BEHAVIORAL GENETICS AND CRIME, IN CONTEXT

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I

INTRODUCTION

Two experiences clarified for me precisely how worried people can get about the legal implications of behavioral genetics. First, I attended the 1994 conference on genes and crime,[1] at which interrupting protestors famously chanted, "Maryland conference, you can't hide; we know you're pushing genocide." Two signs illustrated their concerns. One read: "Jobs, Not Prozac." The other read: "This Conference Predisposes Me to Disruptive Behavior Disorder."

The second experience was in 1997, when I was a panelist on the subject "Biological Aspects of Human Action" at a conference of social scientists. When my turn came, I had barely begun the opening sentences, which would start in the most general terms to lay a foundation for why law should care about biological influences on behavior, when a woman in the front row began to shake her head—then her entire body—with obvious passion. I paused, and asked what I had said that had so offended. Her reply, which was just as much a non sequitur in the original as it will come across here, was, "I just don't believe we should put people in jail before they've done anything wrong."

In each of these instances, the yawning gulf between what I or anyone else was actually saying (or about to say) and the pre-empting assumption about what we must mean, intend, and advocate was breathtaking. The leaps of logic necessary to cross this divide typically reflect misunderstandings about the relationships between biology and behavior, the relationships between genes and environments, the implications of those relationships, the ways in which

    1. The conference—"Research on Genetics and Criminal Behavior: Scientific Issues, Social and Political Implications"—was held September 22–24, 1995, at the Aspen Institute's Wye Center in Queenstown, Maryland.

those implications will be considered, the goals a speaker is pursuing, and the way those goals might be translated—if at all—into social, legal, or political action. Some of these subjects I will touch on here, in an effort to provide some context for considering the relationships between behavioral genetics and crime.

One thing seems clear: misunderstandings or no, issues at the intersection of behavioral genetics and crime will be with us for some time. Behavioral genetics is developing at a quickening pace, and developments within that field continue to inspire efforts to use them, principally in post-arrest contexts. *State v. Landrigan*[2] illustrates this point.

The defendant in *Landrigan* was born Billy Hill. Billy's biological father—the son of a man who was killed in a shootout with police—allegedly raped Billy's mother the first time they met. The two later became step-siblings and subsequently married. Billy's mother apparently abused alcohol and drugs while pregnant with Billy. After Billy was born, his father went to prison and his mother relinquished parental rights and ties.

When six months old, Billy was adopted by the Landrigan family and renamed Jeffrey Landrigan. After a markedly troubled childhood, Landrigan was sentenced to prison in Oklahoma for killing his best friend. While there, a fellow inmate commented that Landrigan looked just like a man on death row in Arkansas who—it later turned out—was Landrigan's biological father. Landrigan subsequently escaped from prison and traveled to Arizona, where he committed and was convicted of another murder. The trial court sentenced Landrigan to death, noting that Landrigan appeared to be an exceptionally amoral person, utterly lacking remorse.[3]

On direct appeal, the Arizona Supreme Court affirmed the death sentence.[4] Subsequently, the federal public defender replaced prior counsel and sought habeas corpus relief on the grounds that, among other things, Landrigan's first counsel was ineffective for failing to investigate, develop, and introduce genetic and other biological evidence.[5] Upon preliminary exploration of various biological angles, Landrigan's attorneys argued that Landrigan was entitled to present evidence of mitigating factors at a resentencing hearing. Specifically, they sought to introduce evidence of genetic predisposition for disordered behavior, *in utero* poisoning due to maternal drug and alcohol abuse during

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2. Landrigan's various circumstances as related here are drawn from several sources, including: State v. Landrigan (*Landrigan*), 859 P.2d 111 (Ariz. 1993); Landrigan v. Stewart (*Landrigan II*), 272 F.3d 1221 (9th Cir. 2001); Brief of Petitioner-Appellant, *Landrigan II*, 272 F.3d 1221 (No. 00-99011); Brief of Respondents-Appellees, *Landrigan II*, 272 F.3d 1221 (No. 00-99011); Landrigan v. Stewart (*Landrigan III*), 397 F.3d 1235 (9th Cir. 2005); *60 Minutes: Murder Gene; Man on Death Row Bases Appeal on the Belief That His Criminal Tendencies are Inherited* (CBS television broadcast February 27, 2001) [hereinafter *60 Minutes: Murder Gene*].

3. *Landrigan*, *supra* note 2, at 117 (quoting the trial judge).

4. *Landrigan*, *supra* note 2.

5. Brief of Petitioner-Appellant, *supra* note 2, at 45–51.

pregnancy, early maternal rejection, and severe drug and alcohol addictions.[6] They claimed that "Landrigan's behavior and activities from infancy into childhood, and through adulthood, were not the products of 'free will' as society defines this term because Landrigan lacked the ability to make non-impulsive, considered choices about his life's path."[7] In other words, Landrigan's actions had been caused principally by his various genetic and other circumstances.

The United States District Court denied habeas corpus relief. The Court of Appeals for the Ninth Circuit affirmed, indicating that the genetic argument was "exotic" and that "assuring the court that genetics made him the way he is could not have been very helpful."[8] Highlighting the double-edged nature of genetic evidence, the court also concluded, "although Landrigan's new evidence can be called mitigating in some slight sense, it would also have shown the court that it could anticipate that he would continue to be violent."[9] Landrigan successfully petitioned for a rehearing en banc, arguing among other things that the panel had neglected other independent biological arguments, including both organic brain damage and the interaction of genetic and in utero environmental influences. And the court recently affirmed in part, reversed in part, and remanded for an evidentiary hearing.[10]

It remains unclear what genetic evidence Landrigan will introduce, and how significant that evidence will be. However, the Landrigan case illustrates the criminal justice purposes for which some defense attorneys hope to use behavioral genetics. Although it seems unlikely that Landrigan's success will ultimately turn on genetic evidence, it does seem likely that cases like Landrigan's will arise with increasing frequency. This is due not only to advances in behavioral genetics (which, rightly or wrongly, are perceived to offer hope to defendants) but also to every defense attorney's obligation to mount a rigorous defense. One way or another, the criminal justice system will need to continue grappling with how to assess specific findings within behavioral genetics, whether to admit genetic evidence, and how to do so (for example, with what limitations and implications). One researcher explains the situation this way:

> Although it has been previously argued that genetics play no part in shaping antisocial and criminal behavior, a growing literature base has served to substantiate that genetic factors are as important to the development of some forms of criminal activity as are environmental factors.
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> This attitudinal shift has occurred for several reasons. First, there are simply too many studies, in too many countries, using different methodologies that converge on the same conclusion: genes do play a role. Second, other, potentially less controversial fields of behavioral trait research have not only identified heritability in psychiatric

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6. *Id*. at 6.

7. *Id.* at 6–7.

8. *Landrigan II*, *supra* note 2, at 1228–29.

9. *Id.*

10. Petition for Panel Rehearing and Rehearing En Banc, *Landrigan III*, 397 F.3d 1235 (No. 00-99011); Landrigan v. Schriro, 441 F.3d 638 (9th Cir. 2006) (en banc).

disorders such as autism, schizophrenia and reading disability, but also in personality traits such as political conservatism. Thus, it would be surprising if criminal behavior—particularly recidivistic crime—was not in some way influenced by genetic factors.[11]

Such views and developments have already sparked a number of scholars to consider what behavioral genetics might mean for the criminal justice system. For example, Friedland considers and critiques ways in which a "genetically oriented criminal justice system" might differ from current approaches in contexts of pre-trial release, character evidence at trial, post-trial release, sentencing, and parole.[12] Greely has asked the important question: how accurate would a genetic test have to be (at predicting future dangerousness, for instance) before it should be given significant weight?[13]

Others in this symposium will provide more detailed updates on the latest findings from behavioral genetics and the latest cases in law to confront issues raised by behavioral genetics.[14] My task here is more general. Part II attempts to situate behavioral genetics, criminal law, and their overlap within larger contexts of law and biology. Part III attempts to situate the inquiries of this symposium issue within the context of work to date on behavioral genetics and crime. To help avoid needless duplication of efforts, it also provides a brief summary of views, gleaned from a variety of different sources, on which it appears the majority of relevant scientists and commentators have reached at least tacit agreement. Part IV then outlines some of the complications and implications of discussing behavioral genetics and crime, including definitional and methodological challenges, as well as implications for free will and responsibility. Finally, Part V raises two issues worth exploring. The first concerns how the respective contributions of behavioral genetics and behavioral ecology will compare over time, and how those efforts might best be joined. The second issue concerns what it would mean to put environmental

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11. Sharon S. Ishikawa & Adrian Raine, *Behavioral Genetics and Crime*, *in* THE NEUROBIOLOGY OF CRIMINAL BEHAVIOR 81, 81–82 (Joseph Glicksohn ed., 2002) (internal citations omitted).

12. Steven I. Friedland, *The Criminal Law Implications of the Human Genome Project: Reimagining a Genetically Oriented Criminal Justice System*, 86 KY. L.J. 303 (1997–98).

13. Henry T. Greely, *Prediction, Litigation, Privacy, and Property*, *in* NEUROSCIENCE AND THE LAW: BRAIN, MIND, AND THE SCALES OF JUSTICE: A REPORT ON AN INVITATIONAL MEETING CONVENED BY THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND THE DANA FOUNDATION 114, 120–23 (Brent Garland ed., 2004) [hereinafter NEUROSCIENCE AND THE LAW].

14. Some relatively recent overviews appear in Ishikawa & Raine, *supra* note 11; L. F. Lowenstein, *The Genetic Aspects of Criminality*, 8 J. HUM. BEHAV. SOC. ENV'T 63 (2003); Richard P. Epstein & Robert H. Belmaker, *Genetics of Sensation or Novelty Seeking and Criminal Behavior*, *in* THE NEUROBIOLOGY OF CRIMINAL BEHAVIOR, *supra* note 11, at 5l. The Human Genome Project's introduction to Behavioral Genetics appears at http://www.ornl.gov/sci/techresources/Human_Genome/elsi/behavior.shtml. A recent overview prepared in association with the American Association for the Advancement of Science (AAAS) and The Hastings Center is CATHERINE BAKER, BEHAVIORAL GENETICS: AN INTRODUCTION TO HOW GENES AND ENVIRONMENTS INTERACT THROUGH DEVELOPMENT TO SHAPE DIFFERENCES IN MOOD, PERSONALITY AND INTELLIGENCE (2004). A more thorough introduction appears in ROBERT PLOMIN ET AL., BEHAVIORAL GENETICS (Robert Plomin ed., 4th ed. 2001).

considerations and genetic considerations on equal footing in the criminal justice system—and whether such a thing would be desirable.

II
CONTEXTUALIZING BEHAVIORAL GENETICS AND CRIME

On the one hand, taking behavioral biology into account in criminal law is not, in itself, new. For example, we implicitly take developmental biology into account when defining different levels of civil or criminal responsibility on the basis of age—as when state contract law allows minors to void contracts or the Supreme Court holds that a state cannot constitutionally execute an adult for a crime he committed when under the age of eighteen.[15] Numerous states allow that various mental diseases (such as schizophrenia) and various brain injuries (such as those damaging the prefrontal cortex) can reduce moral blameworthiness.[16]   And epilepsy can, in some circumstances, preclude blameworthiness entirely.[17] On the other hand, there is a general perception that steadily quickening developments in biology will enable greater and greater biological insight into the causal processes underlying human behavior, with consequences both important and disturbing for criminal law.

To situate the specific topic of behavioral genetics and crime, two points need noting at the outset. First, behavioral genetics is but one of many fields within behavioral biology that are potentially relevant to crime. Second, crime is but one area of law to which behavioral genetics is potentially relevant.

A. Behavioral Genetics within Behavioral Biology

For those interdisciplinary legal thinkers who draw principally on the social sciences and humanities, the corpus of biology relevant to behaviors that are in turn relevant to law is generally undifferentiated—if indeed biological influences on behavior are contemplated at all. Unfortunately, lumping all of behavioral biology together prevents meaningful consideration of where biology is most and least likely to be useful in law.

In fact, scientists study the biology of behavior in a wide variety of biological subdisciplines in addition to behavioral genetics. These include, for example, evolutionary biology, evolutionary ecology, animal behavior, developmental biology, cognitive neuroscience, and behavioral ecology, as well as neuroanatomy, brain chemistry, evolutionary psychology, Darwinian medicine, Darwinian psychiatry, psychopharmacology, neurophysiology, brain imaging, and, most recently, neuroeconomics. Although the boundaries between these

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15. Roper v. Simmons, 125 S. Ct. 1183, 1200 (2005).

16. *See* C.T. Drechsler, Annotation, *Mental or Emotional Condition as Diminishing Responsibility for Crime*, 22 A.L.R. 3d 1228, §§ 1–2, 5–9 (1968; 2005).

17. Eunice A. Eichelberger, Annotation, *Automatism or Unconsciousness as Defense to Criminal Charge*, 27 A.L.R. 4th 1067, § 6(a) (1984).

fields blur at the edges, as one might expect, the fields yield different insights, from different perspectives, from scientists trained differently.

Put another way: behavioral geneticists are not the only biologists to study the effects of genes on behavior, nor do all biologists studying behavior study genes. For example, neurological damage (particularly brain damage)— whether prenatal or postnatal—can affect behavior regardless of a person's genetic complement.[18] Fetal maldevelopment, cortisol, testosterone, hypoglycemia, lead ingestion, and various birth complications, as well as nicotine or cocaine exposure during pregnancy, are among the many other biological phenomena that can have powerful effects on behavior relevant to law.[19]

B. Crime within Behavioral Genetics

Just as behavioral genetics is but one of many fields within behavioral biology that are potentially relevant to crime, crime is but one area of law to which behavioral genetics is potentially relevant. One could imagine that if behavioral genetics were to usefully illuminate predispositions relevant to crime, it might also help illuminate predispositions relevant to many other areas of law. For example, scholars continue to debate the proper effects on health law (insurance coverage, for example) of discernible genetic effects on susceptibility to disease. Possible genetic effects on sexual preferences could affect family law, genetic effects on risk perceptions could affect various regulatory policies, and genetic effects on acquisitive behavior could affect corporate law, and the like.

III

POINTS OF (NEAR) CONSENSUS

There are many ways to approach the intersection of behavioral genetics and crime. Some of the many relevant questions include: (a) What do we think we know? (b) How might that knowledge aid various legal goals? (c) Would the likely benefits of incorporating such knowledge—given the potential for error, misunderstanding, or misuse—exceed the likely costs? (d) What kinds of knowledge are and are not likely to emanate from behavioral genetics in the future? The existing literature on behavioral genetics and crime suggests that

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18. *See* Hanna Damsio, et al., *The Return of Phineas Gage: Clues about the Brain from the Skull of a Famous Patient*, 264 SCIENCE 1102 (1994) (providing discussion of a classic case of behavioral changes consequent to brain damage).

19. Useful discussion appears in ADRIAN RAINE, THE PSYCHOPATHOLOGY OF CRIME: CRIMINAL BEHAVIOR AS A CLINICAL DISORDER 191–213 (1993). *See also* Diana H. Fishbein, *How Can Neurobiological Research Inform Prevention Strategies?*, *in* THE SCIENCE, TREATMENT, AND PREVENTION OF ANTISOCIAL BEHAVIORS: APPLICATION TO THE CRIMINAL JUSTICE SYSTEM 25-1 (Diana H. Fishbein ed., 2000).

there are a number of points on which everyone, or nearly everyone, seems to agree:[20]

(1) Behavior is a complex phenomenon, neither attributable to single causes nor easily parsed among multiple causes.

(2) All behavior results from the interaction of genes, environments, developmental history, and the evolutionary processes that built the brain to function in the ways it does.

(3) Genes and learning are not mutually exclusive explanations for behavior, for genes affect learning and contribute to cultural patterns that are common to the species.

(4) The human organism is neither genetically determined nor environmentally determined, but rather possesses multiple potentials that arise through the successive interactions of genes and environments.

(5) To say something is genetically influenced is not to say that environmental influences are irrelevant.

(6) To say a behavior is genetically influenced—even with high heritability—is not to say it is inevitable, unalterable, or "determined" in any inflexible sense. A predisposition is not a predestination.[21]

(7) A high statistical correlation between the presence of a particular allele[22] and a behavior does not necessarily indicate any particular causal connection between that allele and the behavior.

(8) There is no gene or set of genes (or allele or set of alleles) that are for—or directly responsible for—criminal behavior.

(9) Criminal behavior is influenced by both environmental and genetic forces, as well as by their interaction.

(10) To say that genes influence behaviors relevant to crime does not mean that genetics can explain why certain individuals commit crime.

(11) To say a behavior is natural, biological, or genetically influenced is never to say it is for that reason good or excusable, or automatically entitled to any legal deference or relevance whatsoever. Explanation is not exculpation.

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20. These are distilled from a wide range of sources, including RAINE, *supra* note 19; Ishikawa & Raine, *supra* note 11; David Wasserman & Robert Wachbroit, *Introduction: Methods, Meanings, and Morals*, *in* GENETICS AND CRIMINAL BEHAVIOR 1 (David Wasserman & Robert Wachbroit eds., 2001); Elliot Sober, *Separating Nature and Nurture, in* GENETICS AND CRIMINAL BEHAVIOR, *supra*, at 47. *See also* Gregory Carey & Irving I. Gottesman, *Genes and Antisocial Behavior: Perceived versus Real Threats to Jurisprudence*, 34 J.L. MED. & ETHICS 342 (2006).

21. Arguably, there are some very limited exceptions. So far as we know, for example, everyone with the allele for Huntington's Disease eventually will display behavioral manifestations of the disease, if they live long enough. Yet even here there can be significant variation in age of onset and rapidity of the course of the disease.

22. Alleles are different variants (forms) of two or more genes that reside at a specifically named genetic locus. Discussions of genetic differences among individuals ordinarily refer not to individuals having different genes per se, but rather to individuals having different alleles of genes.

(12) A person's behavior can be genetically influenced and still be subject to legitimate moral condemnation.

(13) The extent to which different alleles of genes influence behaviors relevant to crime provides no justification for human eugenics.

(14) The extent to which different alleles of genes influence behaviors relevant to crime provides no justification for discrimination.

These points of consensus or near-consensus highlight the extent to which all human behavior—the criminal necessarily included—is a complex phenomenon. It is difficult to know what one can say with reasonable confidence about the probability that biology generally or behavioral genetics specifically will be useful to the criminal law.

For example, one commentator argues that "our judicial system ultimately must address[] the criminal responsibility one will bear for committing a crime when the actions are determined by the actor's genetic makeup . . . . which rendered him unable to exercise free and independent will to restrain from committing the offense . . . ."[23] On the one hand, the commentator seems right to raise a question about how behavioral genetics will affect the legal system's approach to criminal behavior. On the other hand, the commentator seems distinctly outside the biology mainstream to frame the question in terms positing that actions may be "determined by the actor's genetic makeup." As has often been noted, imagining that an individual's behavior is determined by genes in any hard sense, irrespective of environment, is a bit like imagining that the area of a rectangle is the product only of its length, irrespective of its width.[24] So it seems likely that questions framed in this way have more rhetorical than actual use.

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23. Marcia Johnson, *Genetic Technology and Its Impact on Culpability for Criminal Actions*, 46 CLEV. ST. L. REV. 443, 444, 466 (1998). In a similar vein, the commentator states:

> Once genes for behavior are identified, many geneticists believe a person's genetic predisposition to violent behavior can be shown. When that predisposition is so compelling that a person cannot overcome the compulsion to act in accordance with noncriminal behavior, then he or she is not responsible for his or her actions. A criminal defendant suffering such a genetic predisposition could be found not guilty by reason of genetic predisposition . . . .

Id. at 470.

24. The key point is that genetic determinism is incoherent. Nonetheless, the rectangle analogy requires additional explanation, highlighting the initially counterintuitive result that although it is impossible to ascertain separate contributions of genes and environment to an individual's behavior, it is simultaneously possible (at least in theory) to closely estimate the separate contributions of genes or environment to the *variance* in behavior across a population. Plomin usefully illustrates this in his discussion of the often misunderstood concept of "heritability." He notes length and width contribute equally and indivisibly to the area of a single rectangle. At the same time, given a population of rectangles having (for instance) a constant width, one could state with confidence that one hundred percent of any variance among the rectangles in area can be attributed to differences among the rectangles in their lengths. *See* PLOMIN ET AL., *supra* note 14, at 85–91.

IV

COMPLICATIONS AND IMPLICATIONS

David Wasserman—a scholar who has long been thinking about genes and crime—captures the present situation this way: "No serious researcher believes that there are genes for crime; no responsible critic believes that genetic differences have no effect on personality and behavioral disposition."[25] If the statement is true (I believe it is), and if most commentators would agree the statement is true (I believe they would), then why do commentators so frequently talk past one another? The principle reasons can be divided into three general categories: definitions, methods, and implications.

A. Definitions

There are at least two kinds of definitional problems. The first concerns the different meanings attributed to words used in discussion of behavioral genetics and crime. For example, one person might be using the term "behavioral genetics" loosely—perhaps intending to refer broadly to biological influences on behavior—while another uses or understands the term according to its more precise meaning.[26] Similarly, discussants may part ways when using the words "heritable" or "heritability." One might intend to refer generally to the capacity of a trait to be inherited genetically; the other may use or understand heritability in its more technical sense as "the proportion of phenotypic variance that is attributable to genotypic variance."[27] Some might be using "gene" (knowingly or unknowingly) as a shorthand for "allele of a gene," "a combination of genes," or "a combination of alleles," while a listener interprets the usage more literally.

The second definitional problem concerns the link between an allele and a given criminal behavior. That link in fact spans a great distance. Consider: genes code for amino acid sequences, which string together in long chains to make proteins, which in turn are used to build neural architecture, which is in turn influenced by environmental conditions, which conditions may also affect what genes are active when, which may in turn affect information processing in ways that in turn lead to increases or decreases in the probability of defined behaviors.

But what behaviors, really, are we talking about? Labeling a behavior as "criminal" is not meaningfully similar, in this respect, to labeling a behavior as chewing, drinking, or swallowing. The latter words code for very specific behavior on which all but the most philosophical would agree. What is criminal, on the other hand, varies by culture, time, and context—it is socially rather than biologically defined. And as Rutter put it, "Genes do not, and cannot, code for

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25. David Wasserman, *Research into Genetics and Crime: Consensus and Controversy*, 15 POL. & LIFE SCI. 107, 107 (1996).

26. For more on that meaning, *see infra* Part V.

27. PLOMIN ET AL., *supra* note 14, at 349.

socially defined behaviors."[28] In addition, things socially defined as crimes are often quite different from one another and, within their own categories, are not meaningfully homogenous.[29] As Epstein and Belmaker note, "Criminality is a complex phenotype and is characterized by a wide spectrum of acts, from non-violent white collar crimes to serial killings."[30]

Perhaps as a partial reaction to definitional ambiguities, there is a marked tendency in discussions of behavioral genetics and crime to focus on violent behaviors, notwithstanding the fact that a great deal of crime is theft. But this offers little analytic comfort, for even if we were to explicitly limit a discussion to a subset of criminal acts—such as violence—even this does not represent a single behavioral category.[31] Premeditated murders are meaningfully different from bar-room brawls—as are beatings, rapes, and torture. And even these phenomena are not uniform. Moreover, we know that the motives for committing even a single criminal act can vary dramatically, with implications for the principal goals of criminal law: deterrence, retribution, isolation, and rehabilitation. For instance, a person might commit arson because she is a pyromaniac, because she wants to cover up evidence of a separate property crime, because she wants the insurance money, because she seeks revenge, or for a variety of other reasons.

B. Methods

Much of the inherent difficulty in figuring out the relationship between genes, crime, and the criminal justice system flows from the same difficulties encountered in other areas linking science and potential legal implications. What have studies actually shown? How confident are we that the findings may be generalized? What are the possible implications of what we believe to be true? What are the projected costs and benefits of those implications? How should variations in the kinds of implications affect how confident we should be in scientific findings before acting in reliance upon them?   In what legal contexts, and how, should science make a difference?

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28. Michael Rutter, *Concluding Remarks*, in GENETICS OF CRIMINAL AND ANTISOCIAL BEHAVIOR 266 (Gregory R. Bock & Jamie A. Goode eds., 1996).

29. Pamela J. Taylor, *Forward*, in THE NEUROBIOLOGY OF CRIMINAL BEHAVIOR, *supra* note 11, at xiiv, xiv-xvi; Troy Duster, The Implications of Behavioral Genetics Inquiry for Explanations of the Link Between Crime, Violence, and Race 6–7 (Dec. 15, 2003) (unpublished manuscript, on file with author, cited by permission of Troy Duster); Troy Duster, *Selective Arrests, An Ever-Expanding DNA Forensic Database, and the Specter of an Early-Twenty-First-Century Equivalent of Phrenology*, in DNA AND THE CRIMINAL JUSTICE SYSTEM: THE TECHNOLOGY OF JUSTICE 315 (David Lazer, ed., 2004) [hereinafter Duster, *Selective Arrests*]. *See also* Tabitha M. Powledge, *Genetics and the Control of Crime*, 46 BIOSCIENCE 7, 7 (1996) ("[T]hat motley mass of disparate actions—ranging from stock fraud to serial homicide—we lump under the catchall rubric *crime*.").

30. Epstein & Belmaker, *supra* note 14, at 51.

31. *See* Stephen C. Maxson, *Issues In The Search For Candidate Genes In Mice As Potential Animal Models Of Human Aggression*, in GENETICS OF CRIMINAL AND ANTISOCIAL BEHAVIOR, *supra* note 28, at 21, 24.

In addition to carrying these typical law–science difficulties, human behavioral biology carries at least four more, each of which compounds problems significantly. First, with only rare exceptions, each organism in a sexually reproducing species is genetically unique. Second, each human organism is environmentally unique, encountering its own combinations of experiences from womb to tomb. Third, obvious ethical constraints accompanying differences between humans and other animals mean that only a tiny fraction of the potential experiments that might control for various confounds can be administered.

Fourth, the proximate mechanisms linking genes and behavior are incredibly complex, as Schaffner, among others, has vividly described. Schaffner notes that behaviors are generated by groups of neurons acting together, a single genetic change can affect multiple neurons, a single neuron can affect multiple behaviors, and multiple neurons can affect the same behavior.[32] In addition, many genes can affect one neuron, development can affect neuronal connections, differences in environment can yield different behaviors through short-term environmental influence (such as learning), environments can create long-term environmental influence (by affecting the expression of genes that affect behavior), and one gene can affect another gene that can in turn affect behavior.

Each of these four difficulties poses important problems for what can be learned from dissimilar human subjects, what can be predicted about subjects not yet studied, and with what confidence we should hold our tentative conclusions about the relationships between behavioral genetics and crime. Chastened but uncowed by these problems, scientists simply endeavor to do the best they can with what they have. For example, studying identical and fraternal twins reared apart, and comparing those groups, provides useful controls for genetic variation.[33] Comparing findings from genetic studies of prison populations with findings of such studies in unincarcerated populations may also yield important clues, if allele frequencies at a particular genetic locus were to differ significantly between the two populations.

Such studies are nevertheless imperfect, as a number of critics have argued.[34] For example, adoption placements are not random, and selective placement

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32. Kenneth F. Schaffner, *Complexity and Research Strategies in Behavioral Genetics*, *in* BEHAVIORAL GENETICS: THE CLASH OF CULTURE AND BIOLOGY 61 (Ronald A. Carson & Mark Rothstein eds., 1999). The balance of this paragraph is drawn from *id.* at 74, 76.

33. For discussions of methods generally, see Ishikawa & Raine, *supra* note 11; RAINE, *supra* note 19, at 54–78. For further information, see NANCY L. SEGAL, INDIVISIBLE BY TWO: LIVES OF EXTRAORDINARY TWINS 2–3 (2005); Stephanie L. Sherman & Irwin D. Waldman, *Identifying the Molecular Genetic Basis of Behavioral Traits*, *in* BEHAVIORAL GENETICS: THE CLASH OF CULTURE AND BIOLOGY, *supra* note 32, at 35; Dorret Boomsma et al., *Classical Twin Studies and Beyond*, 3 NATURE REVIEWS GENETICS 872 (2002).

34*. See, e.g.*, Sober, *supra* note 20; Lowenstein, *supra* note 14. Useful discussions of some limitations to methods appear in David Wasserman, *Is there Value in Identifying Individual Genetic Predispositions to Violence?*, 32 J.L. MED. & ETHICS 24 (2004); and Duster, *Selective Arrests, supra* note 29.

factors can confound efforts to extract useful and reliable information from adoption studies.[35] Moreover, such studies occasionally lead us down a path that later proves incorrect—as was the case with early studies suggesting that the unusual XYY chromosomal complement meaningfully predisposed its bearer to violent criminal activity.[36] In addition, important questions also surround the validities of measurements, as well as complications arising from the search not just for genes, but also for relevant interactions of genes and environments.

C. Implications

It is, of course, in the realm of implications that the future for behavioral genetics and crime is most hotly contested. Many others (including many contributing to this symposium) have mapped and continue to map this territory in detail. What follows here provides several introductory but key concepts about the implications of behavioral genetics for criminal law that are also useful when navigating the terrain.

1. Free Will and Responsibility

As is well known, the criminal law is one of the few areas of law in which motive matters. In general, the criminal law cares whether a person has requisite mental intent, choosing freely to perform an act, and choosing with an awareness of distinctions between right and wrong. It is therefore in criminal law that issues of free will are often raised—and it is in the context of free will that the influence of biology on behavior generates concerns.

A key question, of course, is whether free will exists in the first place. On the one hand, all but the most physically or mentally constrained humans perceive life as an endless series of choices. Economic, social, political, and religious conditions, among others, may present constraints within which choice will be exercised. But at some meaningful level individuals still choose what to do, when to do it, and, indeed, whether to abide by many of the social

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35. Lowenstein, *supra* note 14, at 67.
36. Wasserman and Wachbroit summarize the episode succinctly:

In 1965, researchers found an apparently high prevalence of [the XYY chromosomal combination] among prison inmates in Britain. That is to say, the percentage of prison inmates with XYY was higher than the percentage of XYY males in the general population. Unfortunately, many people quickly took this finding to be evidence of a direct link between an extra Y chromosome and a tendency to hyperaggressivity and violence. That assumption was eventually rejected by genetic researchers, but it held sway in the popular imagination long enough to stigmatize a generation of XYY males and (reportedly) lead to the abortion of a significant number of [XYY] fetuses . . . . It is now widely believed that if an extra Y chromosome leads to incarceration, it is by a indirect route. XYY individuals are no more aggressive than average, but they may be taller and less intelligent, hyperactive, and generally more impulsive. Their increased risk of arrest or conviction may stem from an increased likelihood of getting caught, or of committing crimes more likely to be detected, rather than from heightened aggressiveness or greater disregard for social norms.

Wasserman & Wachbroit, *supra* note 20, at 9 (citations omitted).

constraints encountered. So human will seems "free," even if it does not result in limitless possibilities.

On the other hand, all choices emerge from the human nervous system. And each state of the nervous system is, in part, a function of the prior state of that nervous system. The system is composed of molecules, in turn composed of atoms, and it is driven by chemical reactions and electrical circuits. The nervous system and its brain are therefore part of a material world in which present events are caused by prior events, extending back to the beginning of time and matter. If genes we inherit affect our nervous systems in ways that affect our behavior, in what sense is our will free?

This question opens the door to a series of pressing and yet seemingly intractable problems, many of which have challenged commentators for ages.[37] How free must will be in order to justify the law's punishment of actors who behave criminally? Is free will binary, such that you have it or you don't? If not binary, is there any reliable way to measure the proportion in which a person's action was free? If there were such a way to measure free will, how much, in a given context, will be necessary for purposes of exculpation at trial, or mitigation at sentencing?[38]

Most commentators subscribe to beliefs within a grey zone of compatibilism. The central idea of compatibilism is that—in all but the rarest cases—adult humans should be deemed to have free will in sufficient quantities (whatever that may mean) to justify holding them legally accountable for their behaviors. As always, however, the precise location of the threshold is unclear. And here behavioral genetics presents complications that are new in detail, but in fact old in kind. Behavioral genetics may afford us tools for more clearly understanding the multiple causes that lead to behavior, but whether that behavior reflects the operation of a normal brain is a question the legal system has already been asking in the mental health context for a long time.[39]

2.   The Separate Realms of "Is" and "Ought"

Even if we were able to identify, with reasonable specificity, some combination of alleles and environment that significantly increased the

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37. *See generally* Michael S. Gazzaniga & Megan S. Steven, *Free Will in the Twenty-First Century: A Discussion of Neuroscience and the Law*, *in* NEUROSCIENCE AND THE LAW, *supra* note 13, at 51; Stephen J. Morse, *New Neuroscience, Old Problems*, *in* NEUROSCIENCE AND THE LAW, *supra* note 13, at 157; Wasserman & Wachbroit, *supra* note 20, at 201–327; Richard Lowell Nygaard, *Freewill, Determinism, Penology, and the Human Genome: Where's A New Leibniz When We Really Need Him?*, 3 U. CHI. L. SCH. ROUNDTABLE 417, 423 (1996); Matthew Jones, Note, *Overcoming the Myth of Free Will in Criminal Law: The True Impact of the Genetic Revolution*, 52 DUKE L.J. 1031 (2003).

38. A number of these issues are explored in Gazaniga & Steven, *supra* note 37; Morse, *supra* note 37; Steven Goldberg, *Evolutionary Biology Meets Determinism: Learning from Philosophy, Freud, and Spinoza*, 53 FLA. L. REV. 893 (2001); Owen D. Jones & Timothy H. Goldsmith, *Law and Behavioral Biology*, 105 COLUM. L. REV. 405, 485–88 (2005).

39. *See, e.g.*, Christopher Slobogin, *Is Atkins The Antithesis Or Apotheosis Of Anti-Discrimination Principles?: Sorting Out The Groupwide Effects Of Exempting People With Mental Retardation From The Death Penalty*, 55 ALA. L. REV. 1101 (2004); Christopher Slobogin, *Rethinking Legally Relevant Mental Disorder*, 29 OHIO N.U. L. REV. 497 (2003).

likelihood of certain behaviors labeled criminal, it is a separate question whether that information ought to play any role in criminal justice. We could not, for example, legitimately conclude that simply because a convicted individual has certain alleles relevant to the behavior at issue, he is entitled to greater leniency.

The reason is simple: the realms of fact and meaning are logically distinct. That is, the realm of what "is" and the realm of what "ought-to-be" are as necessarily separate as description and prescription. Explanation is not justification. And one simply cannot move from facts to normative conclusions without passing through a prism of human values. Arguments to the contrary—which seek to draw causal arrows directly from fact to normative conclusion—have long been recognized as committing the grave logical error labeled the "naturalistic fallacy."[40]

Moreover, even if we were able to identify, with reasonable specificity, some combination of alleles and environment that significantly increased the likelihood of certain behaviors labeled criminal, and even if we were inclined to find normative meaning in biological fact, it would often be unclear what that normative meaning would be. Genetic information can cut in different directions simultaneously. For instance, we could conclude it mitigates (if responsibility seems materially lessened), we could conclude it exacerbates (if greater deterrence seems advisable to offset greater proclivities), or we could conclude it has no or some other implication.

In any case, there are no convenient shortcuts from "is" to "ought." We cannot avoid the hard work of netting out our often competing values by imagining that increasing advances in behavioral genetics will make our legal responsibilities easier.

3. The "Isms"

Over time, people have found cause—often good cause—to be concerned about ways that biology can be invoked in the service of sexism, racism, genetic determinism, eugenics, and Social Darwinism (more properly though less commonly known as Social Spencerism[41]). These collected subjects, each significant in its own right, serve as an important backdrop against which all discussions of behavioral genetics and crime take place. Consequently, no effort to put behavioral genetics and crime in context could be complete without acknowledging that history gives ample reason to be skeptical about the uses to which biological information will be put. Missteps are not uncommon,

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40. The term apparently was coined by G.E. Moore in *Principia Ethica*. *See* G.E. MOORE, PRINCIPIA ETHICA 90 (Thomas Baldwin ed., rev. ed. 1993). The concept traces back, however, to David Hume's *A Treatise of Human Nature*. *See* DAVID HUME, A TREATISE OF HUMAN NATURE 469–70 (L.A. Selby-Bigge & P.H. Nidditch eds., Oxford, 2d ed. 1978) (1739–40).

41. Jones & Goldsmith, *supra* note 38, at 492–93.

as is illustrated by reexamining the history of phrenology, craniometry, and the XYY controversy.[42]

Although it is important to be alert to the possibility that people will either misunderstand the biology in a way that leads to misuse, or count on other people misunderstanding the biology in a way that opens the door to intentional misuse, two things bear noting. First, it is important to recognize that there is nothing inherent *in the underlying biological reality* that justifies any of these uses.[43] The uses are always a function of the injection of various human values, many of which have nothing to do with the biology itself. Second, it is rarely clear ex ante that we are better off without information that could be misused, since the lack of information also imposes its own costs.[44]

4. The Wide Variety of Criminal Justice Contexts to Consider

When discussing possible interactions of behavioral genetics and the criminal law, it is important to keep in mind the wide variety of potential interactions, spanning the preventive, the corrective, and the therapeutic. Each creates its own fork in the analytic road. Are we interested in pre-offense identifications? If so, what kind of screenings—if any—could legitimately be implemented? Are we interested in pre-offense interventions? If so, of what kind? Are we interested in post-offense treatment? If so, are social, chemical, or genetic treatments worth pursuing? Each choice risks a misstep, warranting more than customary caution and deliberation.

V

TWO ISSUES WORTH EXPLORING

The preceding survey of some of the many themes bearing on this conference is necessarily short. There are many possible launching points for further discussion. Here are two worth exploring.

A. Relative Contributions of Behavioral Genetics and Behavioral Ecology

It is often noted that people tend to misunderstand behavioral biology.[45] One of the key misunderstandings concerns the distinction between behavioral

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42. Duster, *Selective Arrests, supra* note 29, at 8–10. Useful discussions of the XYY controversy appear in RAINE, *supra* note 19, at 47–53; Deborah Denno, *Legal Implications of Genetic and Crime Research, in* GENETICS OF CRIMINAL AND ANTISOCIAL BEHAVIOUR, *supra* note 28, at 248; Deborah Denno, *Human Biology and Criminal Responsibility: Free Will or Free Ride?*, 137 U. PENN L. REV. 615 (1988).

43. This is explored in much greater detail in Jones & Goldsmith, *supra* note 38, at 484–99.

44. *See* Jones & Goldsmith, *supra* note 38, at 499. Nygaard phrases this idea somewhat differently—"[I]gnorance can also be used for illegitimate purposes"—and suggests the results can be at least as or even more culturally destructive. Nygaard, *supra* note 37, at 430.

45. For example, some commentators note the importance of distinguishing the study of behavior generally from the study of behavioral differences attributable to differences in genetics. *See* Wasserman & Wachbroit, *supra* note 20, at 5; Martin Daly, *Evolutionary Adaptationism: Another Biological Approach to Criminal and Antisocial Behavior, in* GENETICS OF CRIMINAL AND ANTISOCIAL BEHAVIOR, *supra* note 28, at 183. Others have argued for the importance of

genetics and an area of study that goes by various names, including behavioral ecology.

The distinction, essentially, is this. Behavioral genetics often focuses on how different behaviors from different individuals can arise from genetic differences among the individuals. Behavioral ecology generally focuses on how different behaviors from different individuals can arise when evolved and algorithmic predispositions that are widely shared among brains encounter different environmental circumstances.[46] The important distinction between behavioral genetics and behavioral ecology is not whether environments affect behavior; in both fields environmental conditions are vitally important. The important difference in disciplinary focus is that behavioral genetics often looks for differences in behaviors that can be attributed largely to genetic differences, while behavioral ecology generally looks for differences in environments that lead organisms with evolved neural architectures that are fundamentally similar to behave differently from one another.

These two related subfields provide complementary rather than competing perspectives—two sides of a coin. The question is not which one is right. Instead, the questions are: (1) how might each perspective aid legal efforts to achieve social goals; and (2) how do the perspectives differ on dimensions relevant to their ultimate utility in law?

One initially tempting approach to answering these questions is to think that behavioral ecology is more useful at the broad policy level, while behavioral genetics may be more useful in litigation contexts. That is, some might be tempted to conclude that behavioral ecology is the more useful of the two perspectives when legal thinkers and lawmakers are attempting to change, through law, environmental conditions a large population encounters—to reduce violent aggression in society, for example. And some might be tempted to conclude that behavioral genetics is the more useful of the two perspectives when an individual's behavior is at issue.

Yet the utilities of behavioral ecology and behavioral genetics are probably not so neatly divisible. For one thing, both behavioral ecology and behavioral genetics can be important tools for identifying the kinds of environmental conditions that are likely to increase the probability of criminal acts, either through the conditional and algorithmic processes behavioral ecology studies or through the context-sensitive, gene-environment interactions that behavioral geneticists study.[47] For another, both fields are inherently probabilistic, rather

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incorporating evolutionary perspectives on crime. *See* MARTIN DALY & MARGO WILSON, HOMICIDE (1988); RAINE, *supra* note 19, at 27–46; Alan Gibbard, *Genetic Plans, Genetic Differences, and Violence: Some Chief Possibilities, in* GENETICS AND CRIMINAL BEHAVIOR, *supra* note 20, at 169; and Jones & Goldsmith, *supra* note 38, at 484–98.

    46. Efforts to represent this distinction graphically appear in Owen D. Jones, *Proprioception, Non-Law, and Biolegal History*, 53 FLORIDA L. REV. 831, 840 (2001) and in Jones & Goldsmith, *supra* note 38, at 501.

    47. *See, e.g.*, Fishbein, *supra* note 19 (proposing structuring the environment to minimize risk factors). Fishbein notes that neurobiological research can be used to help identify individual

than deterministic. Application to given individuals is therefore, under any circumstances, complicated and indeterminate, at best. For instance, even if an individual convicted of a crime bears a genetic sequence positively correlated in a population with behavioral predispositions relevant to the crime he committed, behavioral genetics still does not answer a question often important at the sentencing phase: why did this individual commit this criminal act?

If one of our main interests is in reducing crime, rather than in simply increasing the number of contexts in which behavioral genetics is used, then the advantages and disadvantages of behavioral genetics and behavioral ecology should be explored. More particularly, we should consider ways in which those perspectives—each of which identifies biological processes that can be simultaneously operating in every person—can be usefully integrated in furtherance of a synthetic, and hopefully improved, approach.

For example, one weakness of the way behavioral genetics information tends to be understood by nonscientists is that it inclines people to think that crime is somehow principally the result of criminals having genes (or, more precisely particular alleles of genes) that noncriminals do not have. This can mislead us into thinking that crime comes far more from "criminal minds" than from what we might call "criminal moments"—opportunities to gain personal advantage through means society defines as criminal that the species-typical brain will notice and find tempting. The behavioral ecology perspective suggests that even if we were to magically and instantaneously sequester all those who had ever committed a crime, the positive effect on subsequent crime rates would be dampened by the probability that otherwise law-abiding citizens would move opportunistically into the vacuums created.

Conversely, one weakness of the way insights from behavioral ecology can be internalized is that the foregoing could be misunderstood to suggest that all people are materially the same, and that therefore genetic differences are irrelevant to criminal behaviors. This could distract attention from those probably rare but significant contexts in which a person who behaved criminally bears some highly influential genetic trait that, while not determining his behavior, could have played a sufficient role such that a just society would want to consider whether that role might be mitigating at a sentencing phase. The behavioral genetic perspective suggests that, even when encountering environmental conditions that most people find irrelevant or only trivially relevant to the probability that they would commit a criminal act, some people will find such an environment disinhibiting.

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vulnerabilities as a function of genetic, biological, and environmental conditions; assist in identifying environmental conditions that trigger antisocial behavior and drug-taking behaviors, among other vulnerabilities; signal which prevention programs under which specific conditions will likely be most effective (including methods for early detection, interventions, treatments, and primary prevention strategies); and decrease reliance on incarceration by emphasizing the superiority of public health and medical approaches. *Id.* at 25-3.

This suggests we should neither categorically nor cavalierly exclude evidence of the sort Landrigan seeks to introduce in his case. At the same time, it is not going to be easy, given the inherent complications explored above, for legal thinkers and behavioral biologists to settle on a sensible, fair, and administratively workable approach that balances the inherent uncertainties of science with the aspiration to do immediate individual justice in the courts.

B. The Parity Principle, Bias, and Varying Standards

Another aspect of using behavioral genetics in criminal contexts concerns the comparative uses of the social sciences and the life sciences in criminal trial contexts. Except in the rarest circumstances, information attempting to explain extenuating causes of a defendant's behavior should not be wholly exculpatory in criminal contexts. Nevertheless, one can readily imagine that information from advances in behavioral genetics will from time to time be admitted in criminal trials, during liability phases, sentencing phases, or both. Whether in the end admitting this evidence is good or bad depends on a variety of factors. These include the precise purpose for which the information is offered, the soundness of the underlying science, and the like. But four points bear noting.

First, genes do not "determine" behavior to any extent greater than environments do. It is true that, in any given case, the behavioral variation between two groups of people can be explained to a greater or lesser degree by genes or environment.[48] But that fact alone provides no support for the idea that, when genetic effects are identifiable and present, they should necessarily have an effect on criminal justice outcomes.

Second, and at least in the context of assessing moral blameworthiness, our concerns about the extent to which genes "determine" criminal behavior should not be thought categorically different from our concerns about the extent to which environments "determine" behavior. If we were somehow trying to apportion among various causal elements the extent of influence over a defendant's behavior, it would initially appear to makes no sense to be more concerned about an *x* percent environmental influence than about an *x* percent genetic influence. Causes are causes, and what we often attempt to evaluate—the degree to which a person's behavior was "free"—should be sensitive to the extent a cause imposes on freedom, not to the kind of cause it is. That is, one could legitimately say that although genetics evidence should not receive any special admissibility privileges, nor should it receive any lesser privileges than those afforded environmental evidence.[49] We might refer to this view as *the parity principle*.

Third, this parity principle is problematic when one considers its application rather than its theoretical justification. Because even when genetic information

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48. *See* discussion *supra* note 24.

49. Among those who have argued similarly, see Joseph S. Alper, *Genes, Free Will and Criminal Responsibility*, 46 SOC. SCI. MED. 1599 (1998).

about causes and environmental information about causes may share similar promise and limitations, these types of information may be—and probably are—dissimilarly incorporated into the minds of judges and jurors. That alone may provide sufficient justification for treating these two kinds of evidence differently at trial. This asymmetry in the application of the two kinds of evidence in the minds of decisionmakers undoubtedly traces, in part, to common misunderstandings about how biology affects behavior generally, how behavioral genetics affects behavior specifically, and what statistical and probabilistic language does and does not mean.[50] It may trace, in part, to the ease with which, and the length of time during which, environmental conditions—physical abuse, injuries, sociocultural milieu—are observable at the macroscopic level, compared to the relative difficulty of detecting genes, the relative novelty of our ability to do so, and the manifest difficulty in understanding what genes do and how. It likely also has something to do with apparently widespread public interest in, and frequent over-ascription of sufficiency to, explanations from the natural sciences, when such explanations can be offered. But the bottom line is this: if jurors were likely to endow a quantum of information from behavioral genetics with more significance than an equivalent quantum of information from the social sciences, treating genetics and environment identically for analytic purposes may result in systematic bias in favor of genetic explanations. Education may be an antidote to this bias. But the potential for bias nonetheless warrants caution and concern.

   Finally, there is a potential for bias that cuts precisely the other way. It results in potential over-favoring of social science insights over behavioral genetic ones. The problem is this: if social and natural sciences are often (perhaps improperly) deemed competitive in legal arenas, they should be held to similar standards for purposes of admissibility.[51] For example, holding information from behavioral genetics to a higher standard than information from psychology would inevitably favor the latter. Why, for example, should an inherently uncertain prediction of future dangerousness, based on either individual or statistical analysis by a psychologist, be admitted any more easily than an equally uncertain prediction of future dangerousness based on either individual or statistical analysis by a behavioral geneticist? The likelihood of the information being held to different standards in law is exacerbated by each discipline's having its own standards of what it takes to establish some proffered piece of information as more probably true than not. Some might say the natural sciences are more reserved on this score. And the problem of varying standards between social and life sciences is further compounded by the

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50. As an example of the latter, a probability can be dramatically higher in one set of people when compared with another set, at the same time that the absolute incidence of the behavior on a per capita basis is still quite low.

51. Owen D. Jones, *Brains, Evolution, and Law: Applications and Open Questions*, 359 PHIL. TRANS. R. SOC. LOND. B 1697 (2004).

unavoidable fact that our legal system already (and quite properly) deploys different standards in different contexts (such as trials versus legislative action).

VI

CONCLUSION

We are learning a great deal from the bio-behavioral sciences about how and why humans behave as they do. We now recognize that animals of each species—including humans—come evolutionarily equipped not only with behavioral predispositions, but also with proclivities to learn some behaviors far more easily than others. Evolutionary theory, together with animal studies in both natural and experimental conditions, helps clarify the patterns in which social systems can evolve. Technological advances have enabled neurobiologists to investigate the operations of single nerve cells in neural circuits of active animals, to clarify how neurons operate on known principles of physics and chemistry, and to localize cognitive activities in human brains by using noninvasive techniques, such as functional magnetic resonance imaging. And researchers in evolutionary anthropology and evolutionary psychology are helping to illuminate features of human behavior shared widely around the world.

We have come increasingly to understand how even the tiniest brains—such as those of ants—have sufficient complexity to enable highly sophisticated social behavior, as well as flexible and successful navigation of environmental challenges. We can see how synaptic connections in the human brain ebb and flow—not only over long periods, but also across a single day. And we can not only see how different parts of the brain perform different functions, but we can also observe in real time how different parts of a brain operate when it is thinking, analyzing, deciding, or experiencing emotions.

Amidst the swirl of all this activity, the discovery of DNA's structure in 1953 opened the door to a host of related discoveries about the operations of genes and development. Developmental biology examines the processes by which genes and environments interact and guide a brain's construction and function, with consequences for developmental psychology, learning, and the evolution of behavior. And behavioral genetics has helped us to understand some of the important ways that genes influence behavioral predispositions—some of which in turn contribute to behaviors that law classifies as criminal. The task now is to keep the constraints as well as the insights of behavioral genetics in perspective as it continues to develop as a field and as it continues to intersect with criminal law. In this brief overview, I have attempted to situate some of the many issues addressed by other authors in this symposium issue within the larger biological context. I have also summarized some points of widespread agreement, highlighted a few complications and implications, and raised a variety of issues at the inter-section of genes and crime that seem worth exploring.