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NEUROSCIENCE AND THE LAW

ROBERT M. SAPOLSKY*

Thank you for having me here, Charles and Allie. I greatly appreciate it.¹ Although it is not clear what being here means any more in our virtual world.

All of you today have gotten to hear some wonderfully subtle, nuanced explorations of the intersection between law and neuroscience. My intent in this talk is to do anything but that, and to be incredibly unsubtle and unnuanced. I will perhaps represent the lunatic fringe in terms of the views of where the two fields intersect. I think maybe the best way of summarizing it is that this will be a version of a talk I gave a couple of years ago at the Stanford law school to first-year students in their first week of law school. The talk was entitled, “Why You Should Quit Law School Immediately,” and, as far as I can tell, it had no impact whatsoever. It is probably just as well. To jump to the punch line, I am a very, very hard incompatibilist. I believe there is no free will whatsoever, and that is going to have to utterly transform how we think about every aspect of our society. From how we judge harshly, to how we praise, and everything in between.

I would like to start off with a landmark law decision, one that informs a lot of what I will be talking about. This is from 1457. This was a law case where a ten-year-old boy in rural France was walking down the road and was attacked by a pig and her piglets.² The pig proceeded to kill him, and the pig and her piglets consumed him. With the wheels of justice turning, the pig and piglets were brought to trial. As was often the case at that time with animal trials and for murder,

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¹ Symposium, *Neuroscience and the Law*, UNIV. ST. THOMAS J.L & PUB. POL’Y (2020).

² See generally Alexander Lee, *Pigs Might Try*, HIST. TODAY (Nov. 11, 2020), <https://www.historytoday.com/archive/natural-histories/pigs-might-try>.

the judge produced a Psalmaic decision in which was the pig, of course, was guilty of murder and was hung. The piglets, however, were acquitted because the judge ruled that they were too young to know better at that point.³ Many of you will recognize that some centuries later, *Roper v. Simmons* was built on that exact same logic.⁴ Somewhere in the aftermath people figured out that is not how behavior works, that is not how the behavior of animals works. They had no control over their carnivory.

We now jump a few centuries later when there was apparently a shift in the axial orbit of earth that was introduced around 1650 what came to be known as the Little Ice Age. It was another century-and-a-half or so of horrible downturn. The weather throughout Europe caused crops to fail, famines, and hailstorms that destroyed crops in the middle of the summer. The savants and wise learned voices at the time had a very clear explanation for what had caused the Little Ice Age—which was obviously witches.⁵ Witches were thought to cause the hailstorms, which led to no shortage of witches being burned at the stake. Then at some later point, people figured out that hailstorms are not caused by demonically hanging out with Satan. That is not how the human potential for behavior works, and things changed.

Also commonplace in the sixteenth century there were very clear legalistic attitudes about epilepsy. Epilepsy was commonplace for thousands of years. It is well described in the Bible. Victims writhe, they convulse, they fall down. They have all of the symptoms that we recognize, which are exquisitely, accurately, clinically described in the Bible and historical texts.⁶ Specifically, the incident is described in the Gospel of Mark, where Jesus cured a boy of his epilepsy, a boy who

³ See *id.*

⁴ *Roper v. Simmons*, 543 U.S. 551 (2005).

⁵ See generally Jennie Cohen, *Little Ice Age, Big Consequences*, HIST., <https://www.history.com/news/little-ice-age-big-consequences> (last updated Aug. 29, 2018).

⁶ See, e.g., Philip Lee, *St. Valentine and Others – Patron Saints of Epilepsy*, EPILEPSY ACTION, <https://www.epilepsy.org.uk/about/st-valentine-epilepsy-patron-saints> (last visited Feb. 23, 2021); Elaine Reeves, *Former Christian Fundamentalist on Epilepsy and the Bible*, EPILEPSY BLOG RELAY (Mar. 21, 2019), <https://livingwellwiththeepilepsy.com>.

had fallen down writhing, the falling disease as it was known historically. Jesus did the proper clinical intervention, which was to drive the satanic being infecting the boy out of him.⁷

In the centuries after that, people were not quite as effective at being able to drive out the demons causing epilepsy. There was, more importantly, a shift in the attitude of viewing the demonic possession of epilepsy, not as being a case of the sufferer of these seizures being a victim of Satan, but rather being a collaborator with Satan. This was most influentially stated in a book that came out in 1487.⁸ A pair of monks, Kramer and Springer, wrote the textbook, the handbook, of how to recognize demonic possession and how to recognize Satan's hammer - *Malleus Maleficarum*. This was one of the most influential books in the early centuries of publishing, and went through endless editions, and explained all the ways for recognizing witches, all the ways for recognizing those who have taken league with Satan, and what to do about them. Firmly established among them was the view that part of satanic evidence is having an epileptic seizure. The book recommended a very clear neurological clinical intervention, which was to burn them at the stake.⁹ The best estimates are that thousands of people, thousands of epileptics—almost certainly tens of thousands—were burned at the stake as a result.

Then at some point around the 19th Century people learn that it is not demonic possession. It is a disease, a neurological disease. What we have learned since is that epilepsy is not deciding to sleep with Beelzebub.¹⁰ It is usually from having screwed up potassium channels in your temporal lobe.¹¹ So we made progress there. We made even more progress in the last century. Schizophrenia is a tragic destruction of those who suffer from it. For the family members who are touched by it, schizophrenia is a horrendous disease. Starting around the 1930s

⁷ See Lee, *supra* note 6; Mark 9:14-29.

⁸ HEINRICH KRAMER & JACOB SPRENGER, *MALLEUS MALEFICARUM* (1487).

⁹ *Id.*

¹⁰ See, e.g., Lee, *supra* note 6; M.J. Eadie & P.F. Bladin, *A Disease Once Sacred: A History of the Medical Understanding of Epilepsy*, *J. CHILD NEUROLOGY* (2006).

¹¹ See generally Rüdiger Köhling & Jakob Wolfart, *Potassium Channels in Epilepsy*, *COLD SPRING HARBOR PERSPS. IN MED.* (2016), <https://doi.org/10.1101/cshperspect.a022871>.

or so, there was a very clear explanation for the roots of schizophrenia that dominated for decades.

This was something that every highly credentialed psychiatrist was a believer in. This was something brought over by a psychodynamic view of mental illness in the 1930's, when some of the leading lights of it fled Hitler and came to the United States. What you would have is the following scenario: a child, a teenager, has been showing increasingly abnormal behavior, disordered thought, and inappropriate affect. This child, this teenager, has begun to report that they are hearing voices that are growing to a catastrophic extent. And finally, the parents, the mother, brings this teenager to a psychiatrist. They were fortunate enough to go to the most skilled, most credentialed, most prestigious psychiatrist around. The psychiatrist confirms exactly the nightmare fear that the mother has been having: "Yes, this is this disease called schizophrenia that most of you have not heard of," would be the 1930 statement. "This is a horrendous nightmare of a disease, it is terrible, we can't do anything to cure it, and this is what your loved one is stuck with." At that point, the mother would invariably say something like: "Where did this disease come from? Where did this nightmare of a disorder come from?" The best of psychiatry, the best of medicine, the best of modern thought at that time had a very clear answer: "Where did your child's schizophrenia come from? It came from you. You, the mother. Because of your mothering style, you caused the schizophrenia in your child." It even had an official term, it was called "schizophrenogenic mothering," a mothering style that generated schizophrenia.¹²

A few decades later, things became so much more humane. Insights showed that it was not just the mothers who could cause schizophrenia in their kids, the fathers could cause it too. Wow, progress of all sorts there! This came to be formalized in the view of the double-bind hypothesis of schizophrenia. Parents - mothers, ninety-five percent of the time - induced schizophrenia in their

¹² See generally Anne Harrington, *Mother Love and Mental Illness: An Emotional History*, UNIV. OF CHI. PRESS J. (2016), <https://www.journals.uchicago.edu/doi/pdf/10.1086/687559>.

children by giving them highly emotionally charged conflicting situations.¹³ This is the mother who says: “Why don't you ever tell me you love me? Why don't you ever tell me you love me? I love you! What is that supposed to mean when you are just being forced to say it?” Out of this supposed terrible emotional double bind comes the disordered thought of schizophrenia. That is what generations of parents of schizophrenics were taught. You generated this disease in your child by your terrible, emotionally abnormal parenting.¹⁴

In parallel with that, there were parents who brought their their children to psychiatrists and neurologists and were given the then very new diagnosis of autism. “Your child has autism: Where did this come from? Where did this disease come from? It was caused by you. You, the mother.” The term from the time came to be refrigerator mothering. The fact that you were incapable of expressing love and your child sensed this, or at the Freudian extreme, that autism was caused by refrigerator mothering caused by an unconscious Freudian hatred of your child.¹⁵ That is what every best clinician taught their patients’ parents at the time. “Where did this disease come from? You caused it. You caused it by your heartless, incompetent, abnormal, pathological parenting and this is the cause of the disease.”

Then we learned something. In the 1950s, people first discovered what are now known as “neuroleptics,” antipsychotic drugs that help to cure, help to control, the symptoms of schizophrenia, and they have nothing to do with changing the mothering styles of the parent.¹⁶ They have to do with blocking the receptors for a neurotransmitter called dopamine. It was by the 1980s that the first neuroimaging of schizophrenia occurred, and people noted for the first

¹³ *See id.*

¹⁴ *See id.*

¹⁵ *See, e.g., id.; James Harris, Leo Kanner and Autism: 75-Year Perspective*, INT’L REV. OF PSYCHOL. (2018), <https://doi.org/10.1080/09540261.2018.1455646>.

¹⁶ *See, e.g., MAYO CLINIC*, <https://www.mayoclinic.org/diseases-conditions/schizophrenia/diagnosis-treatment/drc-20354449> (last visited Feb. 24, 2021); Krishna R. Patel et al., *Schizophrenia: Overview and Treatment Options*, J. PHARMACY AND THERAPEUTICS (2014), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4159061/pdf/ptj3909638.pdf>.

time that “My God, there were structural abnormalities in the brain. Everyone in the field gasped at that point, collectively, and said, “It’s a biological disorder. It is a neurochemical disorder. It is a neuroanatomical disorder.” What you see, then, was an entire field of clinicians who had to say, “My God, what have we done wrong?” because we learned it works differently.

An extraordinary episode happened in the annals of autism research. Leo Kanner, one of the psycho-analyst pioneers who fled Europe and came to the United States, is the person who first formalized autism as a clinical disorder. He is also the person who invented the sound bite of refrigerator mothering.¹⁷ In his old age, Leo Kanner went to a parent support group for parents of autistic individuals, and he said, “I apologize for the enormous damage that I did to all of you. We were so wrong. Look at the harm we did by not understanding this is a biological disorder.”¹⁸

Now, what you begin to see as you push on with this is, all of these lessons apply in current times as well. Now, we have parents wondering why their children have not been learning to read effectively. Teachers and school counselors for centuries, and up until very recent times, attributed this to laziness, to lack of motivation. That is why your child is not learning well. In the past few decades, what we have learned instead is that this disorder, which we now call dyslexia, involves structural abnormalities in the cortex. Your cortex is wired up in a jumbled way and, as a result, letters are reversed or your eyes make uncontrolled cyclonic movements, so you have trouble focusing on reading.¹⁹ It is not their fault. There is something screwy with their brain wiring. The notion of attributing dyslexia to laziness and lack of motivation began to seem as out of date and brutal as deciding that epilepsy is caused by consorting with Satan.²⁰

What we have been seeing now are centuries worth of “Aha” moments of people being forced to say, “I had no idea biology had

¹⁷ See Harris, *supra* note 15.

¹⁸ See *id.*

¹⁹ See generally INT’L DYSLEXIA ASS’N, <https://dyslexiaida.org/dyslexia-and-the-brain-fact-sheet/> (last visited Feb. 24, 2021).

²⁰ See generally Lee, *supra* note 6.

anything to do with this.” Where this becomes most relevant in the world of legal judgment of behavior, on criminal law and such, is the domain which in effect describes ninety-nine percent of criminal acts. Which is, at some juncture, somebody had the choice to make between doing the right thing and doing the wrong thing, and they chose the wrong thing, they made the wrong decision. This could be a decision carried out over the course of years of white-collar crime and embezzlement, or it could be the wrong decision carried out in a fraction of a second as to whether to pull a trigger. What this is all about is, at some juncture, somebody had a choice between making the right decision and the wrong one, and they made the wrong one.

What we are learning is so much of this has to do with another realm of biology. It is another realm of, “Oh! I had no idea biology had something to do with this.” It has to do with the part of the brain called the frontal cortex. The frontal cortex is wonderful, and in retrospect, I realized I’ve spent about forty years of my life, wasted it, studying the wrong part of the brain, something called the hippocampus, which turns out to be boring. I should have been studying the frontal cortex all along. My neuroscientific life has been misspent. The frontal cortex is the coolest part of the brain. We have more of it than any other species. It is the most recently evolved part of our brain. It is the last part of our brain to fully mature, not maturing until we are about twenty-five-years old. What does the frontal cortex do? If you want to summarize a billion studies, and a zillion careers worth of research, what the frontal cortex does, is it makes you do the harder thing when that is the right thing to do. It governs impulse control, long-term planning, gratification postponement, and emotional regulation. If you are sitting there and you are being tempted to do something, tempted to give into it, but you are managing to resist that temptation, it is because you have a frontal cortex that is functioning very effectively in that circumstance.²¹

²¹ See Theodore Y. Blumoff, *Foreword: The Brain Sciences and Criminal Law Norms*, 62 MERCER L. REV. 705, 706 (2011) (citing Robert M. Sapolsky, *The Frontal Cortex and the Criminal Justice System*, 359 PHIL. TRANSACTIONS ROYAL SOC'Y LONDON B. 1787, 1787 (2004)).

What we begin to consider is that juncture - the fact that doing the right thing when it is a harder thing to do can take a whole lot of different forms. The cognitive realm of your frontal cortex, working well, is trying very hard to say the months of the year backwards when that is your task because the much easier thing is to slide into what is more habitual. What takes frontal function in all sorts of settings are highly varied and highly significant. Consider as follows: you were sitting there, you were being tempted to lie for some sort of personal gain, and you were trying to resist that. What is shown in endless neuroimaging studies and cutting edge research is that your frontal cortex is working very hard at that point to keep you from giving into that temptation. But suppose at that point you decide, "What the hell! I am going to give in and indulge in this temptation." At that point, you need your frontal cortex to do a good job at getting away with the lie, at keeping track consciously of making the right amount of eye contact, of making sure your voice does not crack in your nervousness, of keeping track of what the lie was so you do not contradict yourself at a later point.

In other words, we have a part of the brain that is centrally involved in both resisting temptation and then wallowing in it efficaciously when you decide to give into it. By definition, then, we have a very complex part of the brain. We have a brain that is absolutely essential to that moment, where in a fraction of a second, you have to decide whether to pull that trigger. Whether that is in the context where pulling that trigger constitutes an appalling, damaging act, or in a different setting, you do the exact same thing with the muscles in your index finger and the same thing with your motor neurons up in your cortex, and you pull a trigger. In doing so you have magnificently, suicidally drawn fire to yourself so that some innocent people might live. Pulling that trigger can be one of our worst moments, it can be one of our best moments, or it could be ambiguously in between; all of it comes down to that instant where we choose whether or not to pull that trigger.²²

²² See generally Blumoff, *supra* note 21.

What I want to review now are all of the things that determined what you did in that half second which makes the concept of choice nonsensical. You pull that trigger. We can identify the frontal cortical neurons that sent a signal to the pre-motor cortex and the supplementary motor cortex. It was the motor neurons that sent a signal with action potentials down to your finger and when you pull that trigger. We ask a question that we ask as every human out there making sense of our behavior, and that is often asked as a juror: “Why did that behavior occur? Why did he pull that trigger?” It turns out the answer to it is immensely complicated because it is a function of everything from what occurred one second before that instant to a million years before it.

What went on in the second before? By now a huge literature has shown what sort of sensory stimuli, what sort of acute circumstances, make you more likely to pull that trigger when that constitutes the wrong decision. One example of this fantastically interesting literature: you have a part of the brain called the insular cortex. In most mammals out there, the insular cortex is very clear in what it does. You take some lab rat and they bite into some piece of food that is disgusting, rotten, and moldy, and within about a tenth of a second the insular cortex is going to activate. It will trigger all sorts of reflexes. The rat spits out the food. If it is severe enough, its stomach lurches and it throws up. What does the insular cortex do in most mammals out there? It protects you from eating toxic food. It detects gustatorily disgusting things.²³

It does the same thing in humans. You take some poor Psych 101 volunteer and you stick them in a brain scanner, and give them some disgusting, rotten food to bite into. About eighty milliseconds later, their insular cortex is going to activate and they are going to gag and spit it out and that is great. But we are humans. We can do something fancier than that. Now, take this person to the brain scanner, do not give them something disgusting to eat, just make them think about eating something disgusting. Think about eating some

²³ See generally Nadine Gogolla, *The Insular Cortex*, CURRENT BIOLOGY (2017), <https://doi.org/10.1016/j.cub.2017.05.010>.

grasshopper that is writhing, and its little legs are pushing against your lips as you are trying to get it down, and the odds are you are going to activate your insular cortex at that point. Aha! In humans, it is not just about gustatory disgust, it is about imagining gustatory disgust. But now, take things one step further. Put that person in a scanner and do not give them something rotten to eat and do not make them think about something rotten to eat. Instead, show them a picture - a 1910 photograph of a happy cheerful crowd around the body of a man who has been lynched, hanging from a tree. Show them a picture of the concentration camp ovens. Show them pictures of ethnic cleansing in the Balkans. There is a good chance the insular cortex is going to activate at that point. Not because you were feeling gustatory disgust, but because you were feeling moral disgust.

It turns out, the neurons in the insular cortex do moral disgust for us the same way they do gustatory disgust. About 50,000 years ago, when somebody came up with the idea of having moral norms and having norm violations be so extreme that we can formalize them, then we were beginning to invent this thing called morality. There is obviously like a committee meeting or something at that point saying: "Well we don't have enough time to evolve a new part of the brain. Hey! how about that insular cortex? It senses disgusting food. Disgusting behavior? Maybe that's kind of similar. I know, here give me a shoehorn and some duct tape and from now on your insular cortex is going to do moral disgust as well." A neuron in the insular cannot tell the difference between disgusting food and contemplating a disgusting moral act. That is why when something is morally disgusting enough we feel sick to our stomachs. We feel like puking, our stomachs clench, and we are left with a bad taste in our mouths.

As a demonstration of that, shown in one study coming out of a group at Yale, you have somebody generate a disgusting taste in their mouth.²⁴ They swallow some cod liver oil, and the insular cortex is

²⁴ See Jana Schaich Borg, Debra Lieberman, & Kent A. Kiehl, *Infection, Incest, and Iniquity: Investigating the Neural Correlates of Disgust and Morality*, 20 J. COGNITIVE NEUROSCIENCE 1529 (2008) (finding evidence that biological disgust and immorality activate overlapping brain networks); Kendall J. Eskine, Natalie A. Kacinik & Jesse J. Prinz, *A Bad Taste in the Mouth: Gustatory Disgust Influences*

going crazy at that point, and you ask that person to judge somebody's moral act as praiseworthy, blameworthy, or whatever. When you have a bad taste in your mouth, you judge that act more harshly. You recommend a more severe sentence for that person because your brain is having a hard time distinguishing between gustatory disgust and moral disgust, and you recommend a punishment that is more severe than you would recommend at other times. If asked why you did that, you would not attribute that to the disgusting taste in your mouth and your insular cortex, but you would come up with a perfectly rational, post-hoc rationalization.

So, why did the person pull that trigger? You also have to ask what was going on in the minutes to days before. Now we're looking at issues of levels of hormones in your bloodstream. A striking example is stress hormones. If you have been stressed during the previous minutes, hours or days, a part of your brain called the amygdala, which evaluates threats, which is central to fear and anxiety, your amygdala is going to become more active.²⁵ A facial expression that you would otherwise judge as neutral, you now judge as threatening. Even when you were shown it subliminally, you flash up a picture for a tenth of a second of a face that would leave the amygdala in a coma in anybody else, but because you have been marinating your amygdala for the last few hours in high levels of these stress hormones, the amygdala reacts to that face as if it is threatening. The amygdala makes you more likely to decide, "I need to defend myself under this circumstance." The amygdala, and those stress hormones, make you more likely to pull that trigger. You can show this experimentally, where you modify—you manipulate—cortisol levels in people and they have to make decisions as to whether or not to pull a trigger at a hypothetical face, at a hypothetical video game of threat. This hormone

Moral Judgment, 22 *PSYCHOLOGICAL SCIENCE* 295 (2011) (finding that physical disgust induced by bitter tastes elicited feelings of moral disgust).

²⁵ See, e.g., Blumoff, *supra* note 21; LAURENCE TANCREDI, *HARDWIRED BEHAVIOR: WHAT NEUROSCIENCE REVEALS ABOUT MORALITY* (2005); R.J.R. Blair, *The Roles of the Orbital Frontal Cortex in the Modulation of Antisocial Behavior*, 55 *BRAIN & COGNITION* 198 (2004).

makes those neurons more likely to decide there is a threat when there is no threat. Thus, you are more likely to pull that trigger.

We all know endless examples of this in the criminal justice world, and in the world of police officers pulling a trigger before they have processed what they are looking at. When your stress hormones are elevated as documented, you—you a random subject, or you, a trained police officer as shown in the studies—are more likely to decide that a cell phone is actually a handgun that that person is holding, and you are more likely to pull the trigger. This is all because of biology over which you have no control.

But now, pushing further back, how about weeks to years before? What sort of circumstances make you more likely to have your frontal cortex make the bad decision, the wrong decision, and pull a trigger in a disastrous setting? The biology of that time period is relevant as well. All sorts of reasons contribute to making a bad decision. Neural inflammation that impairs function of the frontal cortex. PTSD causing the amygdala to grow larger in people.²⁶ A totally bizarre obscure subject is a parasite called *toxoplasma*. If you are infected with it you become more impulsive in your behavior. Or, probably the most consequential one, is if you have a concussive head trauma to the front of your head. The most common concussion, in neurological jargon, is a coup contrecoup injury to your head, where you damage the frontal cortex, and you have a brain that is less able to do the right thing when that is the harder thing to do.²⁷

One example is that a substantial percentage of people on death row in this country have a history of concussive head traumas to their frontal cortex. When that happens, you are not looking at somebody who is choosing to make the wrong decision. You are looking at a brain with some of its inhibitory circuits that have been taken out of the picture.

Pushing even further back to adolescence, how about back to childhood, back to decades before. It turns out an entire array of things,

²⁶ See, e.g., Blumoff, *supra* note 21; Sapolsky, *The Frontal Cortex*, *supra* note 21.

²⁷ See Sapolsky, *The Frontal Cortex*, *supra* note 21.

an entire array of factors influence what kind of frontal cortex you are going to have as an adult making that quarter second decision whether or not to pull a trigger. An array of events in your childhood is going to result in a frontal cortex that is stronger, or weaker, or more impulsive, or more rigid, or more whatever is going to result in a frontal cortex that is going to be making different decisions. This is not because of your choice, but because of how that frontal cortex was wired by the circumstances of your life early in development.

One example of this is so outrageous that people should be rioting at the barricades now that it has been figured out. Suppose you have made a terrible decision in childhood. You have chosen to be born into the wrong family. You picked the wrong womb to sit in. You were born into a family with low socioeconomic status. Suppose you were a child being raised in poverty. What an array of studies have shown is that by the time you are five years old, by the time you are entering kindergarten, the lower your family's socioeconomic status, on the average, the higher your circulating cortisol levels.²⁸ Your stress hormone levels are higher not when you are being stressed, but when you are just sitting there. Everyday life is more stressful in the absence of overt stress.

What is one of the consequences of those elevated cortisol levels? They impair development of the frontal cortex. By age five, the socioeconomic status of your parents is a predictor of how thick your frontal cortex will have matured into at that point and how metabolically active it is. Already at age five, it is a predictor of how good you are at doing exercises in postponement of gratification. It is a predictor of the trajectory of the frontal cortex you are going to have as an adult. No kid is really choosing which family they were born into.

²⁸ See, e.g., Patrick West et al., *The Relative Importance of Family Socioeconomic Status and School-Based Peer Hierarchies for Morning Cortisol in Youth: An Exploratory Study*, 70 SOC. SCI. & MED. 1246, 1253 (2010); Danielle S. Roubinov et al., *Family Socioeconomic Status, Cortisol, and Physical Health in Early Childhood: The Role of Advantageous Neighborhood Characteristics*, 80 PSYCHOSOMATIC MED. 492, 501 (2018).

This exact same theme leads us to ask the question, why did that behavior occur? We now push further back into childhood and see all the ways in which an array of childhood experiences are going to influence the frontal cortex, the brain, and the endocrine system you are going to have as an adult. This has been formalized in an enormously important field with advances in recent years of understanding and formalizing what sort of adverse childhood experiences have this or that impact on adult behavior and neurobiology. Out of this has come the landmark ACE score, which stands for adverse childhood experiences. You can get an official ACE score ranging from zero, if you were immensely lucky, or up to ten, if you were beyond bad luck and trauma in your upbringing. What we now know in extensive literature is that for each additional “yes” you check off on an ACE inventory, for each additional point, there is an approximately thirty-five percent increased likelihood of you, as an adult, showing antisocial violence, substance abuse, pregnancy as a fifteen-year-old, and criminality.²⁹ All these steps are built around what adversity early in life is doing to the brain and endocrine hormonal systems that you are wiring up and that you will have for the rest of your life.

That seems like it is really getting at the root of some of these effects over which we have no individual control. But you have to push even further back, for example, to fetal life. Once again, if you have foolishly and imprudently chosen the wrong womb in which to develop, you are exposed to elevated stress hormone levels as a third trimester fetus. Where are the stress hormone levels coming from if your mother is stressed by poverty, by abuse, by psychiatric disorder, by famine etc., etc.? If you were being exposed to elevated stress hormone levels, there is what is called an epigenetic change in your

²⁹ See, e.g., Christopher B. Renjilian et al., *Feasibility and Face Validity of a Modified Adverse Childhood Experiences (Aces) Inventory Formatted to Improve Youth Acceptance and Confidence with Participation in Research*, 60 J. ADOLESCENT HEALTH 112 (2018); David Finkelhor et al., *A Revised Inventory of Adverse Childhood Experiences*, 48 CHILD ABUSE AND NEGLECT 13, 21 (2015).

brain, specifically in your amygdala. Consequently, as an adult, on average, your amygdala is going to be bigger than normal and more reactive than normal. It is more likely to decide that a neutral face is a threatening face. This is all because of those events you had no choices about back during your fetal life.

Stepping back even further, we know by now there are all sorts of genes that contribute to the likelihood of making the wrong decision. One example that has been intensely studied is a gene called MAO-alpha, monoamine oxidase alpha. It has to do with a neurotransmitter called serotonin. MAO comes in two different flavors.

What we now know from animal studies is that if you got the bad version of MAO, you were more likely to be aggressive. In humans, if you got the bad version of MAO, if you were born with that gene over which you had no control, you are more likely to evidence anti-social violence by the time you were a young adult, but if, and only if, that genetic vulnerability is coupled with being abused in childhood - a gene/environment interaction. If there is no childhood abuse, then it does not matter which version you have.

Genes thus play a role in it. I emphasize that this is not a deterministic rule because there is a real temptation to get overly impressed with what genes can do to behavior. Genes are vulnerabilities and potentialities. Genes are predispositions.

So, you are now back to being a fertilized egg. When you were nothing more than genes, then it is pertinent to whether or not you will pull that trigger. Remarkably, you have to push even further back. It turns out the sort of cultures your ancestors were inventing centuries before have something to do with the likelihood of whether or not you were going to pull that trigger. By now, an entire literature has shown this difference between individualistic versus collectivist cultures. Your eyes in milliseconds look in different places in the picture. If your ancestors were herders versus farmers versus hunter-gatherers, you were more likely to have formed different sorts of religions. If your ancestors were desert dwellers, they were more likely to have set

things up so that you were a member of a monotheistic religion. If they were rainforest dwellers, you were more likely to be polytheistic.

Most relevant here, is if your ancestors were inventing what is called a “culture of honor,” which is most common amongst nomadic pastoralists, where you see high rates of violence built around social norm violations, violations of honor, retribution, and clan violence. Think of the Hatfields and McCoys.³⁰ There is very convincing literature on how the well-documented culture of honor in the American South leads to elevated levels of one very clear category of violence.³¹ This descends from the fact that the people who settled the American South were not Puritans in New England or Quakers in the mid-Atlantic states. They were shepherds and folks from Scotland, Ireland, and northern England. They brought the indigenous culture of honor from there. The culture of honor has an effect on the mother. As has already been documented, it is going to influence how long she is going to hold you when you were a baby, how loud she is going to sing lullabies to you, and what the latency is when you were crying before she picks you up. In other words, from within moments of birth, how your brain is being wired together by experience is being influenced by the ecology that led to the culture that your ancestors came up with. Finally, we go all the way back to evolution. We have evolved to be a particular type of primate that has particular patterns of aggression. People understand the evolutionary neurobiological effect.

What we have here is a long, long list. Why did he disastrously, stupidly, impulsively, and imprudently pull the trigger? Why did he choose to do so? What we take to be that choice, is the outcome of the

³⁰ See, e.g., Nadia Suleman, *The Causes of the Hatfield and McCoy Feud Ran Deeper Than You May Think*, TIME (Sept. 10, 2019, 12:00 PM), <https://time.com/5672415/hatfields-mccoys-feud-cause/>; Barbara Marazani, *7 Things You Didn't Know About the Hatfields and McCoys*, HIST. (Sept. 1, 2018), <https://www.history.com/news/7-things-you-didnt-know-about-the-hatfields-and-mccoys>.

³¹ See, e.g., Grosjean, Pauline, *A History of Violence: The Culture of Honor and Homicide in the US South*, 12 J. EUR. ECON. ASS'N 1285, 1316 (2014).

biology. This biology went on from a second before the incident up to what went on up to a million years before. He had no control over this. I think what we wind up seeing here is a very important point, which was emphasized by Francis Shen in his talk.³² Let us look at the chronology of some of these discoveries about the biology behavior. I am not actually sure if there was a Journal of Porcine Criminality in France in the 15th century, but what we begin to see are the first real examples in 1850. This is the first evidence that if you destroy the frontal cortex you get someone who involitionally violates social norms. In 1860, one sees the first paper suggesting that epilepsy was a neurological disease.³³ What you see there are more and more of these findings. I showed this in a different way, but it was remarkably similar to a figure that you saw in Shen's talk.³⁴

What we see in a random sampling of subjects is that we are learning that biology influences our behavior in a powerful way which we are not conscious of. Look at the number of studies in these areas.³⁵ Just one example, is that the hormone oxytocin has something to do with how readily mammals, including us, trust other individuals or not.³⁶ Virtually ninety-nine percent of what we have learned about what oxytocin does has come in the last twenty years. This is the case with all these fields.

And so we have come to a point, we sit a juncture where we have to say, "What's going to happen next?" What is going to happen next is that we are going to get more and more of those insights. What

³² Symposium, *Neuroscience and the Law*, UNIV. ST. THOMAS J.L & PUB. POL'Y (2020).

³³ Jules Falret, *De l'état mental des épileptiques*, P. ASSELIN (1861), <https://archive.org/details/b21292371>.

³⁴ See UNIV. ST. THOMAS J.L & PUB. POL'Y, *supra* note 32.

³⁵ See, e.g., Robert M. Sapolsky, *Behave: the biology of humans at our best and worst* (PENGUIN PRESS, 2017); John A. Johnson, *Biology Determines Every Thought, Feeling, and Behavior*, PSYCH. TODAY (Oct. 20, 2016), <https://www.psychologytoday.com/us/blog/cui-bono/201610/biology-determines-every-thought-feeling-and-behavior>.

³⁶ See, e.g., Paul J. Zak, *The Neurobiology of Trust*, 298 SCI. AM. 88, 95 (2008).

I say here may seem provocative, but I think it is absolutely the case. What we call free will is the biology that has not been discovered yet. What do you do with that? What do you do in the face of somebody who by age five already has an ACE score of six and is virtually guaranteed to have a life of antisocial behavior ahead of them? If you were asked to judge them, what do you do with someone with frontal cortical damage from a concussive head injury? What do you do with any of these examples of biological shaping, the biological roots of our behavior?

One thing you can do, even though it is completely useless, is to advocate reforming the system. Let me show what reform of criminal justice would look like if you are taking that stance rather than recognizing the biology of who we are. This example of reform comes from a great bleeding-heart liberal, a doctor named Johann Weyer in the 16th century who published an influential book at the time.³⁷ What he focused on was criminal justice at the time and one of the well understood ways to figure out if somebody was a witch.

How do you figure out if somebody is a witch? Here is one of the things you would do at the time. You would sit the person down and you would read that person the story of Christ's crucifixion. At that point, if the person failed to cry at the heartbreak of what was done to our Lord, if the person failed to cry, that was the diagnostic symptom that they were a witch. You should then burn them at the stake.

So where did Johann Weyer come in? He came in and had a very important reform of the system. He said yes, yes, yes, of course there are witches and demons. Yes, yes, yes, of course a way to find out is if they do not cry at the story of our Lord's crucifixion. And yes,

³⁷ See, e.g., Alexis Bridley & Lee W. Daffin, Jr., *Essentials of Abnormal Psychology: 1st Edition*, WASH. STATE UNIV. (2018) ("In the mid to late 1500s, Johann Weyer (1515-1588), a German physician, published his book, *On the Deceits of the Demons*, that rebutted the Church's witch-hunting handbook, the *Malleus Maleficarum*, and argued that many accused of being witches and subsequently imprisoned, tortured, hung, and/or burned at the stake, were mentally disturbed and not possessed by demons or the Devil himself.") cf. *Pseudomonarchia Daemonum* (1577).

yes, yes, the appropriate intervention at that point to keep society safe during our witch wave that we are undergoing is to burn them at the stakes. Yes, all of that is true, but keep one thing in mind. Notice that an awful lot of these witches that we burn are older women. It turns out that I, as a doctor, have noticed that as people get older, and especially women, they have atrophy of the lacrimal glands in their eyes. Sometimes people cannot produce tears because the glands have atrophied. So the next time you believe you have discovered somebody who is a witch and carousing with Satan, and you are all set to burn them at the stake, first make sure that there is not some mitigating circumstance. Make sure that their lacrimal glands have not atrophied with age. As soon as you can rule that out, then go ahead and do the right thing. Burn them at the stake.

This is what reform of the criminal justice system looks like in the context of what we now know about not only the biology of lacrimal gland aging, but everything else about how our brains work. Just to show what a total bleeding-heart liberal Weyer was, his book was banned by both the Protestant and the Catholic Church. What we are left with is instead a much more radical intervention because this is not a case of reform.

What we see is: if you truly follow the logic of all these findings, which are likely to continue to grow, is that justice, evil, punishment, retribution, responsibility, laziness, and immorality—every one of the words—is completely scientifically irrelevant to making sense of our behavior. What we are left with is a model that we all function with.

What do you do when a car's brakes do not work? You sure as hell do not let it go out and drive. That would injure someone and cause damage. If you can fix the brakes, go ahead and do it. If you cannot fix the brakes, what you do is lock the car up inside a garage for the rest of time. This is the intervention. The critical thing is nobody sits there and says that that car deserves not to be able to be driven in a nice park on a Sunday afternoon. We have subtracted a notion of blame, evil, and volition out of it entirely. This is going to sound like an absurd reductionism, but this is the same model we have to have for ourselves.

You may say it is dehumanizing to view us as nothing more than mechanistic productive machines, but it is better to dehumanize us that way than to demonize us with sermons about the rotten state of our soul.

What we are left with is this notion that free will is the biology that has not yet been discovered. That is what we call it until we figure out what is really happening.

What are you supposed to do with that from a legal standpoint? You have to operate with two certainties from what we know about the history of all of this. The first is the lesson of the history of epilepsy - the transition of epilepsy from being demonic possession to a neurogenetic disorder of potassium channels doing screwy things with your action potentials. We have learned it is virtually guaranteed that the judgments you make now about the causes of behavior, and especially the harshest judgments that you make, future centuries people look back at you and they will say, "My God, the ignorance at the time and the damage that they caused to people who suffered for things that they were not responsible for."

The history of theorizing about autism and schizophrenia teaches us is there is a pretty good chance that in your own lifetime, in your later years you are going to look back and say, "My God, the things that I believed before people knew x, y, and z. The damage that I did."

What we see here is the same lesson over and over. We do not have a clue about the subterranean biology that is shaping who we are in ways we have no control over. We had therefore better be conscious of that fact every time we judge someone harshly.

If that sounds extreme enough, what I want to spend the last couple of minutes on is taking on a category that is even more difficult than convincing us not just to subtract satanism out of our views of epileptic seizures. It is to subtract responsibility and volition out of our views of all criminal behaviors.

That is going to be a hard thing to do. We have proven we can do it. We do not think of epileptics as being demonically possessed. We think of it as being a heartbreaking tragedy. If somebody who with

no history of epilepsy has a grand mal seizure while they are driving and they lose control of the car and injure someone in the process, we know that it is an outcome of neurological luck that that happened. It was not an evil soul committing a crime.

We can do that. We have shown we can do that. It has taken us four hundred years to think of epilepsy that way. It has taken us fifty years to do that with schizophrenia. But we can do that.

What is a much tougher domain is one that in some ways is more pertinent. I would guess that everybody sitting and listening to this lecture has a certain profile. The odds are that with great frequency in your past someone has said the following words to you: nice job, good job, good paper, good stance that you argued, good charitable act, good empathetic notion, nice job that you did, nice job at choosing to have done that good thing.

Just to make it utterly absurd, think about a circumstance where someone will say, "Oh, you have such lovely cheekbones." Thanks, thanks, thanks, for making it sound as if I chose to have the zygomatic arches of my skull have a certain shape to them. It is just as utterly irrelevant to think in terms of blame and punishment. It is just as irrelevant to think in terms of praise and differential reward.

Here is an example of where we hit a wall with this. Your kid brings home a wonderful report card. You have two options to respond to them. One version has been studied by a Stanford colleague of mine, Carol Dweck.³⁸ You could sit there as a parent and say, "Wow, what great grades! You must be so smart." Or, you could say, "Wow, what great grades! You must have worked so hard." When you say, "Wow, you must be so smart," what you were implicitly also doing is teaching the child for their whole life that when you work hard at something it is an indication that you are not so smart. You should be able to do it perfectly. Every neurotic parent out there can tell you about Dweck's studies. Don't say you must be so smart. Say, "You work so hard."

³⁸ Lisa S. Blackwell, Kali H Trzesniewski & Carol Sorich Dweck, *Implicit Theories of Intelligence Predict Achievement Across an Adolescent Transition: A Longitudinal Study and an Intervention*, 78 CHILD DEV. 246, 263 (2007).

What that taps into is an utterly false dichotomy that we have here. It is between the biological stuff going on in us, over which we have no control, and all the stuff we do with those biological tendencies that are a measure of our gumption, self-discipline, tenacity, and all those admirable traits. This comes up with a false dichotomy.

Yes, you can have the biological abnormalities that produce a pedophile. That is out of your control. But it is in your control whether or not you resist those urges. This idea was aired in an influential op-ed piece by a legal scholar during the Jerry Sandusky trial.³⁹ Yes, there are genetics for proclivity towards alcoholism. You have no control over that, but you can choose not to enter the bar.

This is what the last forty-five minutes of this talk has been about. Destructive sexual urges, proclivities toward alcoholism, having epileptic seizures, not being all that bright, or not having the loveliest of faces is as much the outcome of your biology as resisting those urges, not entering the bar, not driving without epilepsy meds, working hard, or not getting a hideous nose ring. Both these destructive and self-destructive impulses, and the power to resist them, are the result of the frontal cortex that you have, the countless circumstances that give it shape, and the biology that continues to drive its development. These are the things that have brought you to this moment.

Now, a way to appreciate this is to go back to ACE scores. We see the totally out-of-your-control, lousy luck of winding up with these adversities showing this relationship. Many of us here in a setting like this are not the outcomes of our ACE scores but what I am calling our RLCE scores, our ridiculously lucky childhood experiences. I have come up with a completely arbitrary list. Some of them include: being held and hugged a lot, being raised in a safe and healthy neighborhood, and having loving and expressive parents. They show all of my biases as to what counts as a good upbringing. They are put up in contrast to the ACE scores. We can probably compute an RLCE score the same

³⁹ James Cantor, *Do pedophiles deserve sympathy?*, CNN (June 21, 2012, 10:32 PM), <https://www.cnn.com/2012/06/21/opinion/cantor-pedophila-sandusky>.

way we compute an ACE score. That for every increased number you have on your RLCE score, you are going to have roughly a thirty-five percent increase in the odds of all of these wonderful, good outcomes such as: being able to play a musical instrument, writing a good five paragraph essay, and knowing all the words to Kumbaya.

Again, this is subjective. I happen to like musical instruments. I think that writing a good five paragraph essay is probably a good thing to aim for. I once knew all the words to Kumbaya. What we see is all of the lessons about the biological lousy luck over which we have no control.

That brings us to our million years' worth of scores, outcomes, and diversity. It is the exact same thing going on with the random good luck that has brought us here. We who would think of ourselves as the ridiculously lucky ones. All these insights are pertinent to how we judge them and their bad behaviors are just as pertinent to us, and how we are praised inappropriately and rewarded inappropriately for the best of our behaviors, over which we had no control.

Okay, this is a lot here. What I should admit to at this point is, amid my being totally intellectually at peace with the notion that we have no free will whatsoever, is that I have no idea how we are supposed to function. Truly, truly accepting all of this, I have to prove it to myself over and over again when I am reacting with visceral rage when hearing about some horrendous mass shooting. There are three and a half seconds before I am able to go through the biology of it. For three and a half seconds I think, "Yeah, fry that son of a b**** who did that act. Yes, definitely throw a federal hate crime at him so he can get the death penalty." Before I say, "Whoa, he had nothing to do with that," I have just as much trouble going through the biology for three and a half seconds when someone says to me, "Wow, nice paper you published recently." For three and a half seconds I feel as if I had something to do with that. Then I go through it, which is incredibly hard and I have no idea how we are supposed to function.

Nonetheless, we have proven with the likes of epilepsy that we can think this way. What I think we are left with at the end is to admit vast confusion as to how we are supposed to function are three things

that come to me over and over. If we lack free will, and are nothing more or less than biology, we may fall into existential despair. What that means is you are one of the lucky ones. What you are finding out is that the things you have been rewarded for and praised for had nothing to do with your choices. They were the outcome of biology.

If instead what you have spent your life doing is being punished for and judged harshly for the belief that you had choices over things that you did not, then a lack of free will is not grounds for existential despair. It is grounds for the most liberating state you can imagine.

The second punchline is that when you accept that you have no more right to claim that you have a right to anything more than anyone else. Then, the notion of entitlement becomes biological, scientific gibberish. We have no more rights than anyone else because we have no more to do with who we are than anyone else did.

Finally, this last point strikes me as the most important point. It is also the one I constantly struggle with because it is so hard to think this way. If you truly recognize the extent to which we are nothing more or less than our biology, then there is never a rational reason for hating anyone for anything they have done. This is similar to how there never is a rational reason for hating the damage caused by an earthquake or a tornado.

None of this is easy. None of this is easy especially in the context of the legal system. It sure is even harder in the context of how we view the rest of our lives. I am convinced by looking at the history of how we have come to think more this way in some domains, that all that can come from this is vast amounts of social good.

So, thank you for your attention. I am assuming most of you are not going to quit law school tomorrow on this basis of this talk, but it would be nice if you kept this in mind as you go into a profession where you judge people for things over which biology gave them no control.