Subversive Science

Dov Fox*

ABSTRACT

This Article introduces the phenomenon of subversive science, reveals its operation in modern American society, and analyzes its implications for law and policy amidst calls to defund or repress controversial lines of inquiry. Existing debates center on whether cutting-edge science casts doubt on abstract ideals that animate our legal system, from racial equality to criminal responsibility. This focus misses the deeper and more practical danger that lies in how citizens misperceive and misapply these ideals in election and trial decisions. What makes certain science "subversive" is its power to shake the public's faith in those democratic cornerstones.

Emerging bodies of psychology research show that presenting voters with genomic studies of group differences makes them less willing to fund early education for the underprivileged. In a similar vein, brain imaging studies—that predict whether people will commit certain acts before they even intend to—can lead jurors to question free will and acquit guilty defendants. Neither scientific illiteracy nor cultural worldviews explains away these results, defying the orthodoxy that individuals conform their views on contested matters to their command of the facts or values that define their identities.

* Professor of Law, University of San Diego School of Law. I was fortunate for superb research assistance from Lauren Friedenberg, Thang Huong, Henry Nicholson and David Rao, for exceptional library support by Melissa Abernathy, Jane Larrington, Ruth Levor, and Sasha Orman, and for thoughtful editing by Erin Heaney, Max Jelen, and their colleagues on the *Penn State Law Review*. Paul Appelbaum, Hank Greely, and especially Peter Schuck provided valuable inspiration and feedback at critical stages of this inquiry. Conversation with colleagues improved these ideas considerably. Special thanks to Larry Alexander, Jonathan Anomaly, Stephanie Bair, Adam Benforado, Jen Chandler, Lisa Claydon, Margaret Dalton, Jennifer Drobac, Bruce Edwards, Robert Fellmeth, Miranda Fleischer, Leslie Griffin, Lewis Grossman, Adam Hirsch, Michael Kelly, Adam Kolber, Craig Konnoth, Herbert Lazerow, Jane Moriarty, Osagie Obasogie, Jordan Paradise, Cameron Parker, Natalie Ram, Jessica Roberts, Ana Santos Rutschman, Jacob Sherkow, Christopher Slobogin, Thomas Smith, Mila Sohoni, Christian Sundquist, Melissa Wasserman, Mary Ziegler, and to workshop and conference participants at USD, USC, Pennsylvania, and Stanford, where earlier versions of this project were presented.

Reframing the debate about subversive science means targeting the transmission of knowledge, rather than its production. I advance a range of systematic reforms to combat the alternative facts and cognitive bias through novel forms of engagement in congressional hearings, classroom lessons, and courtroom testimony.

Table of Contents

I. INTRODUCTION

"Let the facts be known as they are, and the law will sprout from the seed and turn its branches toward the light."
— Benjamin Cardozo, What Medicine Can Do for Law[1]

"There are various things we simply ought not to know."
— Nicholas Rescher, Forbidden Knowledge[2]

Science can liberate the law or corrupt it. Some of these influences are familiar. Sound forensics can help put criminals away, while flawed tools and tests can deprive the innocent of their liberty. More subtly, however, scientific discoveries can force us to rethink the ideals that our legal system accepts as true: Do genetic studies of intelligence imperil norms of group *equality*, as when states discriminate on the basis of sex or race?[3] Does brain imaging erode the assumption of *responsibility* for action that's subject to civil suit or prosecution?[4] Might neuroscience undermine the *mind-body dualism* that distinguishes mental phenomena from physical ones in doctrines from tort harm to criminal intent?[5]

Scientific inquiries that carry this power to shake core assumptions in the law have historically gone by the name of "forbidden knowledge."[6] But the moniker is misleading. There is nothing especially menacing about knowledge on its own, separate and apart from why it is pursued or how it is used. Awareness or understanding of some subject can be troubling only when those facts are sought for bad reasons, or when such data are put to bad effects.[7] Knowledge itself, however forbidding, does not plausibly

1. Benjamin Cardozo, *What Medicine Can Do for Law*, 5 BULL. N.Y. ACAD. MED. 581, 583 (1929).

2. NICHOLAS RESCHER, FORBIDDEN KNOWLEDGE 9 (1987).

3. *See, e.g.*, Mark A. Rothstein, *Legal Conceptions of Equality in the Genomic Age*, 25 LAW & INEQ. 429, 455–62 (2007).

4. *See, e.g.*, Uri Maoz & Gideon Yaffe, *What Does Recent Neuroscience Tell Us About Criminal Responsibility?*, 3 J.L. & BIOSCIENCES 120, 132–38 (2015).

5. *See, e.g.*, Dov Fox & Alex Stein, *Dualism and Doctrine*, 90 IND. L.J. 975, 985–92 (2015).

6. *See* Erika C. Hayden, *Taboo Genetics*, NATURE, Oct. 3, 2013, at 26; Joanna Kempner et al., *Forbidden Knowledge*, 307 SCI. 854 (2005); Paul R. Wolpe, *Reasons Scientists Avoid Thinking about Ethics*, 125 CELL 1023 (2006); *see generally* PHILIP KITCHER, SCIENCE, TRUTH, AND DEMOCRACY (2001); RICHARD C. LEWONTIN, BIOLOGY AS IDEOLOGY (1992); RICHARD SHATTUCK, FORBIDDEN KNOWLEDGE (1996); DAVID BALTIMORE ET AL., LIMITS OF SCIENTIFIC INQUIRY (Gerald Holton & Robert Morrison eds., 1979); Agnieszka Lekka-Kowalik & Daniel Schulthess eds., *Forbidden Knowledge*, 79 MONIST (1996); Gary E. Marchant & Stephanie J. Bird, *Editors' Overview: Forbidding Science?*, 15 SCI. & ENG'G ETHICS 263 (2009).

7. Even in the Garden of Eden what God forbid was not the existence or discovery of the tree's fruit, but eating it. *Cf.* JOHN MILTON, PARADISE LOST 3, 98, 137, 282 (1821).

qualify as forbidden. The phenomenon needs a new name. I call it *subversive science*.[8]

What makes certain lines of scientific inquiry "subversive," in the sense I mean, is not that it deprives subjects of informed consent to participate in an experiment, or that it exposes them to unjustified suffering.[9] Nor is it that research visits unknown dangers on future generations, as germline editing of human embryos might.[10] The subversive element of science that I have in mind is not even the risk that dual-use studies of airborne viruses or nuclear power can be put to either peaceful or destructive ends—to sustain goods like public health or national security, or imperil them.[11]

Science subverts by disrupting cherished ideologies. One example is the widely held conviction that individuals choose among different possible courses of action unimpeded by force or fate. This sense of free will goes to the heart of subjective identity. Another example is an animating feature of our social fabric, such as principles of moral equality that withstand any number of individual or (average) group differences. Where research might challenge such ideals, many people would give it free rein, either because the intrinsic value of truth is too great to trade off or because their compensating benefits inexorably outweigh whatever havoc the results of that research may wreak.[12]

Others would stifle such scientific study.[13] Scholars across multiple disciplines and political stripes have pressed agencies that consider human

8. The expression has little resonance today. It was coined a half-century ago by ecologist Paul B. Sears, *Ecology: A Subversive Subject*, 14 BIOSCIENCE 11, 11 (1964), who argued that conservation research, "if taken seriously as an instrument for the long-run welfare of man-kind, would . . . endanger the assumptions and practices accepted by modern societies."

9. Such debasing or harmful methods have discredited notorious research throughout U.S. history. The Tuskegee study denied poor black men treatment for syphilis after penicillin was known to cure the disease. SUSAN M. REVERBY, EXAMINING TUSKEGEE: THE INFAMOUS SYPHILIS STUDY AND ITS LEGACY 32–50 (2009). Milgram had participants believe they electrocuted innocent strangers. GINA PERRY, BEHIND THE SHOCK MACHINE 65–94 (2012). And the Stanford experiment let subjects acting as "guards" subject prisoners to psychological torture. PHILIP G. ZIMBARDO, THE LUCIFER EFFECT 26–47 (2007).

10. *See* Gina Kolata & Pam Belluck, *Why Are Scientists So Upset About the First Crispr Babies?*, N.Y. TIMES (Dec. 5, 2018), https://nyti.ms/2E44tNN; *see also* Julia D. Mahoney & Gil Siegal, *Beyond Nature? Genomic Modification and the Future of Humanity*, 81 LAW & CONTEMP. PROBS. 195, 204–06 (2018).

11. *See* Filippa Lentzos & Pamela Silver, *Synthesis of Viral Genomes, in* INNOVATION, DUAL USE, AND SECURITY 133–38 (Jonathan B. Tucker ed., 2012).

12. This permissive approach is typified by essays published in leading scientific journals like *Cell*, *Nature*, and *Science*. *See* Hayden, *supra* note 6, at 26; Kempner et al., *supra* note 6, 854; Wolpe, *supra* note 6, at 1023.

13. *See generally* KITCHER, *supra* note 6; LEWONTIN, *supra* note 6; SHATTUCK, *supra* note 6; BALTIMORE ET AL., *supra* note 6; Lekka-Kowalik & Schulthess, *supra* note 6); Marchant & Bird, *supra* note 6).

subject inquiries to "reject proposed research that will promote racial theories of intelligence" for "fostering racism even if not motivated by" it.[14] And they have implored scientists to "exercise restraint" in reporting on brain studies that risk "disabusing people of the [free will] illusions that undergird all they hold dear."[15] Calls to restrict this science ring loud and clear: "If the choice is between the true and the good, then for the sake of society, the true must go."[16]

Both perspectives have a point. The laissez-faire position appreciates the critical role of science in a free society, and heeds historical lessons from Galileo's inquisition to the *Scopes* trial.[17] This view neglects cause for concern about subversive science in a "post-truth"[18] world, in which social media algorithms increasingly supply "alternative facts" to fortify whatever people already believe.[19] The alternative, reactionary stance is alert to these dangers. But it undervalues the emancipatory power of scientific discoveries—from Earth orbiting the sun to *Homo sapiens* evolving from apes—to cast out unsound ideals or breathe life into tired ones.[20]

This Article charts a third path. I would deflect the threat of subversive science from abstract conceptions of equality, responsibility, or dualism. The larger danger concerns the practical ways in which scientific research can lead people to misperceive those ideals. This middle ground advises policies that target the transmission of knowledge, not its production. It would resist calls to defund or restrict subversive science in favor of mediating its transmission to the public in ways that are designed to avoid misunderstanding.[21]

14. John Horgan, *Should Research on Race and IQ Be Banned?*, SCI. AM.: CROSS-CHECK (May 16, 2013), https://bit.ly/2QesJRl.

15. Stephen Cave, *There's No Such Thing as Free Will*, ATLANTIC (June 2016), https://bit.ly/2gY2HEe.

16. *Id*. Or take the Trump administration's treatment of global warming, which embarrasses its creed of America First. *See* Dov Fox, *Can Trump Censor Climate Science?*, HUFF POST (Aug. 31, 2017, 11:55 P.M.), https://bit.ly/2VCTMae. The White House quickly shut down the Environmental Protection Agency's ("EPA") climate webpage and forbid agency scientists from discussing their research with media or the public. *See* Editorial Board, Editorial, *President Trump's War on Science*, N.Y. TIMES (Sept. 10, 2017), https://nyti.ms/2wRc0K5.

17. JULES SPELLER, GALILEO'S INQUISITION TRIAL REVISITED 145–60 (2008); MICHAEL BURGAN, THE SCOPES TRIAL: FAITH, SCIENCE, AND AMERICAN EDUCATION 52–63 (2010).

18. Amy Wang, *Post-Truth Named 2016 Word of the Year by Oxford Dictionaries*, WASH. POST (Nov. 16, 2016), https://wapo.st/2w6XMFx.

19. *See* Olivia Ward, *Truth, Lies and Democracy: Journalism in the Age of Trump*, BILLMOYERS.COM (Mar. 13, 2017), https://bit.ly/2mCSxIb.

20. *See* DAVID B. RESNIK, PLAYING POLITICS WITH SCIENCE 115–32 (2009).

21. *See infra* Part II.C.

I focus on two central cases of subversive science: genetics research that lawmakers invoke to oppose social welfare programs, and neuroscience that criminal lawyers present to exculpate defendants. Recent and prominent examples abound in each. As for genetics, many bristle at policies relying on group-difference claims to advocate eliminating equality-promoting programs such as Head Start.[22] When it comes to the neuroscience, the United States Supreme Court forbids the harshest punishments for juvenile offenders by appeal to brain imaging that infers "impetuous and ill-considered actions and decisions" result from children's "underdeveloped sense of responsibility."[23] Legal scholars variously fret and celebrate the prospect that new research could reduce the ascription of culpability even to adults of sound mind who commit crimes.[24]

Legal scholars have responded by appeal to theory. No scientific fact, they say, could weaken rationales for treating citizens as responsible equals.[25] Understandings of equality indeed look immune to empirical challenge, while concepts of responsibility withstand such encounters for now, even if brain research might yet one day disprove free will as a justification for punishment. Science can wear down not only abstract ideals, but also the ways in which they are adopted in practice. Existing literature neglects this far more pressing question about the impact that this science can have on the decisions people make about law and policy.

Society should resist calls to suppress or obscure subversive science, while attending to its real, distinct, and substantial misinformation challenges. This Article sets forth clear roles for the scientists who produce knowledge, the reporters who impart it to the public, and the citizens—voters, jurors, activists—who fold these facts into their public decisions. These stakeholders must hold subversive science to domain-specific standards of proof before incorporating its implications into their stock of working assumptions about the world.

Part I of this Article defines the democratic ideals of responsibility and equality and distinguishes theoretical conceptions of those ideals from people's practical perceptions of them. Part II examines research

22. *See* Toby Helm, *Michael Gove Urged to Reject 'Chilling Views' of His Special Adviser*, GUARDIAN (Oct. 12, 2013, 3:57 P.M.), https://bit.ly/2WTdT5r (discussing a memo urging the education secretary to execute reforms reflecting evidence that "up to 70% of a child's performance is related to his or her genes").

23. Roper v. Simmons, 543 U.S. 551, 569 (2005).

24. *See, e.g.*, Matthew Drecun, *Cruel and Unusual Parole*, 95 TEX. L. REV. 707, 715–16 (2017); Michael M. O'Hear, *Not Just Kid Stuff? Extending Graham and Miller to Adults*, 78 MO. L. REV. 1087, 1094 (2013).

25. *See* JOHN E. COONS & PATRICK M. BRENNAN, BY NATURE EQUAL 53–54 (1999); Stephen J. Morse, *Neuroscience, Free Will, and Criminal Responsibility*, *in* FREE WILL AND THE BRAIN 251, 254 (Walter Glannon ed., 2015).

developments in genetics and neuroscience that threaten to subvert these ideals and spells out why and how certain among these discoveries lay widely shared perceptions of those ideals on the line, without imperiling our best conceptions of them. Part III advances an original framework of cross-cutting policies to combat cognitive bias. It ranges from scientific engagement and knowledge brokers to rules about the admission of and warnings about expert testimony in courts and Congress.

II. DEMOCRATIC IDEALS

Scientific advances have long been assumed to challenge two ideals that anchor our legal system. The first of these is the *responsibility* of adults with normal capacities to control the conduct in which they engage. The notion that we are responsible for our actions, and should be treated as such, animates a broad swath of law and policy that expects us to comport our behaviors to certain rules, and blames or punishes us for not doing so.[26] The second ideal is *equality*—here, I focus on moral and legal equality among salient groups based upon, for example: sex and race. That individual members of these groups are, and should be, treated as equal animates important rules and norms against discrimination and exclusion.[27]

Responsibility and equality operate at theoretical and practical levels that are crucial to distinguish. How legal theorists or moral philosophers conceive of their contours in theory is one thing—this constitutes the conception of each ideal. But even scholarly consensus may fail to persuade lay people, who may perceive the meaning of responsibility and equality in ways that depart from model theory. Common understandings of these ideals—perceptions of what they mean—are what matter when members of the public rely on those beliefs on juries and in elections. This distinction between conceptions and perceptions is central to my argument: Subversive science can shape how decision-makers perceive responsibility and equality, even as it leaves the way theorists conceive of those ideals unscathed. These distinctive influences on perceptions and conceptions warrants leaving these controversial lines of inquiry to proceed unobstructed, while imparting their results to the public with greater care.

26. *See* THOMAS GREEN, FREEDOM AND CRIMINAL RESPONSIBILITY IN AMERICAN LEGAL THOUGHT 10 (2014); RICHARD POSNER, THE PROBLEMS OF JURISPRUDENCE 167–79 (1990).

27. *See* Erwin Chemerinsky, *In Defense of Equality: A Reply to Professor Westen*, 81 MICH. L. REV. 575, 575 (1983); Cass R. Sunstein, *General Propositions and Concrete Cases (with Special Reference to Affirmative Action and Free Speech)*, 31 WAKE FOREST L. REV. 369, 373 (1996).

A. Responsibility

Responsibility, in the moral and legal sense I have in mind, requires more than just acting in a way that risks some harm or causes some danger.[28] It goes beyond a sufficiently close causal connection between an action—bumping a bag-toting train passenger, for example—and the resulting injury when the fireworks within that bag explode.[29] Much of our law reflects the common intuition that individual freedom to choose some course of action matters morally, apart from its consequences, in attributing blame. The rules setting forth fines and jail time insist that punished acts be done voluntarily and culpably—this ideal of individual responsibility figures prominently in criminal law. Its significance comes from more than how the law conceives of that ideal in theory. It also matters how decision-makers perceive it in practice.

1. Conceptions

To hold a person criminally responsible for some action he performs, the law demands (for all but strict liability crimes) that he do more than just act in a way that causes a prohibited outcome. He must consciously will the action with a culpable state of mind, such as an intent to harm, knowledge of its likelihood to endanger others, or unjustified indifference to such risks.[30] These requirements for conviction explain why causing even mass destruction will not make a defendant responsible if he is too young (no guilty mind), sleepwalks (no voluntary act), or otherwise lacks the power, capacity, or opportunity to do what is legally required.[31]

What justifies restricting the reach of criminal law to voluntary acts that are performed with a guilty mind? It is the assumption that human beings have rational faculties that enable them to meaningfully choose whether to act in way A and not B or C. It would be unfair to hold people responsible, on this view, if delusion or duress keeps them from being able to reasonably decide to act in some other way. The conception of responsibility at the heart of our criminal law requires the kinds of

28. *See* MICHAEL S. MOORE, CAUSATION AND RESPONSIBILITY: AN ESSAY IN LAW, MORALS, AND METAPHYSICS 21 (2009) (explaining that causing harm is "neither sufficient nor necessary for moral responsibility" under the "moral view reflected in the structure of Anglo-American criminal law," but instead "increases the blameworthiness of an already blameworthy defendant" when he tried to bring such harm about, or at least risked it).

29. *See* Palsgraf v. Long Island Railroad Co., 162 N.E. 99 (N.Y. 1928).

30. *See* United States v. Lyons 739 F.2d 994, 998 (5th Cir. 1984) ("An adjudication of guilt is more than a factual determination that the defendant pulled a trigger, took a bicycle, or sold heroin. It is a moral judgment that the individual is blameworthy.").

31. *See* H.L.A. HART, PUNISHMENT AND RESPONSIBILITY: ESSAYS IN THE PHILOSOPHY OF LAW, CH. IV (2008).

conscious intentions or beliefs on which basic acts may be praised or punished.[32]

2. Perceptions

Beyond abstractions, ordinary understandings about responsibility—what it is, who has it, and under what conditions—also matter a great deal for the law.[33] The way in which citizens think about responsibility informs more than just votes for elected officials who promise either law and order or criminal justice reform. Decisions about capital punishment depend on whether jurors think an "individual has lost his moral entitlement to live."[34] After finding a defendant guilty of a death-eligible crime, jurors are afforded broad discretion to bring their beliefs about responsibility to bear on whether the defendant should live or die.[35] Our law leaves the determination of mitigating factors and their balancing against aggravating ones to jurors' open-ended judgments about which aspects of a defendant's background, character, and crime they think make him more or less responsible.[36]

Legislators also draw on perceptions of responsibility to determine which crimes get what punishments. The Eighth Amendment proportional requirements "forbid[] only extreme sentences that are grossly disproportionate to the crime."[37] That courts consider enacted laws to be the "clearest and most reliable objective evidence of contemporary values"[38] explains a judicial "tradition of deferring to state legislatures in making and implementing such important policy decisions."[39] This deference invests lawmakers with broad discretion to determine sentencing guidelines for certain classes of offenses or offenders based on

32. *See* Stephen J. Morse, *Culpability and Control*, 142 U. PA. L. REV. 1587, 1592–94 (1994). This is not to assume that criminal responsibility is necessarily compatible with decision making in a world that is deterministic. *See* Adam J. Kolber, *Free Will as a Matter of Law*, *in* PHILOSOPHICAL FOUNDATIONS OF LAW AND NEUROSCIENCE 9, 17–18 (Michael Pardo & Dennis Patterson eds., 2016).

33. *See* Emad H. Atiq, *How Folk Beliefs About Free Will Influence Sentencing: A New Target for the Neuro-Determinist Critics of Criminal Law*, 16 NEW CRIM. L. REV. 449, 467 (2013).

34. Spaziano v. Florida, 465 U.S. 447, 468–89 (1984) (Stevens J., concurring in part and dissenting in part).

35. *See* Lockett v. Ohio, 438 U.S. 586, 608 (1978) (invalidating limits on a jury's consideration of mitigating factors).

36. *See* Buchanan v. Angelone, 522 U.S. 269, 275 (1998) (holding that the Constitution imposes no obligation on judges or legislatures to instruct capital jury on mitigating factors).

37. Harmelin v. Michigan, 501 U.S. 957, 1001 (1991) (Kennedy, J., concurring). The Court has subsequently treated Justice Kennedy's *Harmelin* opinion as controlling. *See* Ewing v. California, 538 U.S. 11, 23–24 (2003) (plurality opinion).

38. *Roper*, 543 U.S. at 331.

39. Ewing v. California, 538 U.S. 11, 24–25 (2003).

their own beliefs (or those of their constituents) about what legal responsibility entails.[40]

B. Equality

Conceptions and perceptions of equality loom large among policies that entitle citizens to the same sort of rights or resources. The ideal implies shared qualities or relations among people that justify treating them equally.[41] Equality claims carry moral force "because they are regarded as affirming an equality which is believed in some sense already to exist."[42] That is how Bernard Williams puts it. "[T]he normative conclusion that people ought to be treated equally," Peter Westen infers, "rests on the factual premise that they are equal."[43]

The Declaration of Independence evokes this line between normative and descriptive equality in declaring people (at first, white men) "endowed with certain unalienable rights."[44] What motivates this normative equality is a descriptive equality which assumes that "all men are created equal."[45] The Declaration upholds this basic sense of sameness among men (later extended to all people) as a moral condition for the law to ratify and implement. But it does not specify the sense in which people are equal in their intrinsic value or inherent worth. It famously proclaims that proposition and its meaning "self-evident."[46] My concern is the content of this descriptive claim, so frequently invoked to justify egalitarian laws and policies.

1. Conceptions

The conception of equality that moors antidiscrimination and similar laws most plausibly looks to the powers that people share to reason about what is good and right.[47] These equal capacities for what Rawls called "moral personality" lay the secure groundwork that resists disruption through data or demonstration.[48] So human equality is not, on this view,

40. The sentencing guidelines, while now advisory rather than mandatory, strongly encourage courts to abide by legislatively specified ranges. *See* United States v. Booker, 543 U.S. 224, 264 (2005).

41. *See* JOHN WILSON, EQUALITY 98 (1966).

42. Bernard Williams, *The Idea of Equality*, *in* BERNARD WILLIAMS, PROBLEMS OF THE SELF 111–12 (1973).

43. PETER WESTEN, SPEAKING OF EQUALITY 266 (1990).

44. THE DECLARATION OF INDEPENDENCE, para. 1 (U.S. 1776).

45. *Id*.

46. *Id*.

47. *See* Benjamin Eidelson, *Treating People as Individuals*, *in* PHILOSOPHICAL FOUNDATIONS OF DISCRIMINATION LAW 203, 213 (Deborah Hellman & Sophia Moreau eds., 2013).

48. JOHN RAWLS, A THEORY OF JUSTICE 442 (Harv. U. Press 2000) (1921); COONS & BRENNAN, *supra* note 25, at 41–43.

"the empirical claim that all groups of humans are interchangeable; it is the moral principle that individuals should not be judged or constrained by the average [or assumed] properties of their group."[49]

Affirmations of genetic similarity emerged as a way to dislodge the pernicious view that some people "are naturally inferior or . . . only fitted for a narrow range of opportunities and positions."[50] Nobel laureate Gunnar Myrdal explained that "the moral equality doctrine carried with it, even in America, a tendency toward a belief in biological egalitarianism" that denies meaningful genetic variation as a way to deprive group discrimination of its putative logic or justification.[51] But it is a mistake to ground the moral equality of humans on their natural similarity—difference becomes an argument for inequality.[52]

2. Perceptions

Real-world beliefs about equality matter too.[53] One such context is voter support for funding of opportunities that privilege some at the expense of others. For example, the Head Start program provides small classes and better teachers to foster academic success;[54] but the taxpayer-funded program is costly and limited to low-income minorities.[55] Citizens might deny funding to equalize opportunities through such policies if they deem the children who would benefit less worthy by their very nature. *The Bell Curve* provoked a national firestorm with its claims of a genetic basis for IQ differences between African-Americans and Caucasians.[56] Authors Charles Murray and Richard Herrnstein argued that socioeconomic disparities owe less to environmental factors like poverty, racism, and bad schools than to inferior aptitude by poorer performing minority students.[57]

Genomics research today seeks to rehabilitate a personalized version of this connection between biology and school that distances itself from

49. STEVEN PINKER, THE BLANK SLATE: THE MODERN DENIAL OF HUMAN NATURE 340 (2003).

50. *See, e.g.*, Philip Kitcher, *An Argument About Free Inquiry*, 31 NOUS 279, 281 (1997).

51. GUNNAR MYRDAL, AN AMERICAN DILEMMA 84 (1944).

52. *See* A.W. Edwards, *Human Genetic Diversity: Lewontin's Fallacy* 25 BIOESSAYS 798, 801 (2003); *see also* James F. Crow, *Unequal By Nature: A Geneticist's Perspective on Human Differences*, DÆDALUS 81, 84–85 (2002).

53. *See, e.g.*, Celeste M. Condit et al., *Human Equality, Affirmative Action, and Genetic Models of Human Variation*, 4 RHETORIC & PUB. AFF. 85, 100 (2001).

54. *See* EDWARD ZIGLER & SUSAN MUENCHOW, HEAD START: THE INSIDE STORY OF AMERICA'S MOST SUCCESSFUL EDUCATIONAL EXPERIMENT 7–55 (1992).

55. *See id*. at 17, 138.

56. *See* RICHARD HERRNSTEIN & CHARLES MURRAY, THE BELL CURVE 389–416 (1994).

57. *See id*. at 389–93.

claims of entrenched inequality.[58] "Genetic differences in human life are a scientific fact," one researcher argues, and "knowing which genes are associated with educational success will help scientists understand how different environments also affect that success . . . . [I]f we want to invest wisely in interventions that can truly make a difference."[59] But when it comes to genetics research, it is notoriously difficult to wall off discussion about individual differences without implying group differences. Today's studies of intelligence that never mention race are still invoked to argue that genes should decide which types of children get special access to scarce advantages.[60]

III. DISRUPTIVE DISCOVERIES

The kind of research I am concerned with aims to build on generalizable facts about the world by using experimental means to generate or analyze them. Scientific inquiry systematically develops, refines, extends, or rejects established propositions in the pursuit of truth.[61] It accumulates empirical observations and trials to extend reliable explanations, predictions, and applications to more and more natural phenomena.[62] Science seeks "to increase the store of human knowledge."[63] That project becomes *subversive* when it challenges a dominant social ideology: here, the ideals of responsibility and equality so central to our democratic system. What matters is not just the abstract conception of those ideals, but practical perceptions of them. These real-world beliefs are what lay vulnerable to certain research in neuroscience and genetics.

A. Neuroscience and Free Will

Two lines of neuroscientific inquiry have captured public imagination as a threat to popular understandings of responsibility. The first—imaging research—generates real-time pictures of the neural processes that explain human decisions.[64] However free these decisions seem to us, some worry their visual representation threatens to expose

58. *See* KATHRYN ASBURY & ROBERT PLOMIN, G IS FOR GENES 14–21, 141–46 (2014).

59. Kathryn P. Harden, *Why Progressives Should Embrace the Genetics of Education*, N.Y. TIMES (July 28, 2018), https://nyti.ms/2K4odAa.

60. *See, e.g.*, Carl Zimmer, *In 'Enormous Success,' Scientists Tie 52 Genes to Human Intelligence*, N.Y. TIMES (May 23, 2017), https://nyti.ms/2rLkFu3; Aaron Panofsky, *What Does Behavioral Genetics Offer for Improving Education?*, 45 HASTINGS CNTR. REP. S43, S49 (2015).

61. *See* Carl G. Hempel, *Inductive Inconsistencies*, 12 SYNTHESE 439, 460 (1960).

62. *See* THOMAS KUHN, THE STRUCTURE OF SCIENTIFIC REVOLUTION 234 (2d ed., 1970).

63. Lasercomb Am., Inc. v. Reynolds, 911 F.2d 970, 976 (4th Cir. 1990).

64. *See* DAWN M. MCBRIDE & J. COOPER CUTTING, COGNITIVE PSYCHOLOGY: THEORY, PROCESS, AND METHODOLOGY 36–37 (2d ed. 2018).

brain activity as the accumulation of genetic, environmental, and other causes, none of which we choose or control. The second—timing research—looks instead at whether the unconscious brain processes that precede and seem to initiate certain actions leave any room for conscious decisions.[65] This section analyzes the challenge of causal determinism and preconscious bypassing, and argues that neither threatens the conception of responsibility in criminal law—which is not to say that they might not imperil the perceptions of that ideal.

1. Brain Imaging

Scanning technologies are no longer limited to static pictures of the brain to locate head injuries or neurological disease. Imaging tools can measure variations in blood flows and electrical waves to generate vivid detail of what is happening inside the brain at a particular point in time.[66] These operations are so complex it might never be possible to reliably or precisely predict the presence of deception, bias, or pain, let alone their influence on decisions.[67] And yet, functional magnetic resonance imaging (fMRI) studies have begun to yield evidence that can be used to identify which trial witnesses are lying,[68] whether employment discrimination defendants are biased,[69] and how much personal injury plaintiffs are suffering.[70]

Cognitive scientists Joshua Greene and Jonathan Cohen have argued this research, by putting our brain activity on display in real-time and high-resolution, shows that all mental states can be fully explained by the workings of the brain.[71] "Every decision is a thoroughly mechanical

65. *See id.* at 33–34.

66. *See id.* at 34–36.

67. *See* Emily R. Murphy & Henry T. Greely, *What Will Be the Limits of Neuroscience-Based Mindreading in the Law?*, *in* OXFORD HANDBOOK OF NEUROETHICS 635, 642 (Judy Illes ed., 2011).

68. *See* Shawn E. Christ et al., *The Contributions of Prefrontal Cortex and Executive Control to Deception: Evidence from Activation Likelihood Estimate Meta-analyses*, 19 CEREBRAL CORTEX 1557, 1559 (2009). For further discussion, see Dov Fox, *The Right to Silence Protects Mental Control*, *in* 13 LAW AND NEUROSCIENCE 335, 342–48 (Michael Freeman ed., 2011).

69. *See* Harrison A. Korn et al., Neurolaw: *Differential Brain Activity for Black and White Faces Predicts Damage Awards in Hypothetical Employment Discrimination Cases*, 7 SOC. NEUROSCIENCE 398, 404 (2012). For additional discussion, see Dov Fox, *Neuro-Voir Dire and the Architecture of Bias*, 65 HASTINGS L.J. 999, 1015 (2014).

70. *See* Justin E. Brown et al., *Toward a Physiology-Based Measure of Pain: Patterns of Human Brain Activity Distinguish Painful from Non-Painful Thermal Stimulation*, PLOS ONE, Sept. 13, 2011, at 2, 7. For further discussion, see Amanda C. Pustilnik, *Pain as Fact and Heuristic: How Pain Neuroimaging Illuminates Moral Dimensions of Law*, 97 CORNELL L. REV. 801, 811–16 (2012).

71. Joshua Greene & Jonathan Cohen, *For the Law, Neuroscience Changes Nothing and Everything*, 359 *PHIL. TRANSACTIONS. ROYAL SOC'Y. B.: BIOLOGICAL SCI.* 1775, 1778 (2004).

process," they say, "the outcome of which is completely determined by the results of prior mechanical processes."[72]

> The brain is a physical thing subject to the rules of the physical world. The physical world is determined; therefore, the brain must also be determined. If the brain is determined and the brain enables the mind, thoughts and actions arising from the mind must also be determined occurrences rather than voluntary expressions of free will.[73]

Imaging looks to reveal a causal bottleneck in the brain through which the sum of genetic, environmental, and other forces affect a person's beliefs and behaviors.[74] "Ordinary conceptions of human action and responsibility" are flawed, on this account, and "the legal principles we have devised to reflect these conceptions" accordingly require radical revision to reflect less robust accounts of free will.[75]

The following real-world case illustrates the ostensible threat that brain imaging poses to responsibility. A 40-year-old man developed a sudden interest in child pornography and was thereafter convicted of child molestation for fondling his 12-year-old stepdaughter.[76] Court records kept his name anonymous, so let us call him Russell. As a first-time offender, Russell could avoid incarceration by passing a simple treatment program. But he flunked, complaining of acute headaches. A brain scan revealed a tumor the size of an egg.[77] After surgery removed the tumor, Russell's urges toward children vanished. He then completed the treatment program easily and returned to his law-abiding self. However, when his urges returned months later imaging revealed that the tumor had as well. When it was once more removed, those impulses again went along with it.[78]

Brain tumors like this are so rare that it might seem like a mistake to make too much of the example. But Uri Maoz and Gideon Yaffe explain how its implications reach beyond such vivid and fixable impairments on the individual's capacity to act freely.[79] Russell's criminal behavior "is no different from anyone else's," they argue, in that it "has its source in the

72. *Id.*; *see also* SAUL SMILANSKY, FREE WILL AND ILLUSION 137–38 (2000).

73. *See generally* Nita Farahany, *A Neurological Foundation for Freedom*, 2012 STAN. TECH. L. REV. 4 (2012).

74. *See generally* NADA GLIGOROV, NEUROETHICS AND THE SCIENTIFIC REVISION OF COMMON SENSE 46 (2016).

75. Greene & Cohen, *supra* note 71, at 1779–80.

76. *See* Jeffrey M. Burns & Russell H. Swerdlow, *Right Orbitofrontal Tumor with Pedophilia Symptom and Constructional Apraxia Sign*, 60 JAMA NEUROLOGY 437, 437 (2003).

77. *Id.* at 438.

78. *Id.*

79. *See* Uri Maoz & Gideon Yaffe, *What Does Recent Neuroscience Tell Us About Criminal Responsibility?*, 3 J.L. & BIOSCIENCE 120, 120–22 (2016).

person's brain and his environment."[80] And "if we knew enough about the brain and our medical technology was sophisticated enough, wouldn't every case in every courtroom be just like" this one?[81] Perhaps not. Our criminal law operates to punish any adults who commit crimes, even if under the effect of mental illness, so long as they exhibit minimal capacity to reason or tell right from wrong. Russell's case raises the question of whether culpability should turn on this threshold level of rational or moral capacity, or whether a person's action can be traced less to his "will" than to the unchosen forces in his brain—genetics, randomness, or tumors—that are themselves caused by a cascade of similarly unchosen forces that came before.

It is difficult to imagine what visual representations of the activity in a person's brain could prove him non-responsible for some act that he committed.[82] People with the same brain scans might behave very differently. Unless someone lacks the minimal required capacity to reason, or has some other excuse, the criminal law still holds the person responsible even in a deterministic world.[83] There is, however, a greater neuroscientific threat to responsibility. This comes from research about the timing of decision-making activity in the brain, which seems to suggest that unconscious brain events bypass our conscious intentions altogether.

2. Brain Timing

We think that we act when and how we intend to, even if those decisions are hasty. But timing experiments purport to show that intentions to act form only *after* those actions have been set into motion by unconscious activity in the brain. Intentions are less drivers of action, by this account, than side effects of neural mechanisms. Benjamin Libet pioneered this timing research in the 1980s.[84] Libet measured brain activity in subjects using an electroencephalogram (EEG) device that looks like a hat with tentacles.[85] With the EEG affixed to their scalp, subjects were asked to flex a finger at the exact moment they felt the urge to perform that simple movement.[86] They reported that time using a modified clock

80. *Id*. at 122.

81. *Id*. at 121. For a critical discussion of this analysis, see generally Dennis Patterson, *Criminal Law, Neuroscience and Voluntary Acts*, 3 J.L. & BIOSCIENCE 355 (2016).

82. *See* Stephen J. Morse, *Lost in Translation?*, *in* 13 L. & NEUROSCIENCE: CURRENT LEGAL ISSUES 529, 533 (Michael Freeman ed., 2010).

83. *See* Adam Kolber, *Will There Be a Neurolaw Revolution?*, 89 IND. L.J. 807, 820–26 (2014).

84. *See* BENJAMIN LIBET, MIND TIME: THE TEMPORAL FACTOR IN CONSCIOUSNESS 75-78 (2004).

85. *See id*.

86. *See id*.

whose second hand swept 25 times faster than an ordinary one, marking off 40-millisecond intervals around the periphery.[87] Participants reported when they intended to flex, while EEGs measured the onset of motor preparation.[88]

These measures revealed a pattern. The recorded brain activity increased slowly leading up to the finger flexing, and then fell sharply after that movement. Libet called this horseshoe-shaped pattern of brain activity "readiness potential."[89] It showed up anytime subjects were asked to watch the clock and time their intent to move a finger—but not when they did not act on that intention—suggesting it represents the brain activity that sets human action into motion. Libet found the onset of this readiness potential consistently preceded, by a fraction of a second, the moment at which subjects said they had become aware of their intention to flex.[90]

Timing Results of Libet Experiment

−550 milliseconds	−200 milliseconds	0 milliseconds
Readiness Potential	Reported Awareness	Muscle Movement

That the readiness potential began *before* the subjects' reported awareness of their intention implies that this potential could not have been caused by their later-occurring intentions. The implication is arresting: I myself am not aware of whatever it is that activates the brain processes that make my body move. That initial trigger lies beyond my mindful control.[91]

Some neuroscientists argue that this shows that the unconscious brain activity that precedes conscious intention encodes how a person will

87. *Id.* at 83–86.
88. I*d.* at 91–92, 96–101.
89. *Id.* at 133–36.
90. *Id.* at 151–57.
91. *See* Benjamin Libet, *Do We Have Free Will?*, 6 J. CONSCIOUSNESS STUD. 47, 51–52 (1999). Libet's finding that readiness potential precedes conscious intention has been replicated by scientists using more reliable ways to measure brain activity than those available to Libet. *See, e.g.*, Chun S. Soon et al., *Unconscious Determinants of Free Decisions in the Human Brain*, 11 NATURE NEUROSCIENCE 543, 543–44 (2008). These new studies, like Libet's, have found that the recorded brain activity preceded subjects' awareness that they intended to press the button—this time, up to nine seconds before they realized that intention. *See* Walter Sinnott-Armstrong, *Lessons from Libet*, *in* CONSCIOUS WILL AND RESPONSIBILITY: A TRIBUTE TO BENJAMIN LIBET 235, 237–38 (Walter Sinnott-Armstrong & Lynn Nadel eds., 2011). For further discussion, see Victoria Saigle et al., *The Impact of a Landmark Neuroscience Study on Free Will: A Qualitative Analysis of Articles Using Libet and Colleagues' Methods*, 9 AJOB NEUROSCIENCE 29, 41 (2018).

decide.[92] Our minds backdate the subjective experience of conscious control, they argue, to a previous time at which readiness potential could be measured in the cortex.[93] By inferring intentionality after the fact, we reorder our perception of events to preserve the sense that we intend our actions.[94] Suppose these findings cannot be explained, as scholars have argued, by methodological flaws like inaccurate reporting times.[95] That our unconscious brain activity predicts what we do before we decide to do it seems to relegate the conscious self to a spectator's role in driving action. What we experience as intention is really part of an unconscious sequence set in motion long before.[96] Our intentions are not causally determined by unchosen forces—instead, they are less conscious than unconscious.[97]

To be sure, finger flexes are not the kind of reason-based action to which we usually assign responsibility. Detached from justifying or motivating grounds to choose among options, moreover, that decision is arbitrary. That it is initiated by unconscious brain processes may not, therefore, tell us anything about actions we have reason to care about for matters of responsibility.[98] And besides, the very fact that unconscious brain processes precede a person's urge to act does not crowd out a causal role for conscious agency or voluntary control. These findings still leave space—in the time before the readiness potential is activated—for the individual to choose either to permit or to prevent any of those urges.

Neuro-timing studies have consistently found a window of time between the push-button of awareness of intent and the action itself that is more than sufficient for a person to decide whether to consummate an act-in-progress. Libet himself wrote that the conscious mind stands guard like a gatekeeper, letting some of the "unconscious initiatives" that "'bubbl[e]

92. *See* Jeffrey P. Ebert & Daniel M. Wegner, *Bending Time to One's Will, in* CONSCIOUS WILL AND RESPONSIBILITY: A TRIBUTE TO BENJAMIN LIBET 134, 137 (Walter Sinnott-Armstrong & Lynn Nadel eds., 2011).

93. *See* TOR NORRETRANDERS, FEEL THE WORLD: THE SCIENCE OF CONSCIOUSNESS 319 (1997).

94. Say you are driving down a street when a boy runs in front of the car. Your awareness of the boy takes longer than (occurs after) braking to avoid him. *See* LIBET, *supra* note 84, at 183.

95. *See* Alexander Batthyany, *Mental Causation and Free Will after Libet and Soon: Reclaiming Conscious Agency*, *in* IRREDUCIBLY CONSCIOUS 135, 137 (Alexander Batthyany & Avshalom C. Elitzur eds., 2009); Daniel C. Dennett, *The Self as a Responding—and Responsible—Artifact*, 1001 ANNALS N.Y. ACAD. SCI. 39, 4243 (2006).

96. John-Dylan Haynes, *Beyond Libet: Long-term Prediction of Free Choices from Neuroimaging Signals*, *in* CONSCIOUS WILL AND RESPONSIBILITY: A TRIBUTE TO BENJAMIN LIBET 85, 92 (Walter Sinnott-Armstrong & Lynn Nadel eds., 2011).

97. *See* Deborah W. Denno, *Crime and Consciousness: Science and Involuntary Acts*, 87 MINN. L. REV. 269, 328 (2002).

98. *See* Dennis Patterson, *Legal Dimensions of Neural Antecedents to Voluntary Action*, COGNITIVE NEUROSCIENCE 1, 8 (2014).

up' in the brain" take completed form as actions, while holding others back.[99] This gatekeeper view preserves a kind of veto power. This view demotes the role of the conscious will from the volition of free *will* to the regulation of free *won't*. But it does not imply that our brain decides before we do.[100] Timing research just shows, unremarkably, that "urges come before intentions."[101]

B. Genetics and Human Diversity

Few lines of scientific research are more explosive today than inquiry into biological variation among groups. Human biodiversity is wholly uncontroversial as to certain individual differences in, for example, height. But invoking it is divisive as even a partial explanation for sex- or race-based differences in other socially valued traits, such as athleticism or intelligence. Jonathan Haidt has rightly called genetic research into these kinds of group differences "the most offensive idea in all of science for the last 40 years."[102]

> A wall has long protected respectable inquiry from accusations of aiding and abetting racism. That wall is the belief that genetic change happens at such a glacial pace that there simply was not time, in the 50,000 years since humans spread out from Africa, for selection pressures to have altered the genome in anything but the most trivial way (e.g., changes in skin color and nose shape were adaptive responses to cold climates).[103]

Evolutionary pressure on populations in diverse geographical environments contributes to certain differences among groups that descended from them.[104] Continental separation and reproductive isolation, together with genetic drift, natural selection, and countless environmental exposures, have generated complex patterns of biological diversity among ancestral groups.[105]

99. LIBET, *supra* note 84, at 1, 7.

100. *See* Nadelhoffer & Nahmias, *infra* note 145 at 173, 181–82. Compatibilists may not even demand that timing research admit of this veto power for the state of this neuroscience to preserve the free will required for criminal responsibility. *See* Atiq, *supra* note 33, at 467; *see also* Kolber, *supra* note 83, at 820–26 and accompanying text.

101. *See* Timothy J. Bayne & Neil Levy, *The Feeling of Doing: Deconstructing the Phenomenology of Agency*, *in* DISORDERS OF VOLITION 49, 63–64 (Natalie Sebanz & Wolfgang Prinz eds., 2006).

102. Jonathan Haidt, *Faster Evolution Means More Ethnic Differences*, THEEDGE.ORG, https://bit.ly/30Thvqy (last visited July 18, 2019).

103. *Id*.

104. *See* L. LUCA CAVALLI-SFORZA ET AL., THE HISTORY AND GEOGRAPHY OF HUMAN GENES 16 (1994); YUVAL NOAH HARARI, SAPIENS: A BRIEF HISTORY OF HUMANKIND 5–25 (2015).

105. *See* STEPHEN JAY GOULD, THE STRUCTURE OF EVOLUTIONARY THEORY 510–46 (2002).

Until recently, our understanding of genetic variation was limited by too-similar population samples, low-density gene markers, and crude tools to measure them.[106] But global collaboration now generates genome-wide data sets that make it possible to analyze variation across geographically diverse populations.[107] In contrast to the field of *genetics*, which studies heredity one gene at a time, *genomics* enlists the far greater information enabled by genome-wide tools to study the effects of many genes all at once.

> Modern genetics creates a paradox with regard to human biological sameness and difference. Genetics confirms the close kinship and common origins of all humans and definitively establishes that race is a social, and not a biological, construct. At the same time, genetics provides a detailed array of information about individual variation at an exquisitely refined, molecular level. Genetics helps explain, among other things, why particular individuals differ in response to pharmaceutical products, have certain allergies, or should avoid certain exposures. Genetic information may even permit predictions about the future course of individual health and development.[108]

Two strands of this research lurk as threats to equality.[109] One looks at physical differences, ancestry tests, medical treatments, or forensic tools.[110] The other concerns cognitive differences like intelligence.[111]

1. Physical Differences

Variants underlying even genetically simple physical traits, like skin color, can vary enormously in how they are expressed.[112] But some traits do manifest group-based differences. Take lactose intolerance. People who can digest milk products as adults carry gene variants for the lactase

106. *See* Hannah Pulker et al., *Finding Genes that Underlie Physical Traits of Forensic Interest Using Genetic Tools*, 1 FORENSIC SCI. INT'L: GENETICS 100, 101 (2007).

107. *See* Noah A. Rosenberg et al., *Genetic Structure of Human Populations*, 298 SCI. 2381, 2384 (2002); Noah A. Rosenberg et al., *Clines, Clusters, and the Effect of Study Design on the Inference of Human Population Structure*, 1 PLOS GENETICS 660, 667 (2005).

108. Rothstein, *supra* note 3, at 453 (footnote omitted).

109. *See* JONATHAN MARKS, HUMAN BIODIVERSITY: GENES, RACE, AND HISTORY 183–95 (1995).

110. *See generally* Jonathan D. Kahn, *Beyond BiDil: The Expanding Embrace of Race in Biomedical Research and Product Development*, 3 ST. LOUIS U.J. HEALTH L. & POL'Y 61 (2009); Bert-Jaap Koops & Maurice H.M. Schellekens, *Forensic DNA Phenotyping: Regulatory Issues*, 9 COLUM. SCI. & TECH. L. REV. 158 (2008).

111. *See* Robert Plomin, *Molecular Genetics and g*, *in* THE SCIENTIFIC STUDY OF GENERAL INTELLIGENCE: TRIBUTE TO ARTHUR JENSEN 107, 108 (Helmuth Nyborg ed., 2003).

112. *See* Rebecca L. Lamason et al., *SLC24A5, a Putative Caution Exchanger, Affects Pigmentation in Zebrafish and Humans*, 310 SCI. 1782, 1786 (2005).

enzyme that breaks down dairy proteins. Selection for these variants appears in people who descended within the past 10,000 years from eastern Africa or northern Europe. These populations survived on dairy-based farming, so drinking animal milk conferred a nutritional advantage.[113] Lactose intolerance, pervasive in much of the world, is rare among modern Swedes, Danes, and Tutsis who share gene variants for lactose digestion.[114]

Scholars express anxiety that genomic inquiries into group-based physical differences will shore up racial stereotypes or division.[115] Genocide, slavery, segregation, and sterilization, they note, have historically appealed to physical differences like skin color, hair type, and skeletal structure. These are differences that genetics research has the power to vindicate and legitimize.[116] Some worry that forensic medicine and anthropology "may be used to revive long discredited 19th century theories of race" as a fact reducible to biology.[117] Others fear that "increasing acceptance of DNA science that ascribes a genetic dimension to race has the potential to . . . usher in a new era of scientific racism."[118] The idea that physical variation among groups has a biological basis indeed captured the public imagination in contexts from medicine to athleticism.[119] But these kinds of skin-deep differences matter less than the cognitive or behavioral diversity it implicates. Whatever concerns genetic differences in physical traits might raise, their deeper disquiet relates to ramifications for natural hierarchies of intellectual capacity.[120]

2. Mental Differences

General intelligence—the ability to plan, reason, think abstractly, solve problems, grasp complex ideas, and learn from experience—correlates relatively well with academic attainment and income.[121] Twin

113. *See* Dallas M. Swallow, *Genetics of Lactase Persistence and Lactose Intolerance*, 37 ANN. REV. GENETICS 197, 198–204 (2003).

114. *See* Joachim Burger et al., *Absence of the Lactase-Persistence-Associated Allele in Early Neolithic Europeans*, 104 PROC. NAT'L ACAD. SCI. U.S. 3736, 3737–38 (2007).

115. *See* Amy Harmon, *The DNA Age: In DNA Era, New Worries About Prejudice*, N.Y. TIMES (Nov. 11, 2007), https://www.nytimes.com/2007/11/11/us/11dna.html.

116. *See* TROY DUSTER, BACKDOOR TO EUGENICS 2 (2d ed. 2003).

117. OSAGIE K. OBASOGIE, PLAYING THE GENE CARD? A REPORT ON RACE AND HUMAN BIOTECHNOLOGY, viii (2009).

118. Christian B. Sundquist, *The Meaning of Race in the DNA Era: Science, History and the Law*, 27 TEMP. J. SCI., TECH. & ENVTL. L. 231, 265 (2008).

119. *See generally* JON ENTINE, TABOO: WHY BLACK ATHLETES DOMINATE SPORTS AND WHY WE'RE AFRAID TO TALK ABOUT IT (2000).

120. *See* Steven Rose et al., *Should Scientists Study Race and IQ?* 457 NATURE 786, 789 (2009).

121. *See* Jonathan A. Plucker & Amy L. Shelton, *General Intelligence (g): Overview of a Complex Construct and Its Implications for Genetics Research*, 45 HASTINGS CTR. REP. S21, S23–S24 (2015).

studies show that variation in IQ has a large, if mysterious, hereditary component.[122] And behavioral geneticists have long sought gene variants to explain why some individuals have greater mental ability than others.[123] According to James Watson, the provocative Nobel laureate who co-discovered the DNA double helix: "There is no firm reason that the intellectual capacities of people geographically separated in their evolution should prove to have evolved identically."[124] Recent years have seen renewed hopes that whole genomic sequencing on large enough samples to detect small effects across genetic differences will "make progress in understanding the genetic architecture of intelligence."[125]

Geneticists today can access international collaborations of genome data from thousands of high-IQ people worldwide in search of variations associated with intelligence.[126] The promise of genome-wide association studies, or GWAS, to predict human traits across diverse populations is limited by their heavy reliance on research subjects of European ancestry.[127] And the quest to identify intelligence-linked variants has so far revealed mostly null results and false positives.[128] But recent DNA analysis of over 1,000,000 people used genetic probabilities to explain roughly 11% of differences in educational attainment—more than the variation predicted by parental schooling.[129] Another research team identified three variants connected with higher levels of education attainment in nearly 130,000 people.[130] A third team's analysis of almost

122. *See* Ziada Ayorech et al., *Genetic Influence on Intergenerational Educational Attainment*, 28 PSYCHOL. SCI. 1302, 1307 (2017) (finding that genetics explained half of the differences in social mobility).

123. *See* NICHOLAS WADE, A TROUBLESOME INHERITANCE: GENES, RACE AND HUMAN HISTORY 111–12, 221–22 (2014); *see also* Patrick D. Evans et al., *Microcephalin, A Gene Regulating Brain Size, Continues to Evolve Adaptively in Humans*, 309 SCI. 1717, 1720 (2005).

124. JAMES D. WATSON, AVOID BORING PEOPLE: LESSONS FROM A LIFE IN SCIENCE 326 (2007).

125. Erik Parens & Paul S. Appelbaum, *An Introduction to Thinking about Trustworthy Research into the Genetics of Intelligence*, 45 HASTINGS CTR. REP. S2, S2 (2015).

126. *See* Lee M. Butcher et al., *Genome-Wide Quantitative Trait Locus Association Scan of General Cognitive Ability Using Pooled DNA and 500K Single Nucleotide Polymorphism Microarrays*, 7 GENES, BRAINS & BEHAV. 435, 440–44 (2008).

127. *See* Alice B. Popejoy & Stephanie M. Fullerton, *Genomics is Failing on Diversity*, 538 NATURE 161, 164 (2016).

128. *See generally* Christopher F. Chabris et al., *Most Reported Genetic Associations with General Intelligence Are Probably False Positives*, 23 PSYCHOL. SCI. 1314 (2012).

129. *See* James J. Lee et al., *Gene Discovery and Polygenic Prediction from a Genome-Wide Association Study of Educational Attainment in 1.1 Million Individuals*, 50 NATURE GENETICS 1112, 1115 (2018).

130. *See generally* Cornelius A. Rietveld et al., *GWAS of 126,559 Individuals Identifies Genetic Variants Associated with Educational Attainment*, 340 SCI. 1467 (2013).

80,000 people turned up 52 genes linked to intelligence.[131] All emphasized how small of an influence the specified genes combined to have on intelligence.

Environmental, epigenetic, and other forces influence cognitive ability as well, beside the cumulative effects of thousands more genes awaiting discovery. The effect of these genetic variants may remain uncertain and unpredictable in any person, let alone group. That is because the small effects of myriad variants interact with other parts of the genome and surrounding world in ways that will simply be too complex to add up.[132] Children adopted from working-class homes to middle-class ones see an IQ boost of 12–18 points, for example, while the IQ gap between African Americans and Caucasians has recently dropped by 0.33 standard deviation.[133] These findings show that factors like socioeconomics have a substantial, if indeterminate, effect.

Charles Murray, co-author of *Bell Curve*, blames the "taboo against discussion of group differences" for sustaining a false "assumption of no innate differences among groups" that "suffuses American social policy."[134] Behavioral geneticist Robert Plomin affirms: "The unwelcome truth is that equal opportunity will not produce equality of outcome because people differ in *g* [intelligence] in part for genetic reasons," despite the crucial role of "non-genetic factors" to "the development of individual differences in *g*."[135] Crude accounts of this genetic contribution have been deployed to naturalize and justify existing racial, ethnic, or sex disparities that cast certain groups as less worthy or well-suited for opportunities by virtue of their DNA. Even if *g* were fixed at birth across certain groups, that would not diminish the standing of some relative to others. And yet this idea can be lost on those who find in purported group differences a ready explanation for a range of social ills.

131. *See* Suzanne Sniekers et al., *Genome-Wide Association Meta-Analysis of 78,308 Individuals Identifies New Loci and Genes Influencing Human Intelligence*, 49 NATURE GENETICS 1107, 1109–10 (2017).

132. *See* Eric Turkheimer, *Genetic Prediction*, 45 HASTINGS CTR. REP. S32, S35–S37 (2015).

133. Richard E. Nisbett et al., *Intelligence: New Findings and Theoretical Developments*, 67 AM. PSYCHOLOGIST 130, 142 (2012). *But see* Bo Winegard et al., *Getting Voxed: Charles Murray, Ideology, and the Debate on IQ*, QUILLETTE.COM (June 2, 2017), https://bit.ly/2WoZnFu.

134. Charles Murray, *The Inequality Taboo*, AM. ENTER. INST. (Sept. 1, 2005), https://bit.ly/2WnmMqR.

135. Robert Plomin, *Genetics and General Cognitive Ability*, 402 NATURE C25, C29 (1999). *See generally* ROBERT PLOMIN, BLUEPRINT: HOW DNA MAKES US WHO WE ARE (2018) (examining the influence of people's genetics on their observable characteristics).

C. How Science Subverts

Equality and responsibility are cornerstones of our liberal democracy. If these ideals are under siege by advances in neuroscientific and genomic research, it is not because existing science has established that individuals of sound mind are not responsible for their actions or less equal than the members of another group. Indeed, these normative ideals may be altogether immune to empirical challenge.[136] This does not prove, however, that science is not subversive. After all, legal theorists are not the ones who put those ideals into practice. Their operation relies instead on legislators, voters, judges, and jurors—scientific and philosophical laypeople who cannot apply relevant training and expertise to their understanding of these ideals or their susceptibility to empirical findings. These decision-makers are vulnerable to fictions about agency and identity that steer conclusions about responsibility and equality astray. Biases about mechanism and essentialism represent the genuine and pressing risk that subversive science poses to democratic ideals.

1. Beliefs about Mechanism

The two lines of neuroscientific inquiry examined in this section invite distinct cognitive biases at odds with human agency. Imaging research implicates an assumption of causal determinism that many think compatible with holding people responsible for what they do. Determinism holds that people's actions and intentions are themselves caused by a jumble of forces, none of which they chose or exercised control over. Timing research, in turn, triggers a sense of preconscious bypassing that is much harder for people to square with lay perceptions of responsibility. Bypassing is the idea that what seems like a person's intentions, in fact, results from unconscious urges, such that his consciousness plays no causal role in acting *this* way and not *that*.

a. Determinism

Psychologists measure how much imaging research triggers beliefs in determinism and the effect on perceptions of responsibility. One study asked 1,170 Americans to take part in a mock trial that presented them with either psychological or neuroscientific expert evidence to support a defense of "not guilty" by reason of insanity.[137] Researchers concluded that

136. In *Anarchy, State, and Utopia*, Robert Nozick asks whether aliens that are smarter than humans would be justified in treating humans the way we treat cows. *See* ROBERT NOZICK, ANARCHY, STATE, AND UTOPIA (2d prtg. 2013). Query the implications for fetuses, persistent vegetative state ("PVS") patients, and anencephalic babies.

137. *See* Nicholas J. Schweitzer & Michael J. Saks, *Neuroimage Evidence and the Insanity Defense*, 29 BEHAV. SCI. & L. 592, 594–95 (2011).

"framing mental illness" in neurological terms "remove[s] some skepticism on the part of jurors by making the underlying mechanism of the mental illness more concrete."[138] Far more than psychological evidence, the neuroscience convinced subjects that a defendant lacked control over his otherwise criminal conduct.[139]

A second study presented participants with one of two different descriptions for the same deterministic universe.[140] One adopted explicitly neuroscientific terms to describe how decisions for outcomes are made, while the other used psychological terms that highlighted—in place of brain activity—the role of thoughts and desires in decision-making for those effects.[141] 88.6% of subjects in the psychology group agreed that people could be held morally responsible, compared to just 40.7% of those in the neuroscience group, a result that researchers attributed to deterministic priming.[142]

The impact of such priming faces crucial limits, however. Another recent study asked subjects to imagine a person wore a device that would create pictures of his brain capable of predicting his every decision with perfect accuracy.[143] In some situations but not others, the device would let his actions be manipulated by a scientist.[144] It turns out that perfect prediction by itself was not enough to erode perceptions of praise or blame. Only when the predictive tool was accompanied by an outside actor's capacity to alter outcomes did subjects decline to attribute responsibility.[145] Similar studies bear out this conclusion.[146] In the absence of mind-control-like exploitation, exposure to imaging research tends to feed exaggerated beliefs in determinism. These reduce ascriptions of blame, but only modestly.

b. Bypassing

Attributions of individual responsibility are characteristically weaker, by contrast, if a person's mental state is deprived of any causal role in her actions. This is the challenge of preconscious bypassing that

138. *Id*. at 604.

139. *Id.*

140. *See* Eddy Nahmias et al., *Free Will, Moral Responsibility, and Mechanism: Experiments on Folk Intuitions*, 31 MIDWEST STUD. PHIL. 214, 218 (2007).

141. *See id*. at 218.

142. *Id*. at 227, 232.

143. *See* Eddy Nahmias et al., *It's OK If 'My Brain Made Me Do it': People's Intuitions about Free Will and Neuroscientific Prediction*, 133 COGNITION 502, 504 (2014).

144. *See id*. at 505.

145. *See id*. at 512–14.

146. *See* Dylan Murray & Eddy Nahmias, *Explaining Away Incompatibilist Intuitions*, 88 PHIL. & PHENOMENOLOGICAL RES. 434, 439 (2012); Dylan Murray & Tania Lombrozo, *Effects of Manipulation on Attributions of Causation, Free Will, and Moral Responsibility*, 41 COGNITIVE SCI. 447, 469 (2017).

brain timing research poses. Studies like Libet's suggest to the lay or casual reader that the preconscious urges a person neither chooses nor controls crowd out the conscious intentions he has in driving the decisions he makes to take *this* action rather than *that* one.[147] "If neural processes completely explain our actions," some take away from these experiments, "then what causal work is left for our beliefs and desires to do?"[148]

It is not so hard to see how buying into bypassing might lead people to question the general assumption that individuals are responsible for their actions. Consider the following survey study: Half of all participants read an excerpt that described the timing-based premise behind bypassing—namely, what people experience as conscious intentions are really just unconscious electrical signals within the brain.[149] This group was then asked to adjudicate a sentence for a hypothetical murderer. So were the other half of subjects, except they read a different passage instead.[150] Those who read the brain-timing article advised average sentences that were 50% shorter than did those who were not presented with that neuroscience research.[151] Similar results support the hypothesis that laypeople's confrontation with brain timing studies encourages a belief in conscious bypassing at apparent odds with traditional commitments to individual responsibility.[152]

2. Beliefs about Essentialism

"Genetic essentialism" is the psychological driver linking exposure to genomics research to perceptions of equality.[153] Essentialism represents the idea that groups are "natural kinds" whose members have basic

147. *See infra* Section III.A.2.

148. Thomas Nadelhoffer & Eddy Nahmias, *Neuroscience, Free Will, Folk Intuitions, and the Criminal Law*, 36 T. MARSHALL L. REV. 157, 171–72 (2011).

149. *See* Azim Shariff et al., *Free Will and Punishment: A Mechanistic View of Human Nature Reduces Retribution*, 25 PSYCHOL. SCI. 1563, 1565 (2014) (citing FRANCIS CRICK, THE ASTONISHING HYPOTHESIS: THE SCIENTIFIC SEARCH FOR THE SOUL 14 (1994)).

150. *See id*. at 1566.

151. *See id*. For a discussion of this research, see Gunnar Björnsson, *Incompatibilism and "Bypassed" Agency*, *in* SURROUNDING FREE WILL: PHILOSOPHY, PSYCHOLOGY, NEUROSCIENCE 95, 115 (Alfred R. Mele ed., 2014).

152. *See* Eddy Nahmias & Dylan Murray, *Experimental Philosophy on Free Will: An Error Theory for Incompatibilist Intuitions*, *in* NEW WAVES IN PHILOSOPHY OF ACTION 189, 207 (Jess Anguilar et al. eds., 2010); Andrew E. Monroe & Bertram F. Malle, *From Uncaused Will to Conscious Choice: The Need to Study, Not Speculate About People's Folk Concept of Free Will*, 1 REV. PHIL. PSYCHOL. 211, 219–20 (2009); Eddy Nahmias, *Autonomous Agency and Social Psychology, in* CARTOGRAPHIES OF THE MIND: PHILOSOPHY AND PSYCHOLOGY IN INTERSECTION 169, 180 (Massimo Marraffa et al. eds., 2007); Hoi-Yee Chan et al., *Free Will and Experimental Philosophy*, *in* A COMPANION TO EXPERIMENTAL PHILOSOPHY 158, 168 (Justin Sytsma & Wesley Buckwalter eds., 2016).

153. Ilan Dar-Nimrod & Steven J. Heine, *Genetic Essentialism: On the Deceptive Determinism of DNA*, 137 PSYCHOL. BULL. 800, 808 (2011).

"essences."[154] This idea casts members of a certain race, ethnicity, or gender as sharing the sort of fixed and inborn characteristics that often support stereotypes, prejudice, racism, or nationalism.[155] Social psychologists have distinguished two types of genetic essentialism: biosomatic and biobehavioral.

a. Biosomaticism

Biosomatic essentialism holds that membership in a group is immutable, uniform, inherent and natural, and discrete as a function of physical markers like height and skin color.[156] Biobehavioral essentialism goes beyond the physical to ascribe group members genetically inherited behaviors.[157] Lay confrontation with human genomics research about physical differences reinforces the biosomatic essentialism that many in modern American society already accept as true.[158]

This form of genetic essentialism holds that a person's biological essence as expressed through his physical characteristics does not change, whatever his lived experience, group interaction, or self-identification.[159] This helps to explain why, when subjects were asked to read evidence of biologically-based physical differences among racial groups—rather than evidence that race is uninformed by genetic differences—they were more likely to endorse essentialism beliefs and to exhibit nearly 20% higher levels of racial prejudice and negative stereotyping.[160] After reading an article that connected genetics to a greater risk of disease for members of a racial group, those subjects were more likely to associate certain other

154. *See* Brock Bastian & Nick Haslam, *Psychological Essentialism and Stereotype Endorsement*, 42 J. EXPERIMENTAL SOC. PSYCHOL. 228, 232 (2006).

155. Michael R. Andreychik & Michael J. Gill, *Do Natural Kind Beliefs about Social Groups Contribute to Prejudice?: Distinguishing Bio-somatic Essentialism from Bio-behavioral Essentialism, and Both of these from Entitativity*, 18 GROUP PROCESSES & INTERGROUP REL. 454, 455 (2015).

156. *See id*. at 456.

157. *Id. See also* Michael J. Gill & Dana M. Mendes, *When the Minority Thinks "Essentially" Like the Majority: Blacks Distinguish* Bio-Somatic *from* Bio-Behavioral *Essentialism in Their Conceptions of Whites, and Only the Latter Predicts Prejudice*, 11 PLOS ONE 1, 13 (2016) (distinguishing biosomatic and biobehavioral essentialism).

158. *See* Brian M. Donovan, *Framing the Genetics Curriculum for Social Justice: An Experimental Exploration of How the Biology Curriculum Influences Beliefs About Racial Difference*, 100 SCI. EDUC. 586, 589 (2016).

159. *See* Francisco J. Gil-White, *Are Ethnic Groups Biological "Species" to the Human Brain?*, 42 CURRENT ANTHROPOLOGY 515, 523–25 (2001) (discussing a study finding that Mongolian participants would still regard a child as "Kazakh" if his genetic parents were Kazakh but he was adopted at birth by a Mongolian family, raised only by Mongolians, and learned only Mongolian customs and language).

160. *See* Jo C. Phelan et al., *The Genomic Revolution and Beliefs about Essential Racial Differences: A Backdoor to Eugenics?*, 78 AM. SOC. REV. 167, 173–75 (2013).

limited traits of skill or personality with the "genetic makeup" of that race.[161]

b. Biobehavioralism

These specious associations are stronger and more prevalent in the case of biobehavioral essentialism that links genetic differences directly to traits like intelligence and temperament at the heart of mental group differences research.[162] Several studies have indicated that adherents of biobehavioral essentialism show diminished engagement with racial equality.[163] One study presented subjects with a battery of questions on beliefs in biosomatic and biobehavioral essentialism—for example: "The primary reason why parents and children are so similar in their behavior, personality, and character is that they share much of their DNA"; and "Most of the physical traits in human beings can be traced back to their genes"— before measuring their prejudice levels using the "Modern Racism Scale."[164] Biosomatic essentialism barely correlated to prejudicial views at just 0.20; the 0.66 correlation with biobehavioralism was more than three times as predictive.[165]

Other studies of group essentialism and negative stereotyping have arrived at similar indictments of biobehavioral beliefs over and above biosomatic ones.[166] More pernicious than perceiving groups as innate kinds with physical differences, is thinking all their members "share the 'seed' of negative behaviors 'deep down inside' (even if not all members are currently showing those bad behaviors)."[167] This belief that genes encode human identity, of course, reflects an inflated view of the way

161. *See* Alexandre Morin-Chassé, *Public (Mis)understanding of News about Behavioral Genetics Research: A Survey Experiment*, 64 BIOSCIENCE 1170, 1177 (2014).

162. *See* Brian M. Donovan, *Learned Inequality: Racial Labels in the Biology Curriculum Can Affect the Development of Racial Prejudice*, 54 J. RES. SCI. TEACHING 379, 382 (2016).

163. *See* Melissa J. Williams & Jennifer L. Eberhardt, *Biological Conceptions of Race and the Motivation to Cross Racial Boundaries*, 94 J. PERSONALITY & SOC. PSYCHOL. 1033, 1041 (2008).

164. *See* Andreychik & Gill, *supra* note 155, at 461–63.

165. *See id*. at 463.

166. *See* Johannes Keller, *In Genes We Trust: The Biological Component of Psychological Essentialism and Its Relationship to Mechanisms of Motivated Social Cognition*, 88 J. PERSONALITY & SOC. PSYCHOL. 686, 689–90 (2005); *see also* Benjamin Y. Cheung & Steven J. Heine, *The Double-Edged Sword of Genetic Account of Criminality: Causal Attributions From Genetic Ascriptions Affect Legal Decision Making*, 41 PERSONALITY & SOC. PSYCHOL. BULL. 1723, 1736 (2015) (finding that genetic explanations of criminal behavior reduce ascriptions of control, while increasing perceptions of dangerousness).

167. *See* Andreychik & Gill, *supra* note155, at 466.

genes contribute to people's sense of self.[168] And yet there is a widespread perception that DNA imparts natural and immutable traits in a way that makes it easy to see different individuals as belonging to discrete and unvarying groups.[169]

3. Education and Worldviews

Two other factors plausibly mediate reported beliefs about equality and responsibility. The first is the extent to which people are conversant in scientific facts and concepts that could impact their understanding of and/or receptiveness to neuroscientific or genetic findings. The second is the sort of ideologies that comprise cultural worldviews. Either might inform reported beliefs about cherished ideals in ways that operate independently of or in connection to beliefs about either mechanism or essentialism.

a. Scientific Literacy

The half of Americans who know the Earth takes a year to orbit the Sun might be assumed to think differently about genetic or neuroscientific information and its implications than those who mistakenly think that Earth orbits in just a day.[170] Those less conversant in scientific facts and concepts might accordingly be presumed more deferential to scientific authorities or less critical of unreliable findings.[171] Their weaker basis for independent appraisal or duly skeptical judgment might make them more susceptible to accepting superficially credible implications of scientific evidence that a more informed evaluation would not substantiate. On the other hand, unfamiliarity with basic science may lead some to reject such research as elite propaganda, leading them to resist scientific explanations even more.

168. *See* Dov Fox, *Silver Spoons and Golden Genes: Genetic Engineering and the Egalitarian Ethos*, 33 AM. J. L. & MED. 567, 594–95 (2007).

169. *See* JOHN H. EVANS, WHAT IS A HUMAN? WHAT THE ANSWERS MEAN FOR HUMAN RIGHTS 60–65 (2016); Jason Schnittker et al., *Nature, Nurture, Neither, Nor: Black-White Differences in Beliefs about the Causes and Appropriate Treatment of Mental Illness*, 78 SOC. FORCES 1101, 1132 (2000). *See also* Boby Ho-Hong Ching & Jason Teng Xu, *The Effects of Gender Neuroessentialism on Transprejudice: An Experimental Study*, 78 SEX ROLES 228, 230 (2018) (identifying essentialist beliefs about purported differences between men and women as a major source of prejudice against transgendered individuals).

170. Nat'l Sci. Bd., *Science & Engineering Indicators 2016*, NSF.GOV, https://bit.ly/2CLtCJk (last visited July 18, 2019).

171. *See* Dominique Brossard & Matthew C. Nisbet, *Deference to Scientific Authority Among a Low Information Public: Understanding U.S. Opinion on Agricultural Biotechnology*, 19 INT'L J. PUB. OP. RES. 24, 45–47 (2007) (finding that scientific knowledge plays a modest role on deference to scientific authorities in the context of research related to agricultural biotechnology).

b. Cultural Worldviews

Another factor plausibly complicates the effect that subversive science has on attitudes about equality and responsibility: namely, diverse visions about what makes society good. New findings can offer evidence either for or against these rival visions.[172] Those visions may be informed by factors like race, gender, age, geography, education, religion, personality, or political affiliation.[173] For example, those inclined to a hierarchical rather than egalitarian outlook might be suspicious of genetics research purporting to show that individuals from all groups are meaningfully similar. One might likewise expect those who hold communitarian as opposed to individualist values to sense that brain research only validates whatever existing doubts, they have that adults of sound mind are morally responsible for their behaviors and should be held legally so in the absence of justification or excuse. Past studies suggest that cultural beliefs about morally-laden values, such as responsibility and equality, motivate reasoning about related facts.[174]

III. POLICY IMPLICATIONS

These data call for steps designed to help social institutions produce and disseminate knowledge more effectively.[175] My analysis reframes the threat that controversial lines of inquiry present in terms of actual *perceptions* rather than abstract *conceptions*. This reframing, in turn, advises targeting the *communication* of knowledge instead of its *production*. Therefore, I reject direct government or university restrictions on research in lieu of evidence-based approaches to public engagement and science communication. These strategies must be deployed to combat not just alternative facts, but also cognitive biases from biogenetic essentialisms to neuroscientific determinism or bypassing. This Part identifies and analyzes the chief reason that the government has for regulating subversive science of the kind I studied here. I argue that this reason—the state's interest in preserving secular democratic ideals—is wholly legitimate, albeit insufficiently forceful, to justify any of the direct or intrusive research restrictions that I specify here.

172. *See generally* MARY DOUGLAS & AARON WILDAVSKY, RISK AND CULTURE: AN ESSAY ON THE SELECTION OF TECHNOLOGICAL AND ENVIRONMENTAL DANGERS (1983) (explaining political conflict as a struggle between adherents of competing approaches to ideals of egalitarianism and individualism).

173. *See* Dan M. Kahan, *Cultural Cognition as a Conception of the Cultural Theory of Risk*, *in* HANDBOOK OF RISK THEORY 725, 746 (Sabine Roeser et al. eds, 2012).

174. *See* JONATHAN L. GROSS & STEVE RAYNER, MEASURING CULTURE: A PARADIGM FOR THE ANALYSIS OF SOCIAL ORGANIZATION 6 (1985).

175. *See generally* Elizabeth Anderson, *The Epistemology of Democracy*, 3 EPISTEME 8–22 (2006) (introducing and developing the concept of "institutional epistemology").

A. Research Regulation

Direct regulation by the scientific profession could take form in informal norms or formal codes of conduct that societies, agencies, review boards, funding foundations, or journals set forth to limit what is funded, permitted, or published.[176] The problem is that no professional paradigm could justify the kind of self-regulation that would respond to the risk of subversiveness.[177] The consent model, for instance, derives duties from scientists having chosen to enter their profession—but nothing about that voluntary entrance decision implies any commitment to democratic ideals.[178] No more promising is the gatekeeper model of public dependence on access to scientific progress—it affords no resources to bootstrap a concern for subversion.[179] Both suggest an emphasis on three dimensions of research: funding, free speech, and public morals.

1. Funding

Government funding is another way to regulate costly scientific research that requires state or federal support if private sources cannot provide enough. Funding decisions provide regulatory control. Yet the government has no obligation to subsidize even the most worthy and promising lines of research; indeed, it has no duty to fund science at all. The state must fund only constitutionally mandated activities and institutions like elections, federal courts, and national defense. The political process allots all other funding through deliberation and deal-making.[180] A growing school of scientific researchers, that a recent *New York Times* profile referred to as the "intellectual dark web," fear that their pursuit of controversial lines of inquiry will not only cut off their public funding but may even get them fired.[181]

The government weighs in on the relative worthiness of various pursuits whenever it funds some projects over others. In the scientific research context, consider President George W. Bush's policy restricting

176. *See* The Editorial Board, *Should Scientists Toy With the Secret of Life?*, N.Y. TIMES (Jan. 28, 2019), https://nyti.ms/2Jr4ZZW.

177. *See* Harvey Brooks, *Lessons of History: Successive Challenges to Science Policy*, *in* THE RESEARCH SYSTEM IN TRANSITION, 11, 12 (Susan E. Cozzens et al. eds., 1990).

178. *See* Norbert Elias, *Scientific Establishments*, *in* SCIENTIFIC ESTABLISHMENTS AND HIERARCHIES 3, 42-49 (Norbert Elias et al. eds., 2012).

179. Daryl Chubin & Terence Connolly, *Research Trails and Science Policies: Local and Extra-Local Negotiation of Scientific Work*, *in* SCIENTIFIC ESTABLISHMENTS AND HIERARCHIES 293, 301 (Norbert Elias et al. eds., 2012).

180. Peter Berkowitz, *The Meaning of Federal Funding* (President's Council on Bioethics, unpublished working paper), https://bit.ly/2Wsa5uK.

181. *See* Bari Weiss, *Meet the Renegades of the Intellectual Dark Web*, N.Y. TIMES (May 8, 2018), https://nyti.ms/2IrkbW4.

federal funding for any stem cell research involving the destruction of live embryos.[182] That policy still allowed the federal government to fund existing stem cell lines using embryos that had already been destroyed, as well as state or private funding to create new cell lines.[183] The political right decried the policy as unprincipled—*If life has absolute worth, then all embryo research must stop!*[184] The left lambasted it as sectarian—*Life-saving therapies cannot be forsaken for the sake of eight-cell organisms!*[185] But neither side could rightly complain that the policy violated any entitlement to state funding for certain kinds of projects over others.[186]

2. Free Speech

Modern democracies operate under a presumption that government should not interfere with the content of scientific inquiry.[187] Scholars have long defended an asserted right of scientific speech to be free from state interference in deciding what and how to study, teach, or publish.[188] This is not a demand for resources or facilities to advance knowledge, but a protection against its active suppression.[189] Proponents have sought to justify this right as an element of academic freedom, a precondition for free and open expression, or a form of expressive conduct.[190] What makes science a matter of constitutional concern is its distinctive status—like art

182. *See* George W. Bush, *Stem Cell Science and the Preservation of Life*, N.Y. TIMES (Aug. 12, 2001), https://nyti.ms/2MzTPV8.

183. *Id*.

184. *See, e.g.*, Leon R. Kass, *The Meaning of Life–In the Laboratory*, AEI (Jan. 1, 2002), https://bit.ly/2KkGA7P.

185. *See, e.g.*, Geoffrey R. Stone, *Religious Rights and Wrongs*, CHI. TRIB., July 26, 2006, at 27.

186. Lee Zwanziger, *Roots and Branches of the US National Debate on Human Embryonic Stem Cell Research*, *in* FUNDAMENTALS OF THE STEM CELL DEBATE 108, 133 (K.R. Monroe ed., 2008).

187. STEVEN GOLDBERG, CULTURE CLASH: LAW AND SCIENCE IN AMERICA 11 (1994). A directive issued by President Reagan, and endorsed by every administration since, affirms federal policy that "to the maximum extent possible the products of fundamental research [shall] remain unrestricted." National Security Decision Directive 189, NATIONAL POLICY ON THE TRANSFER OF SCIENTIFIC, TECHNICAL AND ENGINEERING INFORMATION (Sept. 21, 1985), https://bit.ly/2WFS24r.

188. *See, e.g.*, Richard G. Berger, *Government Regulation of the Pursuit of Knowledge: The Recombinant DNA Controversy*, 3 VT. L. REV. 83 (1978); Richard Delgado & D.R. Millen, *God, Galileo, and Government: Toward Constitutional Protection for Scientific Inquiry*, 53 WASH. L. REV. 349 (1977); John A. Robertson, *The Scientist's Right to Research: A Constitutional Analysis*, 51 S. CALIF. L. REV. 1203 (1978).

189. Natalie Ram, *Science as Speech*, 102 IOWA L. REV. 1187, 1208 (2017).

190. *See generally* Richard Delgado, *Can Science Be Inopportune?*, 31 UCLA L. REV. 128 (1983); James R. Ferguson, *Scientific Inquiry and the First Amendment*, 64 CORNELL L. REV. 639 (1979); Steve Keane, *The Case Against Blanket First Amendment Protection of Scientific Research: Articulating a More Limited Scope of Protection*, 59 STAN. L. REV. 505 (2006); Barry McDonald, *Government Regulation or Other "Abridgements" of Scientific Research*, 54 EMORY L.J. 989 (2005).

or philosophy—as a vital way in which citizens produce new knowledge. The validity of restrictions depends on "the strength of relevant state interests."[191]

Subversive science does not endanger tangible interests such as public health or national security; it does not deprive research subjects of informed consent or cause them avoidable pain or suffering.[192] Neither genetics nor neuroscience research can discredit the theoretical foundations of cherished ideals like responsibility and equality. This is so even as people's exposure to new discoveries may nevertheless lead them to doubt those ideals in just this way. Timing research does not "destroy our capacity to function as moral agents" any more than the discovery of genetically affected group differences would destroy our understanding of people as moral equals who share the same worth and dignity as others.[193] The threat that these lines of inquiry present is how susceptible they are to being misunderstood as showing that people lack free will or equal worth.

3. Public Morals

Constitutional and practical problems beset legal restrictions on science to preserve those same democratic ideals that its dissemination threatens to subvert.[194] Responsibility and equality are less concrete at the level of values than public goods of safety or welfare, despite questions about definitions and measurement. State concern for the intangible norms is nonetheless rational, indeed imperative, given their centrality to the effective functioning of political institutions.[195] And their preservation violates no constitutional decree. Affirming those ideals neither singles out protected classes, for example, nor takes sides on religion. Yet it is far from clear that this interest in secular ideals central to democratic culture is strong enough to support direct or onerous restrictions on subversive science.

The Supreme Court raised questions about the government's authority to legislate morality in a very different context when it struck down a ban on gay sodomy in *Lawrence v. Texas*.[196] Justice Kennedy held for the majority that moral disapproval of homosexuality failed to justify a prohibition on private consensual conduct.[197] The Court's holding left unclear, however, how broadly its skepticism about the public morality

191. Robert Post, *Constitutional Restraints on the Regulations of Scientific Speech and Scientific Research*, 15 SCI. & ENG'G ETHICS 432, 432 (2009).

192. *See supra* notes 9–11 and accompanying text.

193. RESCHER, *supra* note 2, at 9.

194. *See* Dov Fox, *Interest Creep*, 83 GEO. WASH. L. REV. 273, 303–11 (2014).

195. *See supra* notes 26–27 and accompanying text.

196. 539 U.S. 558, 583 (2003).

197. *Id*. at 585 (citation omitted).

interest applies. Does it apply narrowly, only to values that demean unpopular groups, as Justice O'Connor suggested in her concurrence?[198] Or does it sweep so broadly that, as Justice Scalia lamented in his dissent, *Lawrence* "effectively decrees the end of all morals legislation[?]"[199] Whichever interpretation prevails, the state's interest in sustaining public perceptions of responsibility and equality is, at any rate, too weak to justify restrictions on subversive science.[200]

Even if it were constitutional for the government to force researchers to look *here* rather than *there*, such limits would make for bad policy. First, who can predict the effects of restricting research? As explained by psychologist Chris Chabris, restrictions designed to be narrow can still "distort[] researchers' priorities and can harm the understanding of related topics" when their foreseeable spillover on shared proofs and methods "causes mistakes in other areas as well."[201] The second casualty of research restrictions is the organic serendipity that characterizes many crucial scientific discoveries, ranging from X-rays to recent innovations in cut-and-splice DNA.[202] The government should be thus wary of interfering with the direction that scientific research takes, any more than its grant funding power already does. Non-state institutions also promote or constrain research by awarding or denying grants, promotions, speaking requests, and publication offers. The next section explains.

B. Public Engagement

The scientists who produce knowledge, the journalists who transmit it to the public, and the legislators and judges who integrate it into law all

198. *See id*. at 580 (O'Connor, J., concurring).

199. *Id.* at 599 (Scalia, J., dissenting). Uncertainty about the status of morals legislation has played out in the post-*Lawrence* circuit split over the constitutionality of laws that ban the sale of sex toys to deter "the pursuit of sexual gratification unrelated to procreation." Reliable Consultants, Inc. v. Earle, 517 F.3d 738, 745 (5th Cir. 2008). The Eleventh Circuit upheld a ban on the ground that "public morality remains a legitimate rational basis for the challenged legislation even after *Lawrence*." Williams v. Morgan, 478 F.3d 1316, 1318 (11th Cir. 2007). The Fifth Circuit struck a ban down, by contrast, suggesting that to do otherwise "would be to ignore the holding in *Lawrence*" that regulation cannot be justified "simply by deeming [a practice] morally offensive." *Reliable Consultants*, 517 U.S. 738 at 745; Manuel Possolo, *Morals Legislation After Lawrence Can States Criminalize the Sale of Sexual Devices?*, 65 STAN. L. REV. 565, 580–89 (2013).

200. Robert F. Nagel, *Unfocused Governmental Interests*, 55 ALB. L. REV. 573, 573, 580 (1992).

201. Hayden, *supra* note 12, at 27. *See*, *Rescuing Science from Politics: Regulation and the Distortion of Scientific Research* 84–99 (Wendy Wagner & Rena Steinzor eds., 2006).

202. *See generally* ROYSTON M. ROBERTS, SERENDIPITY: ACCIDENTAL DISCOVERIES IN SCIENCE (1989).

have crucial roles in managing risks of subversive science.[203] Scientists are rarely equipped to answer the moral or religious questions raised by their research.[204] The ethics of stem cell research or gene editing, for example, turn on how we value embryos—between persons and property—and whether or why the natural lottery matters.[205] Non-scientists cannot avoid navigating these matters for themselves. What Judge Richard Posner has called the "fear and loathing"[206] that Americans show to science should not lead us to write off its more contentious expressions as "inaccessible to popular comprehension and uncontrollable by democratic decision-making."[207] To facilitate constructive public engagement, I recommend a combination of research incentives, communication, and framing.

1. Incentives

Many think scientists should stick to research and leave specialized reporters to translate and transmit their results and implications.[208] Scientists themselves, however, will remain in demand to give media interviews, testify in courts and before Congress, and address local community forums.[209] However, modern graduate education fails to prepare scientific researchers to explain their work and its relevance to non-academic audiences. For basic and applied research, universities train scientists to focus on narrow questions within a much larger puzzle, all while reporting the facts and data that they study and interpret in the technical language and media of their discipline.

Ph.D. students go on to run their own labs without having learned how to explain why their work matters or how to convey that meaning or significance to audiences of laypeople. Yet a team of Carnegie Mellon scientists recognized that the ability to message effectively requires special training before research falls under public scrutiny.[210] And once science

203. *See* Kathleen H. Jamieson & Bruce W. Hardy, *Leveraging Scientific Credibility about Arctic Sea Ice Trends in a Polarized Political Environment*, 111 PROC. NAT'L ACAD. SCI. 13598, 13605 (2014).

204. *See* Susan Haack, *Of Truth, in Science and in Law*, 73 BROOKLYN L. REV. 985, 986–87 (2008).

205. *See* Dov Fox, *Retracing Liberalism and Remaking Nature: Designer Children, Research Embyos, and Featherless Chickens*, 24 BIOETHICS 170, 173 (2010).

206. Jackson v. Pollion, 733 F.3d 786, 790 (7th Cir. 2013).

207. Bruce Bimber & David H. Guston, *Politics by the Same Means: Government and Science in the United States*, *in* HANDBOOK OF SCIENCE AND TECHNOLOGY STUDIES 554, 559 (Shelia Jasanoff et al. eds., 1st ed., 1995).

208. Earle Holland et al., *The Risks and Advantages of Framing Science*, 317 SCI. 1168, 1171 (2007).

209. *See* Anita Makri, *Give the Public the Tools to Trust Scientists*, 541 NATURE 261, 233 (2017).

210. MELISSA D. CLARKSON ET AL., THE ENGAGE PROGRAM 31-32 (Tyler D. Robinson ed., 2012), *available at* http://bit.ly/2YEmh9a.

graduates go on to run their own professional labs, decisions about grants, prizes, publication, promotion, and tenure almost never reward such participation in science festivals, public debates, science-art collaborations, and other citizen-science enterprises.[211]

Most scientists lack the background, talent, or incentive to translate the significance and limits of their research for non-scientists in light of its wider implications.[212] Institutions that employ or fund scientists should provide training programs to help them translate findings more clearly and effectively for a general audience.[213] Programs might include professional meetings, online modules, and internship or residency programs to teach researchers to brief their work using "legislator-derived, value-based criteria to evaluate each option and produce a final recommendation."[214] Modules in neuroscience and genetics, in particular, might focus on the subversive dimensions of research.

2. Communication

Research funders should also encourage and expect scientists to develop plans for public communication and outreach. For example, the National Science Foundation requires applicants who engage in basic research across disciplines, including genetics and neuroscience, to include in any proposal an impact review that answers questions like: "Will results be disseminated broadly to enhance scientific and technological understanding?" and "What may be the benefits of the proposed activity to society?"[215] Now is the time for scientific institutions and organizations to make science communication a priority. Doing so could involve promotional incentives, leave time, and social recognition that rewards public lectures, media work, and development of training activities. Compensation metrics could, for instance, integrate audience size, reach, evaluations, and other proxy measures of impact and excellence in the communication of subversive science.[216]

This culture of science communication should supplement the training of researchers and reporters skilled in and dedicated to the craft of

211. *See* Clare Matterson, *Scientists' Public Engagement Work Should Be Generously Funded*, GUARDIAN (Oct. 10, 2013, 8:17 P.M.), https://bit.ly/2W9qdBw.

212. *See* Ploy Achakulwisut, *Why Are Scientists So Averse to Public Engagement?*, SCIENTIFIC AM. GUEST BLOG (Mar. 8, 2017), https://bit.ly/2JttgOI.

213. *See* Mónica I. Feliú-Mójer, *Effective Communication, Better Science*, SCIENTIFIC AM. GUEST BLOG (Feb. 24, 2015), https://bit.ly/2cL2LnW.

214. *See* Shikhar H. Shah et al., *Systems-Based Training in Graduate Medical Education for Service Learning in the State Legislature in the United States: Pilot Study*, JMIR MED. EDUC., Oct. 2017, at 1, 3.

215. Peter March, *Broader Impacts Review Criterion*, NAT'L. SCI. FOUND., https://bit.ly/2HA3BR7 (last visited July 18, 2019).

216. *See* Judy Illes et al., *Neurotalk: Improving the Communication of Neuroscience Research*, 11 NATURE REVIEWS NEUROSCIENCE, 61, 64 (2010).

transmitting (subversive) science between the scientists who produce knowledge and the non-scientists who consume it.[217] Knowledge brokers, such as science journalists, build networks and exchange information in contextualized, respectful, and intelligible ways among practitioners, policymakers, and citizens. They must receive training in genetics and neuroscience alongside an appreciation of their larger implications, associated biases, and corrective framings.[218] To train knowledge brokers, academic and media institutions should identify promising candidates based on their interest and critical thinking. Second, these institutions should develop programs to train these recruits to examine, synthesize, filter, and adapt subversive science across a range of media to reach diverse audiences.[219]

3. Framing

Potentially biasing information does not come with a warning label. Effective warnings about the pull of mechanistic or essentialist biases can disrupt exaggerated expectations by inducing a temporary state of skepticism that prompts consideration of the research and its implications with a more critical or discriminating eye.[220] Social psychology research on these warnings suggests that, to be effective, they must explain the specific ways in which these biases operate as people process neuroscience, genomics, and other research that carries the power to disrupt cherished ideals.[221]

One crucial place to combat the misperception of subversive science is in the courtroom. Trial judges always issue instructions to jurors in criminal cases—to deliberate only after all of the evidence has been presented, for example, and to make a decision based only on that evidence.[222] Judges may also instruct jurors to disregard or scrutinize some

217. Alex T. Bielak et al., *From Science Communication to Knowledge Brokering: The Shift from 'Science Push' to 'Policy Pull'*, *in* COMMUNICATING SCIENCE IN SOCIAL CONTEXTS 201, 226 (Donghong Cheng et al. eds., 2008).

218. *See* Maureen Dobbins et al., *A description of a knowledge broker role implemented as part of a randomized controlled trial evaluating three knowledge translation strategies*, IMPLEMENTATION SCI., Apr. 27, 2009, at 1, 7.

219. *See* Morgan Meyer, *The Rise of the Knowledge Broker*, 32 SCI. COMM. 118, 127 (2010).

220. *See* Karen L. Chambers & Maria S. Zaragoza, *Intended and unintended effects of explicit warnings on eyewitness suggestibility: Evidence from source identification tests*, 29 MEMORY & COGNITION 1120, 1129 (2001).

221. *See* Yaacov Schul, *When Warning Succeeds: The Effect of Warning on Success in Ignoring Invalid Information*, 29 J. EXPERIMENTAL SOC. PSYCHOL. 42, 60–62 (1993).

222. *See* Blake M. McKimmie et al., *Objective and Subjective Comprehension of Jury Instructions in Criminal Trials*, 17 NEW CRIM. L. REV. 163, 164–66 (2014).

evidence.[223] When expert facts and opinion testimony impart subversive science in court, judges should at least caution jurors to critically appraise its weight and reliability and warn them of proven limits.[224] Judges could inform jurors that neuroscience research, for instance, shows which parts of the brain are active when one person or another is performing a particular task, clarifying that neither timing nor imaging studies can determine any specific cause of individual thoughts or actions.[225] Judges must take special care not to lead jurors astray. But they can and should make them aware of those biases, like determinism or bypassing, that exposure to such evidence commonly invites.[226]

Cautionary instructions will not be enough to contain the risk that some subversive science poses in the courtroom. The rules that govern scientific expert evidence bar testimony that is invalid, irrelevant, or unduly misleading.[227] Expert analysis of a brain scan or neuroimaging or timing studies must, to be admissibly relevant, "reliably apply the principles and methods" of "specialized knowledge" in a way that tends to make some fact "of consequence in determining the action . . . more or less probable than it would be without the evidence."[228] Even relevant evidence is excluded if it is far less probative of that consequential matter than it is confusing or prejudicial.[229] Are brain-imaging or timing studies relevant to the conditions required for criminal responsibility? And does testimony about that research provide markedly less to prove that fact than it does to prejudice jurors?[230]

Brain images can relate directly to a subject's head injury, and indirectly to certain facts related to mental states or conditions like knowledge or psychosis. And studies suggest that evidence like this does not tend to bias or misinform.[231] But is neuroscience relevant to and

223. *See* CRIMINAL JUSTICE STANDARDS COMM., ABA STANDARDS FOR CRIMINAL JUSTICE: SPECIAL FUNCTIONS OF THE TRIAL JUDGE Standard 6-2.6(b) (3d ed. 2000), *available at* https://bit.ly/2WhFktu.

224. Edward Imwinkelried, *Impoverishing the Trier of Fact: Excluding Proponent's Expert Testimony Due to the Opponent's Inability to Afford Rebuttal Evidence*, 40 CONN. L. REV. 317, 350 (2007).

225. *See* Jane Campbell Moriarty & Michael J. Saks, *Forensic Science: Grand Goals, Tragic Flaws, and Judicial Gatekeeping*, JUDGES' J., Fall 2006, at 16, 31.

226. *See* James M. Doyle, *Applying Lawyers' Expertise to Scientific Experts: Some Thoughts About Trial Court Analysis of the Prejudicial Effects of Admitting and Excluding Expert Scientific Testimony*, 25 WM. & MARY L. REV. 619, 636–40 (1984).

227. *See* Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 595 (1993).

228. FED. R. EVID. 702; FED. R. EVID. 401.

229. *See* FED. R. EVID. 403.

230. *See* Stephen J. Morse, *Brain Imaging in the Courtroom: The Quest for Legal Relevance*, AJOB NEUROSCIENCE, Mar. 18, 2014, at 24, 26–27.

231. *See* Adina L. Roskies et al., *Neuroimages in court: less biasing than feared*, 17 TRENDS IN COGNITIVE SCI. 99, 101 (2011); *see also* N.J. Schweitzer et al., *Neuroimages as evidence in a mens rea defense: No Impact*, 17 PSYCHOL. PUB. POL'Y & L. 357, 372 (2011).

probative of basic responsibility? Recall that timing and imaging research measures brain activity while a subject performs an experimental task that bears little resemblance to what any defendant is alleged to have done.[232] Indeed, even individual "causation by a brain abnormality" will be hard-pressed to "remove criminal responsibility" in the absence of available facts about control of the particular defendant's behavior at the time of the crime.[233] Proving relevance to matters of criminal responsibility will be trying.

Publications that control the dissemination of subversive science also have a role to play in helping ordinary people appreciate the facts and concepts that underlie it. Those who transmit this knowledge in peer-reviewed journals or popular media should avoid decontextualized coverage or sensationalist headlines. These oversimplify the complex causes of behavior or overstate the ability of technology to image the brain or decode the genome. But scientists and science writers can and should do more than that to communicate potentially subversive science in a way that is sensitive to the values it implicates.[234]

For now, journals could require lay summaries like the warnings advised above to accompany the publication of unruly research in neuroscience and genomics.[235] Such summaries might include similar caveats that findings need not be taken to prove that traits are hard-wired or that free will is an illusion. Making warnings measured will help guard against their backfiring and priming people to cling to misperceptions more tenaciously.[236] Similarly, framing behavioral genetics through the lens of individuals rather than groups, and framing neuroscientific findings in terms of contributions instead of causes, can diffuse culturally driven impulses to read too much into this research.[237]

IV. CONCLUSION

How can subversive science attend to threats of legal instability, cultural turmoil, and political unrest without being shackled by fear,

232. *See supra* notes 66–75, 85–91 and accompanying text.

233. Walter Sinnott-Armstrong et al., *Brain Images as Legal Evidence*, 5 EPISTEME 359, 367 (2008).

234. *See* Thomas Dietz, *Bringing Values and Deliberation to Science Communication*, 110 PROC. NAT'L ACAD. SCI. 14081, 14087 (2013).

235. *See* Lauren M. Kuehne & Julian D. Olden, *Opinion: Lay Summaries Needed to Enhance Science Communication*, 112 PROC. NAT'L ACAD. SCI. 3585, 3586 (2015).

236. *See* Claartje J. Vinkenburg, *Engaging Gatekeepers, Optimizing Decision Making, and Mitigating Bias: Design Specifications for Systemic Diversity Interventions*, 53 J. APPLIED BEHAV. SCI. 212, 234 (2017).

237. Cliodhna O'Connor & Helene Joffe, *How Has Neuroscience Affected Lay Understandings of Personhood? A Review of the Evidence*, 22 PUB. UNDERSTANDING SCI. 254, 266 (2013).

dogma, or cynicism? I began by asking whether there are truths too disturbing or divisive to pursue or reveal. Controversy about subversive science has long revolved around supposed threats that certain research findings pose to abstract understandings of cherished ideals. This Article has proposed reorienting the debate toward concern for the public commitment to those ideals. This move shifts away from philosophical conceptions to psychological perceptions. Scientific research that does not endanger abstract conceptions of democratic ideals can still risk actual perceptions of them. And these real-world consequences are what matter most for law and policy.