 (discussing the loss of privacy that can occur because physical trespass is no longer necessary in all circumstances).

165 See e.g., Richard A. Posner, *The Uncertain Protection of Privacy by the Supreme Court*, 1979 S. CT. REV. 173, 188 (1979) (“[I]t is circular to say that there is no invasion of privacy unless the individual whose privacy is invaded had a reasonable expectation of privacy; whether he will or will not have such an expectation will depend on what the legal rule is”).

166 See e.g., Susan Freiwald & Stephen Wm. Smith, *The Carpenter Chronicle: A Near-Perfect Surveillance*, 132 HARV. L. REV. 205, 219 (2018) (distilling four factors from the Court’s holding for determining when search violates the Fourth Amendment: “whether the technique was (1) *hidden*, (2) *continuous*, (3) *indiscriminate*, and (4) *intrusive*”).

167 *Rakas v. Illinois*, 439 U.S. 128, 143 n.12 (1978).

to what extent new technologies enable the government to infringe on individuals' Fourth Amendment rights: property law and social views on privacy, as usually evidenced by statute and common practice.¹⁶⁸

Understanding the Court's reference to property law concepts requires delving into the trespass-oriented "historical understandings 'of what was deemed an unreasonable search and seizure when [the Fourth Amendment] was adopted.'"¹⁶⁹ From that, it becomes clear that the property law rights protected at the founding via trespass are indivisible from personal privacy interests such as those at stake in genetic information.

The seminal cases expounding these understandings are *Boyd v. United States* (1886),¹⁷⁰ and the English case it cites heavily, *Entick v. Carrington* (1765).¹⁷¹ In *Boyd*, over the defendant's objection, the government used a subpoena to indirectly seize the defendants' books, papers, and records as part of a customs and revenue case.¹⁷² The Court held that such action constituted an unconstitutional search and seizure, because they were his "private" things and therefore "dearest property."¹⁷³ It did not matter to the Court whether the contents of the papers contained information of a secret nature or whether the items had been hidden upon the defendant's property—the mere fact that the papers belonged to him made their seizure an unconstitutional trespass.¹⁷⁴ Instead, any secret nature of those goods served further as "an aggravation of the trespass" that "demand[ed] more considerable damages."¹⁷⁵ Though the case's holding has since been narrowed, its reasoning remains important for its sweeping discussion of the Fourth Amendment's origins and ambitions.

Boyd's reasoning drew upon the memory of British soldiers' harassment of colonists via general writs of assistance and of related court proceedings both at home and in England.¹⁷⁶ To that end, the Court quoted both James

168 Notably, the same logic runs throughout constitutional procedural due process cases defining the scope of protected property rights. *See e.g.*, *Bd. of Regents of State Colls. v. Roth*, 408 U.S. 564, 577 (1972) ("Property interests, of course, are not created by the Constitution. Rather, they are created and their dimensions are defined by existing rules or understandings that stem from an independent source such as state law . . .").

169 *United States v. Carpenter*, 138 S. Ct. 2206, 2214–15 (2018) (quoting *Carroll v. United States*, 267 U.S. 132, 149 (1925)).

170 *Boyd v. United States*, 116 U.S. 616 (1886).

171 *Entick v. Carrington* (1765) 19 How. St. Tr. 1029.

172 *Boyd*, 116 U.S. at 617–18.

173 *Boyd*, 116 U.S. at 623, 627–28.

174 *Id.* at 627–28. *See also* *Weeks v. United States*, 232 U.S. 383, 395–96 (1914) (reiterating the underlying principle from *Boyd*).

175 *Boyd*, 116 U.S. at 627–28.

176 *See id.* at 623, 625–26 (discussing the practice of issuing general warrants permitting the search of private houses).

Otis and John Adams to the effect that arbitrary searches of private places by police were among “the most destructive [instruments] of English liberty.”¹⁷⁷ The *Boyd* Court also quoted extensively from *Entick v. Carrington*, an English case that would have been forefront in the Founders’ minds whilst drafting the Fourth Amendment.¹⁷⁸ *Entick* was an action for trespass against royal officers who had broken into the plaintiff’s “dwelling-house” to search for and read his papers.¹⁷⁹ On the whole, *Entick* emphatically and repeatedly made note of the rights attached to property ownership. Indeed, in ruling for the plaintiff, Lord Camden stated, “The great end, for which men entered into society was to secure their property,” and trespassers that threatened that security and corresponding right to exclude were subject to strict liability.¹⁸⁰

Boyd was intended from the first to address “the very essence of constitutional liberty and security” protected by the Fourth Amendment and “reach farther than the concrete form of the case . . . to all invasions on the part of the government and its employés of the sanctity of a man’s home and the privacies of life.”¹⁸¹ Its language explicitly linked “personal liberty and private property,” and makes clear that the trespass test of search doctrine protected both.¹⁸² According to the Court, trespass was an appropriate vehicle for protection because the “essence of the offence” by police was “not the breaking of his doors, and the rummaging of his drawers” but rather the invasion of the “sacred right” of property ownership and, presumably, the expectations of privacy, security, and the rights to exclude, use, and transfer that ownership engenders.¹⁸³

Other Fourth Amendment cases prior to *Katz* are likewise replete with language cementing a deep connection between property rights in trespass and the protection of personal privacy interests. In fact, the Court has stated the proposition outright, as in *Adams v. New York* where it held that “[t]he security intended to be guaranteed by the Fourth Amendment against wrongful search and seizures is designed to prevent violations of *private security* in person and property”¹⁸⁴ The house and home, for instance, are almost always mentioned in the same breath as the privacy and security

177 *Id.* at 625.

178 *See id.* at 625–29.

179 *Entick v. Carrington* (1765) 19 How. St. Tr. 1029, 1030.

180 *Id.* at 1066.

181 *Boyd*, 116 U.S. at 630.

182 *See id.*

183 *See id.*

184 *Adams v. New York*, 192 U.S. 585, 598 (1904) (emphasis added).

expected by individuals within it.¹⁸⁵ Indeed, even after the Court adopted the *Katz* test, it consistently held that courts should “afford[] heightened protection to a person’s right to be left alone in the privacy of his house.”¹⁸⁶

The Court’s repeated and emphatic framing of the pertinent privacy interest as a right to be let alone is not insignificant.¹⁸⁷ Arguably, it is this framing that first enabled the Court in *Katz* to discard the trespass test and recognize that privacy rights at times extend beyond the edges of physical property. And, that framing has roots older than even its celebrated debut in Warren and Brandeis’ famous 1890 article.¹⁸⁸ Indeed, even in *Entick*, Lord Camden had noted that an “owner’s goods and chattels . . . are so far from enduring a seizure, that they will hardly bear an inspection” even though at that time “the eye cannot by the laws . . . be guilty of a trespass.”¹⁸⁹ This suggests that the property rights at issue in Fourth Amendment cases brush up against some form of a right to confidentiality, and that secrecy is necessary to limit access to the self so that individuals can determine what they present of themselves to others.¹⁹⁰ Thus, by the time twentieth-century members of the Court had begun to expand Fourth Amendment protections to new forms of information and police surveillance, their arguments represented only the most modern iterations of well-established understandings of privacy interests protected by property law.¹⁹¹ In sum, the “Court has recognized Fourth

185 See *Weeks v. United States*, 232 U.S. 383, 394 (1914) (“[M]uch less was it within the authority of the United States Marshal to thus [without a warrant] invade the *house and privacy* of the accused.”) (emphasis added). See also *Silverman v. United States*, 365 U.S. 505, 511 (1961) (“The Fourth Amendment, and the personal rights which it secures, have a long history. At the very core stands the right of a man to retreat into his own home and there be free from unreasonable governmental intrusion.”).

186 *California v. Ciraolo*, 476 U.S. 207, 226 (1986) (Powell, J., dissenting).

187 See Daniel J. Solove, *Conceptualizing Privacy*, 90 CALIF. L. REV. 1087, 1094 (2002) (pointing out that although privacy is a sweeping concept, it can be more productively discussed in terms of its six main elements: “(1) the right to be let alone; (2) limited access to the self; (3) secrecy; (4) control of personal information; (5) personhood; and (6) intimacy”).

188 See Samuel D. Warren & Louis D. Brandeis, *The Right to Privacy*, 4 HARV. L. REV. 193, 193 (1890) (arguing that “the term ‘property’ has grown to comprise every form of possession—intangible, as well as tangible”).

189 *Entick v. Carrington* (1765) 19 How. St. Tr. 1029, 1066.

190 See e.g., *Privacy*, STAN. ENCYCLOPEDIA OF PHIL., <https://plato.stanford.edu/entries/privacy/> (last updated Jan. 18, 2018) (summarizing the history of privacy from Aristotle to present).

191 See *Olmstead v. United States*, 277 U.S. 438, 478 (1928) (Brandeis, J., dissenting) (“The makers of our Constitution . . . sought to protect Americans They conferred, as against the Government, the right to be let alone”). See also *Warden, Md. Penitentiary v. Hayden*, 387 U.S. 294, 323–24 (1967) (Douglas, J., dissenting) (“The personal effects and possessions of the individual (all contraband and the like excepted) are sacrosanct from prying eyes, from the long arm of the law, from any rummaging by police. Privacy involves the choice of the individual to disclose or to reveal

Amendment privacy interests that are best described as arising from the rights of individuals to exclude others”¹⁹²

As distilled from the Court’s Fourth Amendment cases, the core sticks in the bundle of property rights that the Fourth Amendment recognizes are the following: a right to exclude others from the property; a right to security upon that property; and most importantly, a sacrosanct privacy right usually framed as a right to be let alone that, under certain circumstances, extend beyond the physical boundaries of tangible property.

B. Protecting Genetic Information

Under either or both of the guideposts set out in *Rakas* (i.e. property law and social views of privacy), genetic information is deserving of far more robust Fourth Amendment protections than it currently receives. In this Section, I retrace the five categories of genetic information set out in Part II and argue that the categories of different bundles of property rights sticks suggest corresponding variation in the robustness of the Fourth Amendment protections that attach. To reiterate, those five categories are as follows: (1) source biological materials, including saliva, blood, and whole tissues; (2) extracted and purified DNA; (3) sequenced DNA, in whole or in part; and information gleaned from sequenced DNA at both an (4) individual level and (5) at aggregate, i.e. population-wide. Setting aside, for purposes of this Article, the problem of abandoned DNA,¹⁹³ I assume that the biological materials at issue are those either still on or in a person, or removed with the intention of obtaining a genetic test for personal use.

The raw biological materials that constitute category one should receive some of the strongest Fourth Amendment protections possible given their closeness to the enumerated Fourth Amendment categories of “persons,”

what he believes, what he thinks, what he possesses. . . . [P]rivacy means that the individual should have the freedom to select for himself the time and circumstances when he will share his secrets with others and decide the extent of that sharing.”

192 See Nita A. Farahany, *Searching Secrets*, 160 U. PA. L. REV. 1239, 1243 (2012) (investigating the absence of a coherent doctrinal approach for finding Fourth Amendment “effects”).

193 Under extant case law, the Fourth Amendment does not apply to DNA taken from “abandoned” objects that are “knowingly exposed” to the public, such as saliva lifted from a coffee cup taken from garbage on the curbside. See, e.g., Elizabeth E. Joh, Essay, *Reclaiming “Abandoned” DNA: The Fourth Amendment and Genetic Privacy*, 100 NW. U. L. REV. 857, 865 (2006). But, genetic information and other microscopic biomaterials are arguably not “knowingly exposed” in the way that the Court envisioned larger, tangible objects to be. And, with advances in biotechnology, abandonment doctrine butts heads directly with existing constitutional privacy protections. The doctrine requires significant reworking as applied to biomaterials from which information beyond identification is extracted, though that is a project for another paper.

“houses,” and “effects,” and their treatment in industry contracts. Textualist studies of the Fourth Amendment have argued that “persons” constituted an “important, but discrete” constitutionally protected area that is implicated whenever “police look inside a body cavity, take blood or fingerprints, scrape a cheek for a DNA sample, or administer a breathalyzer test.”¹⁹⁴ Materials in category one would thus obviously fall within this constitutionally protected category. Moreover, Fourth Amendment protections for “houses” appear to follow directly from the Founders’ views of sanctity of the person: such spaces are broadly agreed upon by judges and scholars to “extend[] to ‘a whole host of home-like settings.’”¹⁹⁵ Indeed, the house and home are given heightened Fourth Amendment protection because they enable privacy, security, a space for personal development, and peace of mind. But what good is such an assurance if one cannot be at home within one’s own bodily person? The regular use of contracts suggesting a right of exclusive possession and personal use whilst living and confidentiality rights over these materials would thus correspond to the Fourth Amendment’s right to exclude others from one’s property. And, if source biological materials are not part of “persons” or “houses,” then they may, once removed from the body, be an “effect” because “[e]ffects’ was used in the Framing era as a catchall term that included all tangible objects a person might possess, but not real property (land) and structures (buildings).”¹⁹⁶ At this stage the materials are still very much tangible, and can be handled and seen by the naked eye.

In this sense, genetic information may cause the Fourth Amendment’s enumerated categories to basically collapse on each other, but the difficulty of distinguishing them should be cause for a return to the Amendment’s first principles and liberal grant of protection from intrusive government action. Just as expectations of domestic solicitude and private ownership have founded the rights underlying longstanding property interests like nuisance and trespass, so too should individuals be able to take refuge from government intrusion within the homes of their own bodies.

Genetic information from category two and onwards, however, becomes increasingly intangible and thus more difficult for non-scientists to conceptually link back to the strong privacy rights and sense of personhood that attach to source biological materials. Here, should courts recognize the scientific truth that extracted DNA is both tangible (albeit microscopic), and an integral structure to human existence that is unique to its owner, all the

194 See Jeffrey Bellin, *Fourth Amendment Textualism*, 118 MICH. L. REV. 233, 260 (2019).

195 *Id.* at 262.

196 *Id.*

same Fourth Amendment protections that would flow to category one materials would also apply to category two extracted DNA. Should courts be wary of slipping into the same nitpicky, scientific discussions that governed early claims of intangible trespass, they can instead draw upon tried and tested sources of common law: state law and industry practice. As mentioned in Part II, at least one state has passed legislation stating that DNA samples are “the exclusive property of the person sampled or analyzed,”¹⁹⁷ and genetic testing companies have implied that physical DNA extracted from saliva samples is functionally the same as the saliva itself (and, presumably, any other source tissues from which DNA is obtained) for their purposes.

Because state laws and industry practice amongst genetic testing companies are so much stronger in the context of category three sequenced DNA, Fourth Amendment protections for category three genetic information would be stronger than for category two and closer, if not equivalent, to protections for category one. After all, because sequenced DNA represents the first stage where biological materials are translated into written code showing how an individual is unique at a genetic and statistical level, the Fourth Amendment right to security and privacy is likely close to its zenith here. The familial nature of DNA may mean that the Fourth Amendment right to exclude is limited to only the sections of DNA known at the time to contribute to individual uniqueness. However, even then, a right to exclude should certainly exclude the *government* from improper access to this form of genetic information. In instances where individuals truly do willingly relinquish their (usually category three) genetic information to companies whose terms of service do *not* promise privacy or even go so far as to consent in advance to law enforcement use, such as GEDmatch, FamilyTreeDNA, and DNASolves, here the right to exclude would require the government to limit their use to only the consenting individual. Otherwise, to allow an individual to essentially consent to a search of genetic data of all her biological relatives would stretch beyond any form of search consent that now exists. Even related co-tenants, after all, may not give consent for the police to search the other’s private room over the other person’s objection or clear indicia of expected privacy such as a locked door. While that may cause specific “crime-solving” companies like DNASolves to shutter, that may not be a bad thing. Policing is a public duty—not a private one—and if the police cannot lawfully obtain evidence sufficient for a warrant of a suspect’s involvement beyond some genetic similarity to a

197 ALASKA STAT. § 18.13.010(a)(2) (2020).

distant relative, then perhaps such identifying information is rightly beyond the government's reach.

Category four genetic information (i.e. information gleaned from sequenced DNA at an individual level) presents the greatest analytical problems because of the “nettlesome question [of] *when* an ownable datum of IHI is created.”¹⁹⁸ Again, however, the core inquiry in the context of police searches and seizures should not hinge upon individuals' rights relative to other private individuals. Here, the question is purely whether such private spaces—which would here almost always in the context of scientific research testing, medical genetic testing, or personal genetic testing, include insights into constitutionally protected personal characteristics such as race, ethnicity, and private medical history—may be subject to government intrusion. The answer must be a resounding “no” if the Fourth Amendment is to have meaning in the face of advances in genetic technology. In fact, both Justice Brandeis, dissenting in *Olmstead* (1928),¹⁹⁹ and Justice Gorsuch, “dissenting” a century later in *Carpenter* (2018)²⁰⁰ have stated as much. Popular opinion provides further support: likely in reaction to the passage of data privacy laws such as GDPR and growing concerns over the wildfire-like spread of genetic genealogy techniques, genetic testing companies such as 23andMe have seen a decrease in test sales over the course of 2019 and increasingly sought through their privacy policy updates to assure consumers that their personal testing reports remain confidential, and that companies will not cooperate with police requests unless required to by law.²⁰¹

198 Jorge L. Contreras, *The False Promise of Health Data Ownership*, 94 N.Y.U. L. REV. 624, 637 (2019). Contreras rightly points out that

[c]onscious awareness of property is generally not required for it to exist. . . . If the basis for treating IHI as property derives from one's inherent right to own all information about oneself, then it seems that unfixated, unknown information should, indeed, be considered property. Yet the practical difficulties associated with this extreme version of ownership are significant.

Note that in this Article, “IHI stands for individual health information.” *Id.* at 625.

199 See *Olmstead v. United States*, 277 U.S. 438, 474 (1928) (Brandeis, J., dissenting) (warning that “[a]dvances in the psychic and related sciences may bring means of exploring unexpressed beliefs, thoughts and emotions” of which government surveillance would avail itself).

200 *Carpenter v. United States*, 138 S. Ct. 2206, 2262 (2018) (Gorsuch, J., dissenting) (“Can [the government] secure your DNA from 23andMe without a warrant or probable cause? *Smith* and *Miller* say yes it can—at least without running afoul of *Katz*. But that result strikes most lawyers and judges today—me included—as pretty unlikely. In the years since its adoption, countless scholars, too, have come to conclude that the ‘third-party doctrine is not only wrong, but horribly wrong.’”).

201 See, e.g., Christina Farr, *23andMe Lays Off 100 People as DNA Test Sales Decline, CEO Says She Was ‘Surprised’ to See Market Turn*, CNBC (Jan. 23, 2020, 1:15 PM), <https://www.cnbc.com/2020/01/23/23andme-lays-off-100-people-ceo-anne-wojcicki-explains->

On the other hand, category five presents the weakest case for property ownership and Fourth Amendment protection because it has been pooled and serves a population-wide purpose. I assume here that individuals' data can be easily de-anonymized, but that they have consented to participation in pooled research upon their personal data from categories three and four. Nevertheless, once inferences from genetic information are directed towards population-wide inquiries rather than personal ones, because most companies and researchers explicitly tell individuals that their data cannot be deleted from studies it has already been incorporated into, and that they have no rights or expected profits in commercial items developed from such pooled information, it is likely that category five information would receive weak or no Fourth Amendment rights of exclusion and security while retaining a limited right to privacy.

CONCLUSION

Given the duty of common law courts to update legal doctrine as society evolves, and "to be watchful for the constitutional rights of the citizen, and against any stealthy encroachments thereon,"²⁰² courts should recognize that all forms of genetic information (albeit to varying degrees) likely carry with them a limited property right intended to protect privacy interests. After all, since time immemorial, robust property rights such those of trespass and nuisance have demonstrated the dynamic nature of the common law and the privacy interests they protect.

Upon recognizing a limited property right in genetic information, courts are then bound also to recognize that far more vigorous Fourth Amendment protections follow. Rooted in both social views of privacy and industry practices respecting them, property rights in genetic information implicate all the core guarantees of liberty and private property ownership that the Court's Fourth Amendment cases have strove to protect. Because without Fourth Amendment protection, individuals' chances at redress following an improper

why.html (citing 23andMe CEO, who explains that test sales are down and that "privacy is top of mind").

202 See *Monongahela Navigation Co. v. United States*, 148 U.S. 312, 325 (1893) (declaring that "silent approaches and slight deviations from legal modes of procedure" that first enable "illegitimate and unconstitutional practices" can only be obviated by "adhering to the rule that constitutional provisions for the security of person and property should be liberally construed").

police search are slim to none,²⁰³ an added consequence of recognizing limited property rights in genetic information may be that law enforcement personnel acting in violation of the Fourth Amendment's warrant requirement face greater liability for their actions by means of the exclusionary rule.

There is no doubt that genetic information has great potential to help law enforcement agents fulfill their duty to keep society safe, and that many, if not most, companies trading in genetic information intend to do so for reasons that ultimately benefit society, such as medical research. But no matter how well-meaning the police and corporations may be, it is crucial that courts do *their* duty to safeguard individuals' constitutional rights²⁰⁴ and encourage police and legislators to craft responsible, transparent policy regarding these powerful new surveillance technologies.

203 *See, e.g.,* *Mapp v. Ohio*, 367 U.S. 643, 670 (1961) (Douglas, J., concurring) ("The only remaining remedy, if exclusion of the evidence is not required, is an action of trespass . . . Mr. Justice Murphy showed how onerous and difficult it would be for the citizen to maintain that action and how meagre the relief even if the citizen prevails. The truth is that trespass actions against officers who make unlawful searches and seizures are mainly illusory remedies.")

204 *See, e.g.,* *Harris v. United States*, 331 U.S. 145, 172 (1947) (Frankfurter, J., dissenting) ("Stooping to questionable methods neither enhances that respect for law which is the most potent element in law enforcement, nor, in the long run, do such methods promote successful prosecution.")