Neuroscience and the Law

Brain, Mind, and the Scales of Justice

Brent Garland

A SUMMARY REPORT

A SUMMARY REPORT ON AN INVITATIONAL MEETING CONVENED BY THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND THE DANA FOUNDATION

Neuroscience and the Law

Brain, Mind and the Scales of Justice

A Summary Report on
an Invitational Meeting Convened By

The American Association for the Advancement of Science
and
The Dana Foundation

By
Brent Garland

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

DANA
PRESS

This report reflects the deliberations at the invitational meeting. The report does not necessarily represent the views of the American Association for the Advancement of Science or the Dana Foundation.

The full report of the invitational meeting, *Neuroscience and the Law: Brain, Mind, and the Scales of Justice*, published by Dana Press and distributed by the University of Chicago Press, is available through bookstores and online retailers. It may also be ordered through links at the Web sites of AAAS (www.aaas.org/spp/neuroscience), the Dana Foundation (www.dana.org), University of Chicago Press (www.uchicago.edu), or by phone: 773-702-7000.

Table of Contents

Participants

Judith C. Areen
Georgetown Law Center

Bicka Barlow
Defense Attorney

Erica Beecher-Monas
University of Arkansas
at Little Rock
William H. Bowen School of Law

Floyd E. Bloom
AAAS Board of Directors
The Scripps Research Institute

Joe S. Cecil
Federal Judicial Center

Ming W. Chin
California Supreme Court

Deborah Denno
Fordham Law School

Harold Edgar
Columbia University
School of Law

Martha Farah
University of Pennsylvania

Mark S. Frankel
AAAS

Brent Garland
AAAS

Michael Gazzaniga
Dartmouth College

Steven P. Goldberg
Georgetown Law Center

Henry Greely
Stanford School of Law

Zach W. Hall
University of Southern California
Keck School of Medicine

D. Brock Hornby
United States District Court
for the District of Maine

Owen D. Jones
Arizona State University
College of Law and
School of Life Sciences

Alan I. Leshner
AAAS

Neuroscience and the Law

"[N]euroscience, over the last 30 years, has just blossomed at every point and each year brings a greater understanding of the mechanical way with which we perceive, we remember, we speak, we feel…It is that sense of understanding the brain that really brings us here today with force, and that [sense of understanding] is the one that we have to come to grips with."

—Participant scientist at the meeting

THE knowledge and applications resulting from brain science research are beginning to allow for an increasingly sophisticated understanding of the brain. While advances in neuroscience continue at a rapid rate, their ethical and legal implications are only beginning to be considered. In 2002, *The Economist* made the point that the link between brain and behavior is much closer than the link between genes and behavior, yet the public debate about genetics research and its broad social implications far outweighs that given to neuroscience and technology.[1]

Neuroscience raises numerous issues with respect to some core constructs of the law, such as competency, free will, and the genesis of violent behavior. The question of how developments in neuroscience might interact with the law led the American Association for the Advancement of Science (AAAS) and the

1. "Open Your Mind," *The Economist*, May 23, 2002.

Dana Foundation to convene a meeting with participants drawn from both the legal and neuroscience communities. Lawyers, judges, law professors, philosophers, psychologists, psychiatrists, and neuroscientists engaged in a conversation focused on the relationship between neuroscience and law, and sought to contribute to the larger public discourse by identifying some central issues and suggesting directions for future efforts.

The 27 meeting participants discussed a broad range of topics, a dialogue anchored on four papers commissioned to serve as the shared intellectual framework. Those papers, as well as the longer version of this summary report, are published together in *Neuroscience and the Law: Brain, Mind, and the Scales of Justice, Brent Garland*, editor (Dana Press, New York-Washington, D.C., 2004). Readers looking to learn more about the conference and the ideas that drove it are encouraged to read the larger volume.

The commissioned papers and their authors are:

"Free Will in the Twenty-first Century: A Discussion of Neuroscience and the Law," by Michael Gazzaniga, a psychologist and the director of the Cognitive Neuroscience Program at Dartmouth College, and Megan S. Steven, a doctoral candidate in medical sciences at the University of Oxford in England;

"Neuroscience Developments and the Law," by Laurence Tancredi, a psychiatrist, lawyer, and clinical professor of psychiatry at New York University School of Medicine;

"Prediction, Litigation, Privacy, and Property: Some Possible Legal and Social Implications of Advances in Neuroscience," by Henry T. Greely, a lawyer, C. Wendell and Edith M. Carlsmith Professor of Law at Stanford School of Law, and co-director of the Program in Genomics, Ethics, and Society at Stanford University; and

"New Neuroscience, Old Problems," by Stephen Morse, a psychologist, lawyer, and Ferdinand Wakeman Hubbell Professor of Law at University of Pennsylvania School of Law.

This report summarizes some of the key ideas and concerns that arose from the discussion. The participants did not attempt to reach a definitive set of findings in this still-developing area, but to identify and give intellectual shape to some of the central questions and considerations to address in future efforts. Among the questions raised are:

• How will advances in neuroscientific methods for predicting behavior impact the legal system, and how will our society use these advances?

• What would neuroscience-based lie detection mean for witnesses testifying in court?

• How might neuroscientific knowledge put people at risk for discrimination in schools, the workplace, and elsewhere?

• Are there either benefits or risks to justice and society from enhancing or modifying one's brain through pharmacological or other technologies? What roles will the legal system play in the societal debate over human enhancement?

Beginning the Dialogue

This area of inquiry is so cutting-edge that participants had to consider a few fundamental points before exploring possible issues. First, *is neuroscience likely to impact the law?* Concerns that developments in neuroscience could shatter legal paradigms (say, by undoing the concept of free will) were viewed as unlikely. Developments in neuroscience may well have substantial impact on how the law views people and behavior, but the legal

system is generally robust and should be able to assimilate and use new scientific knowledge as it develops. The meeting focused, therefore, not on some legal brave new world, but on a realistic assessment of the advances in neuroscience and their potential for good or ill effects in law, as well as possible societal impacts.

Second, *how far ahead is it reasonable to look in trying to foresee discoveries and their legal implications?* Because much of the science is still in its nascent stages, it is hard to tell where discoveries might lead. It is apparent, however, that the optimal time to begin the dialogue about appropriate uses of neuroscience is before the science is fully developed. A number of scientific and technological discoveries—from the splitting of the atom to the development of cloning—have demonstrated that, when we don't think about potential social and ethical implications of technologies before they are fully developed, we often feel overwhelmed and unprepared for their use. Similarly, if the science may have powerful and profound effects, prior preparation for its potential uses may prevent abuses.

Finally, given the breadth of topics addressed by both neuroscience and the law, *what analytical framework for considering neuroscience developments in relation to the law might be helpful?* Neuroscience encompasses many fields and addresses far-ranging topics. As a result, one of the most difficult aspects of examining the topics is merely to find an organizing principle for discussing the science. This report uses a simple two-prong classification. In one class are neuroscience findings and technologies related to monitoring and imaging the brain, which encompasses the prediction of behavior, lie detection, and brain death, among other concepts. The other class consists of manipulations of the human brain, including enhancement and pharmacological treatment of addiction. However, a handful of general,

cross-cutting legal issues do not fit easily into this framework. These are discussed briefly toward the end of the report.

Monitoring and Imaging the Brain

Use of the technologies for imaging and monitoring the brain raises a broad range of issues, from brain death to the prediction of behavior. As imaging technologies continue to improve, neuroscientists are taking increasingly fine-grained pictures of brain function, producing an ever-better sense of what happens in our brains as we perform tasks, experience emotion, and engage in various behaviors. While such data may benefit us by enriching our knowledge of the biology of mental activity, we should be sensitive to the concomitant risks that we will misuse such knowledge or be led by it to rely too much on deterministic explanations. The discussion centered on the following topics: prediction of behavior (including prediction of violence), competencies and capacities, lie detection, detection of bias, and brain death.

Prediction of Behavior

Surely, if a single topic captures the sense of promise and of risk from neuroscience, the ability to predict behavior is it. The perspective of many neuroscientists is that a *descriptive* biology of behavior will be available soon (and is likely to incorporate both genetic and neuroscientific knowledge). However, a *predictive* biology is not yet on the horizon, but the increase in neuroscientific knowledge will undoubtedly allow for better predictive ability than we currently can achieve. It is

not essential for predictive technologies to be 100 percent accurate to be of use to the court system. Courts currently use prediction in plea bargaining, sentencing, and decisions about levels of probation, among other proceedings. In each of these examples, the courts must weigh future risks, including the likelihood of recidivism, against other societal and pragmatic concerns (such as prison overcrowding). Accordingly, to the extent that science can better inform those predictions, neuroscience really has something of benefit to offer the court system.

When considering the prediction of behavior based on neuroscientific techniques, discussion often turns initially toward the question of the relationship among developing neuroscientific knowledge, free will, and legal responsibility. The short version of the issue is this: as neuroscience reveals more about the brain, it becomes increasingly clear that the brain is a physical entity governed by the principles and rules of the physical world. If the physical world is determined, in the sense that the principles and rules of the physical world allow us to predict with accuracy what will happen in the physical world (assuming we know the starting conditions and other relevant data), then the brain, too, as a physical organ, must be predictable. It follows that if the brain is predictable, the mind must also be as well. If the mind is thus determined, then the question arises: are our thoughts and actions also determined? Or more bluntly, if we are mere mechanisms, controlled by our mechanistic brains, then how can we have free will? And if we do not have free will, then how can we be held responsible for our own actions, whether those consist of signing a contract or committing a murder?

The notion of responsibility (arising from free will) is central to our legal system—we hold people responsible for their actions only to the extent that they were free to act. Therefore,

questions about free will are in a sense questions about legal responsibility.[2]

Most participants felt that neuroscience is very unlikely to ultimately overturn the concept of free will or personal responsibility in the context of the law, as "responsibility" is a societal construct, not a scientific one. A number of arguments were put forth to support this view:

Some argued that the concept of responsibility arises from observations regarding the ability of simple, rule-based, deterministic systems to learn new rules and behaviors. As a society we expect people to learn and follow these rules. Others felt that the very biology of our brains plays a role in making human beings creatures of rules and in making people feel there should be responsibility.

Others endorsed the idea that humans understand themselves to be rational creatures, moved and motivated by reason. As there is no way for human beings to get outside of our perception of ourselves as rational beings, due to the way we are constructed, we will continue to behave and interact as if we are rational and to base decisions about responsibility on our belief in, and perceptions of, rationality, even if we are completely determined. Accordingly, then, our laws and rules will reflect our understanding of ourselves as rational actors.

Others agreed that the idea of free will is unlikely to be discarded, but felt that it was still possible for developments in neuroscience to have substantial impacts on the concept of responsibility. Some participants made the point that rationality is not well-defined or understood, and that neuroscience could

---

2. While all of the commissioned papers written for the meeting touch on the concept of free will, those of Gazzaniga and Morse specifically address the issue in some depth.

ultimately play a role in helping to understand the construct of "rationality" itself.

Many seemed to believe that the greatest impact of neuroscience on the concept of free will and responsibility will be felt not in exculpatory ways, but in mitigation ("he's not fully responsible, because of his brain") and in perception of risk ("he might try to follow the law, but his brain won't let him, therefore he is a risk to society"). The free will and responsibility debate likely will not end soon (it has occupied philosophers for centuries). Regardless, it seems clear that courts will continue to consider technologies and techniques to predict behavior in their decision making.

Courts, because they must make decisions in a timely fashion, are pressed to use any reasonable tool that might shed additional light on the matter at hand. A risk thus arises that predictive decisions will be based on poor or incomplete science. Additionally, neuroscience-based predictions may be given undue weight as "scientific predictions" when they may still suffer from the typical problems inherent in current risk prediction models. These can include bias in the selection of people for the group to which others are compared; reliability or validity issues in the prediction itself; and the inability of a predictive measure to tell you about the particular individual, but only to tell you, probabilistically, about the group to which the subject belongs.

The use of flawed or incomplete science, or the reliance on scientific predictions beyond what the science is prepared to support, are exactly the kinds of concerns that should be foremost in the public mind when contemplating the potential social impact of predictive technologies or techniques. It is not just in courtrooms that prediction would have an impact, but also in schools, employment, health care systems, government investigations, and in other ways that would dwarf usage by the court system.

The potential to pigeonhole, to discriminate, and to judge on the basis of test results could result in substantial negative consequences, including the development of a "neuroscientific underclass" denied access to education and other societal benefits on the basis of their neuroscience test results. These concerns parallel the current dialogue around genetics, and some felt the public dialogue around genetics may illuminate some of the promises and pitfalls that could accompany a greater understanding of the brain.[3]

Predicting Violence

Though a host of possible predictions might be desirable (such as an individual's tendency to be honest or willingness to follow authority), the potential for violence is of particular interest and significance. Prediction of violence has already been the subject of some neuroscience research, and it will probably continue to interest science as well as the legal system. The previous discussion on behavior prediction is directly relevant to the prediction of violence: it is a predictive measure likely both to have tremendous utility and to carry great risk of misuse, and it is likely to cut both ways in criminal law—in mitigation and in marking someone as being predisposed to violence. While violent behavior probably will never be predicted with complete certainty, the likelihood that techniques will be developed to distinguish those more likely (or even very likely) to react with violence seems great enough that those techniques should be considered for future research and public discussion.

An additional concern is possible pre-emptive uses of prediction of violent behavior (or proneness to violence). Generally,

---

3. For readers interested in the parallels with the genetics debate, Henry Greely's paper in the larger volume is particularly recommended.

in the legal system, we punish people based on behavior, not on thoughts or "tendencies."[4] The idea of imposing treatment, or even making decisions regarding employment, based on some test results, and in the absence of prior violent behavior, opposes this core value of the legal system.

Of course, not all the possible ways in which predictions of "violence-proneness" could be used are negative. For example, in screening people whose jobs require them to confront violence, and in some circumstances to respond with violence—for example, members of the armed forces and law enforcement officers—such tests may be extremely useful. This might be thought of as identifying "violence-eligible" individuals.

Competencies and Capacities

Though it may not be immediately apparent, determining whether someone has the capacity to act in a legally binding or efficacious way—perhaps to sign a binding contract, make decisions regarding one's medical treatment, or manage one's affairs—shares some similarities to the prediction of behavior. Both assessments can influence how we think about a person's legal responsibility for his or her behavior. Regarding a person's capacity to act, we may look for diminished ability to do what the law expects or requires and subsequently either release the person from a legal responsibility or prevent him or her from exercising an option. In general, the law assumes that adults can act in a way that has legal effect. Advances in understanding memory processes, neural circuitries, and the relationship of

---

4. One notable exception regards people who have already committed violence, and the question is the likelihood of their committing further acts of violence. We routinely make decisions on tendencies in the criminal justice system, though we generally reserve such predictions for the most violent offenders. However, we do not do it prior to an initial act of violence.

genetics to neurological function may help to develop increasingly sensitive and accurate methods of evaluating competencies, particularly when paired with advances in neuroimaging. In addition, new medications developed for the treatment of memory disorders may play a future role in competency issues by offering treatment to help ascertain or preserve competency.

Neuroscientific Lie Detection

An area of brain monitoring or imaging with immediate obvious value in the law is the development of neuroscience-based lie detection. Several technologies are currently being explored. However, the neuroscientists cautioned, the existing techniques are not based upon a clear neuroscientific understanding of the phenomenon of lying. The lack of any underlying cohesive theoretical framework means that the current work relies solely on experiments correlating brain activity with the act of lying, essentially "shooting in the dark."

The most significant hurdle facing accurate lie detection is what could be termed "the problem of memory." While it seems likely that techniques might be developed to detect when someone is intentionally lying, several scientists expressed doubt that one could easily detect when someone is merely mistaken—that is, when someone is subjectively telling the truth but is factually wrong. While this circumstance may be a hurdle that will one day be overcome, scientists viewed it as a substantial problem common to many of the scientific approaches to lie detection.

Even if 100 percent accurate lie detection becomes available, two legal issues are undeniably important: the role of the jury and compulsory testing of witnesses for veracity. The evaluation of witnesses and the credibility and weight of their

testimony are matters for the jury (this is true for jury trials; in bench trials, it is the judge). Therefore, in allowing scientific testimony regarding truthfulness as evidence, the court may be invading the purview of the jury. At minimum, there will be concerns about whether such evidence may have undue influence. Members of the jury may weigh "scientific evidence" more heavily than their opinion as formed by their own senses, and may do so specifically on the question of truth. Evaluating the credibility of witnesses has been held to be a core function of the jury and a determination that should rest on the evidence of the jurors' own senses, not to be replaced by expert testimony on truthfulness.[5]

Several concerns are raised by the possibility of allowing witnesses, including defendants, to be tested for truthfulness. Aside from Fifth Amendment concerns about being compelled to testify against oneself, should the judge or jury be allowed to consider a defendant's refusal to take such a test? As polygraph tests are rarely admissible, the legal implications arising from the accurate testing of defendants have yet to be examined, but with accurate, neuroscience-based lie detection techniques, they might come to the fore. Could a party subpoena a witness and demand a lie detection test? Issues of safety would be a concern, as the use of brain imaging technology carries with it some amount of risk, however minimal. Issues of privacy would also be raised—what else might be learned, what else might be asked? Could a person be compelled to answer a subpoena while being monitored for veracity? Clearly, issues abound, making neuroscientific lie detection a strong candidate for future study and discussion.

5. See United States v. Scheffer, 523 U.S. 303 (1998).

Detecting Bias

Closely related to the issue of lie detection is that of detecting bias. Early research has shown that brain activity associated with strong emotion can be detected when people who are biased toward certain groups are shown pictures of members of that group. While such research is in early stages, again the uses seem broad in scope: jury selection, discrimination cases, and employee screening, just to name a few. The difficulty arises in determining exactly what the person being tested is reacting to, and why. While the brain activity may be correlated highly with bias, it may correlate with other beliefs or states as well.

The concept of detecting bias raises a familiar question, one that also permeates the consideration of prediction. To what extent do we, as a society, wish to judge people based on what we perceive they are thinking rather than what they say or do? This is not a trivial matter; it is near the core of our justice system that we reward people, punish them, or hold them responsible *for their actions*, not for their thoughts (or potential actions).

Brain Death

The final monitoring topic is determination of brain death. The question is whether the definition and determination of brain death might be better informed or substantially changed by neuroscientific developments. The current standards are primarily focused on brain stem death—the areas of the brain that deal with the automatic processes of the body, such as respiration and heartbeat. Improvements in understanding and monitoring brain function may well influence definitions of brain death by focusing attention on higher cerebral function and on when speech, cognition, learning, consciousness, and other defining human characteristics are irretrievably lost.

One constraint on the impact of new neuroscience in this area is the extent to which substantial work has already gone into defining brain death, with input from many groups and with substantial moral and religious literature to draw on in conceptualizing and defining the state of being "brain-dead." The current system balances important social, legal, religious, ethical, and moral concerns, and many meeting participants expressed a sense of caution about upsetting that balance.

Modifying the Brain

WHILE one might reasonably expect that the monitoring aspects of brain science would precede the modifying technologies, it turns out that some modifications are already available and may soon pose serious legal questions. On the horizon is a host of what may generally be termed enhancements, but one modification currently available—the pharmacological treatment of addiction—already raises numerous points for discussion.

Enhancements

While we may think of enhancements as only major changes to the brain—cell transplants, chip insertion, and the like—in reality, many of these changes are so far off as to make addressing them impractical. However, some enhancements of a pharmaceutical nature are immediately available, and they can serve as a template for contemplating some of the larger issues of enhancement.

Enhancement raises policy questions of the largest scale, evoking concerns about distributive justice, disadvantaging effects, and the potential of creating an un-enhanced underclass. The general concern may be that those with privilege will seek enhancement to develop a competitive advantage over less privileged individuals.

One use with significant potential for controversy is the off-label use of drugs such as Ritalin to improve attention and performance in scholastic testing. The example of the Scholastic Aptitude Tests (SATs) illustrates these issues clearly. Should we test students for Ritalin use immediately after the SATs, and, if they test positive, void their scores? Have the students using Ritalin plied an unfair advantage? Or is performance enhancement with a drug comparable to SAT prep courses, which may provide students advantages over those without access to such a course? The difference between the two, it may be noted, is that the prep course requires effort. In addition, the use of drugs (even very safe ones) entails health risks.

Reflecting on Ritalin and the SAT highlights a strong aspect of the American legal system: the focus on individual rights will make it difficult to ban or restrict enhancement technologies simply because they may disadvantage those without them. With that in mind, consider the opposite: when can enhancement be ordered?

The case of mandated enhancement arises in the following hypothetical example: could a court or other authority ask or compel someone to take a selective serotonin reuptake inhibitor, a class of drugs commonly prescribed for depression (among other disorders), in order to make that individual less angry, less impulsive, and less irritable, even though the person does not have a diagnosed psychiatric condition? Could we ask or compel prisoners to take medication to improve their state of mind or

disposition? Could it be a condition of probation? Such uses raise substantial ethical concerns, as well as some potential constitutional issues about the "integrity of the person" and the extent to which the state can interfere with the functioning of an individual's mind. By definition, the person who is the target of enhancement efforts does not suffer from an illness, but falls within the normal range of behavior. The real ethical and legal concerns in the situation of mandatory enhancement may not be court-ordered medication, but instead "soft" coercion by the state to "voluntarily" take the medication (by making it a condition for early release from prison, for example). Accordingly, enhancements were an area many felt warranted further study and attention.

Treating Addiction

One type of enhancement with immediacy and pertinence is modification of the brain to treat addiction, particularly addiction to opiates. Treating addiction is viewed by many as a long-term, if not lifelong, process. The relapse rate is high, and the legal penalties for illegal opiate use are substantial. Neuroscientists working in this area have demonstrated that the brains of addicts are different from those of nonaddicts and have found evidence of a genetic predisposition toward addiction.

As it turns out, highly effective pharmaceutical treatments for opiate addiction, with few or no side effects, are currently available and yet not widely used. Here is a clear example where neuroscience could directly influence and impact law, but it has not. For example, one drug, naltrexone, serves to block the pleasurable or rewarding effect of the opiates. By blocking the receptors to which the drug binds, the medication makes relapse impossible as long as the individual continues to take it. The

clinical problem is to achieve compliance with the medication schedule. Compliance could be ordered as a condition of probation or parole. Such mandated adherence to medication would be facilitated by a preparation of naltrexone that would act over a prolonged period, which is currently in the FDA approval process. As long as former opiate addicts were required to take a monthly injection, they could not relapse into opiate addiction. Successful drug treatment not only reduces the health risks associated with drug use, but also eliminates the legal risk of incarceration for possession of drugs or drug paraphernalia. Drug addicts could, in theory, be diverted to a mandatory treatment program at a much lower cost than incarceration.

The naltrexone example raises the question of how such a discovery can result in changes in law and policy. Treatment for addiction perhaps serves as the best example of the need for efforts whereby lawyers and scientists seek to inform each other's work. While it is not obvious how this particular issue might change the law, clearly a continuing dialogue should be maintained and a greater effort should be made to facilitate future and continuing education and interaction between the neuroscience and legal fields. Such efforts may reap real, and possibly immediate, benefits.

Cross-Cutting Legal Issues

As noted at the beginning, some legal issues cut across the monitoring/modifying distinction this report has used to consider neuroscience developments. Significant cross-cutting issues that arose in a variety of contexts include: discrimination, privacy and confidentiality, "pre-formal" uses of neuroscience,

and intellectual property. In addition, just as the science is still developing, the current state of the law regarding neuroscience specifically is even more nascent. Still, to the extent that antidiscrimination statutes may restrict how neuroscience techniques are used, or that intellectual property concerns may have a limiting effect on research, some brief consideration of the potential impact of the law on neuroscience is also appropriate.

Discrimination

Discrimination is a concern with both monitoring and modifying technologies. The use of monitoring technologies, particularly in predictive applications, could lead to the pigeonholing of children, the denial of opportunities, and other forms of discrimination or "neurological prejudice." Similarly, limited access to modification technologies could produce a growing divide between those with access to enhancements and those without, creating a "neurological underclass."

Concerns of discrimination based on neuroscientific tests or procedures have some similarities to concerns about discrimination based on genetic tests, procedures, or information. In both cases, the risk is that people will be disadvantaged based on their biological makeup—either of brain or DNA—rather than judged on their own demonstrated abilities or accomplishments. Interestingly, while genetic discrimination has stimulated a fair amount of activity—including congressional hearings, proposed federal legislation, some enacted state legislation, and numerous meetings by various august bodies—very little litigation has arisen to date. Possibly, neuroscientific discrimination situations could be similarly slow to develop, with the legal and scientific communities leading the charge to examine the issue before such cases arise. Work being done currently on genetic discrimination

may serve as a good model and guide for future efforts to address the risk of neuroscientific discrimination.

Two ideas explored in the discussions of genetics are particularly worth considering in regard to neuroscience. The first is the idea of "exceptionalism," a concern that passing laws and specific rules for neuroscientific discrimination will lead to a public perception that information about our brains is more determinative of our well-being and behavior than it is in fact. Singling out neuroscientific information for special protection seems to indicate that an exceptionally powerful amount or type of knowledge is there—hence, exceptionalism. So while discrimination based on neuroscientific knowledge is a risk the neuroscience and legal communities should work to minimize, it is not clear that a new legal structure specific to neuroscience should be developed. An alternative path may be to strengthen existing antidiscriminatory statutes and schemes to include discrimination based on neuroscientific information.

The other idea with a parallel in genetics is "neuroscientific essentialism"—the idea that the essence of who you are is your mind/brain. However, the essentialism argument may not be as vigorously questioned in neuroscience as it has been in genetic science; people may come to see their brains as much closer to who they are than they do their genes. If so, then neuroscientific essentialism could drive discriminatory behavior (or concerns about preventing such behavior) in a way that neuroscientific exceptionalism does not. That is, if many people feel that their minds/brains truly are the essence of who they are, the public may be less resistant to using neuroscientific information to evaluate people than to using genetic information (which people seem to understand does not define "who" they are).

One key way to reduce the risk of discrimination based on neuroscientific information, of course, is to limit or restrict

access to that information, making it available only as appropri-
ate for uses that society deems acceptable. Accordingly, such
distinctions present questions of privacy and confidentiality.

Privacy/Confidentiality

The issues of privacy (keeping information one does not
want known from being discovered by others) and confidential-
ity (keeping information that must be disseminated from going
to unintended recipients) have strong parallels with the concern
about genetic and other health information. Much of this infor-
mation would be gathered in a health-care context and would
likely be protected as other health-care information is, under the
federal Health Insurance Portability and Accountability Act
(HIPAA) and by state laws regulating the confidentiality of med-
ical information. Other information would likely be gathered in
a research context and would be subject to the confidentiality
protections covering research subjects. So, while the risks inher-
ent in possible breaches of privacy and confidentiality are an
important concern, some good protective measures are already in
place and vigilant enforcement of those protections may protect
against most problematic disclosures.

However, the scope of information gathered is a significant
issue that the current standards and practices may not be pre-
pared to address. Compared to the results of a blood test for the
presence of a specific antibody, the data produced by a single
imaging procedure is considerably broader in scope. When scan-
ning a brain for one particular characteristic or marker, the
machine records substantial additional (or collateral) informa-
tion. This collateral information may be sufficient to identify
other characteristics, markers, or conditions that can be used to
discriminate, or that the person being tested would like to keep

private. What if, in addition to the information originally sought, a brain scan reveals signs of early-stage Alzheimer's? Addressing the issue of collateral information will be particularly important when testing is being sought or ordered by the state.

"Pre-formal" Usage

While many of the uses of neuroscience addressed in this report are in "formal" contexts (lawsuits, competency proceedings, criminal trials, and other proceedings), a cause for concern could be how the legal system might use neuroscience in "pre-formal" ways—particularly prior to bringing criminal charges, but in other situations as well. For example, a defense counsel could bring test results to prosecutors as part of a pre-charging dialogue, seeking dismissal, reduction of charges, or some other outcome. Such usages would be essentially unreviewable, and possibly nonpublic. While the exact nature of these pre-formal usages is unclear, it seems prudent that both lawyers and neuroscientists consider how such uses might be dealt with in ways that are both legally and scientifically appropriate. The scientific and legal communities may even wish to go so far as explicitly to explore such possible uses and to begin a dialogue on standards, knowledge, and scientifically appropriate uses.

Intellectual Property Issues

In general, neuroscience seems unlikely to pose any new challenges for intellectual property law. To the extent concern may be warranted, it relates to the possibility that neuroscience patents could restrict the development of "downstream" or derivative products.

A patent is a type of property right granted to an inventor (the "patent holder"), giving the exclusive right to the use of some invention (including mechanical devices, chemical compounds, and manufacturing processes) for a limited period of time. While the inventor is rewarded by exclusively profiting from the fruits of his or her labors, the larger society benefits by requiring the inventor to disclose the details of the invention as part of being granted a patent. This disclosure allows others to improve, modify, and otherwise build on the patented invention. Products developed using the patented invention are referred to as "downstream" products. A patent holder can prevent or restrict the use of the patented invention (for the period of the patent), thereby preventing the development of downstream products. The risk of restricting downstream product development is not exclusive to neuroscience patents, but given the fact that these are inventions with potential applicability to our brains and our well-being, it may be a particularly sharp area of concern.[6]

Future Directions

THE need for increased interaction among the legal and neuroscientific disciplines is apparent. One useful form would be scientific educational efforts designed to inform lawyers and judges. Similarly, neuroscientists could benefit from education in the legal system's use of science and the types of uses lawyers and judges foresee for neuroscience. Establishment of a formal body, an ongoing conference, or some other mechanism to allow

---

6. Of course, the same concerns hold true in non-neuroscience areas as well—gene therapy patents, for example.

lawyers and neuroscientists to inform each other's work could also be quite valuable.

In a related vein, the two communities might cooperate in establishing which neuroscience methods are legally useful and scientifically sound. While the law will likely incorporate new neuroscientific knowledge successfully, less clear is how that might best occur. Several participants suggested the two fields could consider developing an accrediting process (for labs and technologies), or encourage some legislatively driven creation of an approval process.

Finally, one lawyer made the case for expanded clinical testing of the neuroscience technologies likely to be used in legal settings:

> "[Y]ou should be able to do pretty good controlled clinical-trial kinds of experiments to see whether these things work, whether they work for everybody, whether they work for only certain people, whether you can beat it…
>
> You want to put a new drug out, the FDA requires you to go through years and years of detailed clinical trials. There's no such requirement for nonmedical technologies. Does anybody have the interest, the funds, and the will to fund serious rigorous clinical testing of these technologies? If the answer is no, I'd suggest the answer should be changed to yes."

While these sentiments specifically refer to lie detection technologies, opinions like it echoed throughout the meeting regarding many of the technologies discussed. The lawyers recognized that many of the relevant neuroscience developments

are in their earliest stages of exploration but felt the scientists should consider explicit clinical testing of neuroscience tests and technologies for courtroom and other legal uses.[7]

In the end, the overarching concern, strongly expressed, was that lawyers and neuroscientists alike be cautious about how brain science is used and presented. For the well-being of both fields, the science must be presented, used, and discussed in a realistic and accurate fashion, one that reflects both the limitations and the potentials of the science. As one participant put it, it is time for neuroscientists to start identifying and delineating the boundaries of what is known and likely to be knowable—the limits of neuroscience knowledge. In turn, this process will enable the legal community to appreciate better what neuroscience can and cannot tell us, and to what uses neuroscience can be put in the service of the law and of society. Simply that the future is not fully knowable is not reason to delay the dialogue. As one neuroscientist noted, "[We] really do have an obligation to think about things, even if they don't seem likely right now, because they will come faster than we can possibly believe."

---

7. In general, early scientific research is considered more "pure" than "applied" research, in part because initial exploratory work is often necessarily descriptive and explanatory, rather than an attempt to manipulate or alter the phenomenon or mechanism under investigation. In the case of neuroscience, many applied uses are only beginning to be developed. In the meeting, the lawyers were essentially arguing that, since we expected the scientific knowledge and the technologies to be used in legal settings, perhaps researchers should conduct some experimentation directly addressing the potential legal uses.

Acknowledgments

Index