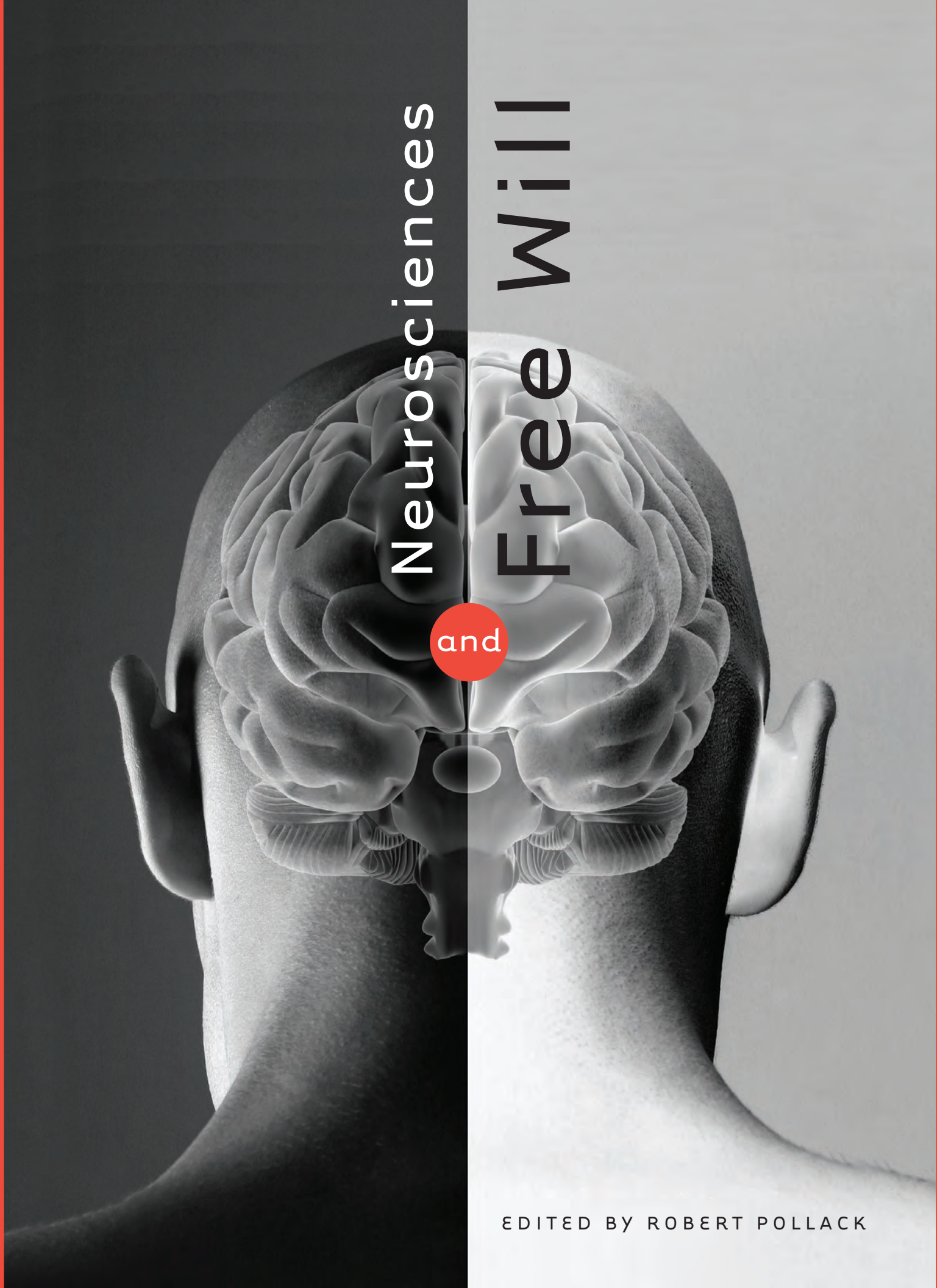

EDITED BY ROBERT POLLACK

Neurosciences and Free Will

Neurosciences and Free Will is the proceedings of a symposium held March 30-31, 2008, at Low Memorial Library, Columbia University, New York. The third in a series of symposia sponsored by the Fetzer Institute of Kalamazoo, MI on the science of spiritual questions, this program brought together leaders in the fields of neuroscience, physics, philosophy, psychology, and theology from a variety of religious traditions to discuss the scientific, philosophical, and moral questions raised by recent findings in the sciences on free will.

Neurosciences and Free Will

Edited by Robert Pollack

Center for the Study of Science and Religion
at the Earth Institute

Columbia University

New York

The Center for the Study of Science and Religion wishes to acknowledge the support of the Fetzer Institute in the publication of this book. We also would like to thank Nicholas Frankovich for his excellent work editing the manuscripts, and Susan Gordis for transcribing a portion of these contributions.

Columbia University in the City of New York

Contents

Preface

This volume presents the contributions of many colleagues to the spring 2008 Neurosciences of Free Will Symposium held at Columbia University in the City of New York. The symposium was cosponsored by the Center for the Study of Science and Religion (CSSR), of the Earth Institute at Columbia, and by the Fetzer Institute, Kalamazoo, Michigan. The symposium brought together experts from intellectual domains as diverse as astronomy, Buddhism, neurobiology, Christianity, physics, and Judaism. They all defined, explored, and discussed free will from their different but intersecting viewpoints.

Our goals for this forum, as for our two previous symposia, were to bridge the gap between scientific and religious worlds, to reconcile differences that many once believed to be irreconcilable, and to clearly anatomize remaining gaps.

In the opening remarks, Paul Gailey, physicist and senior science advisor to the Fetzer Institute, stressed the importance of studying free will from multiple disciplines and reminded the audience that our knowledge has so far raised more questions than it has answered. Jeffrey Sachs, director of the Earth Institute, Columbia University, responded with a detailed tour of the central nervous system's changes as a person makes a decision, by way of arguing that current knowledge of neurophysiology is insufficient for us to understand free will.

The three speakers in the first session, "Free Will in the Natural World," discussed the notion of free will in the contexts of the human brain, the natural universe, and the human genome. Darcy Kelley, professor of biological sciences at Columbia, explained how brain functions express the burden of decision-making when rationality and emotionality conflict. David Helfand, professor of astronomy at Columbia, argued forcefully that we should seek understanding rather than any sort of "meaning" beyond understanding, warning that failure would lead us back to the anthropocentrism of the Age of Myth. Paul Appelbaum, professor of psychiatry, medicine, and law at the College of Physicians and Surgeons of Columbia University, outlined how recent advances in behavioral genetics have changed our interpretation of free will and personal responsibility, especially in the criminal courts.

The second session of the symposium, "Right and Wrong," focused on free will in light of morality. David Krantz, professor of psychology and statistics at

Columbia, explained how the study of perception and choice are central to understanding free will: People judge moral responsibility for an action to be diminished when they perceive that the action is not freely chosen. Alan Mittleman, professor of Jewish philosophy at the Jewish Theological Seminary, and B. Alan Wallace, president of the Santa Barbara Institute for Consciousness Studies, addressed the struggle between determinism and free will as it is dealt with according to Jewish and Buddhist traditions, respectively.

In the last session, "Emergence," Nobel Laureate Charles Townes, professor of astrophysics at the University California, Berkeley, made the argument for a scientific agenda that would seek to understand free will through the testing of disprovable hypotheses. Piet Hut, astrophysicist at the Institute for Advanced Study in Princeton, responded in conclusion with the argument that questions about free will could not be answered with our current tools for understanding, so that investigation of the issue remains a task for the future.

Lee C. Bollinger, president of Columbia University, opened the concluding session by extolling the ability of science to challenge the certainties of the day. The senior minister emeritus of the Riverside Church, Reverend Dr. James Forbes, now president of Healing of the Nations, closed the symposium with a powerful sermon on the relationship between faith and free will.

On behalf of the CSSR, we wish to thank Fetzer Institute president Rob Lehmann and his board for their continued support of this seminar series, and our colleagues for providing us with the manuscripts of their presentations. Finally we wish to thank Ossian Foley, Cynthia Peabody, and Miranda Hawkins of the CSSR for their tireless support of this project, Nicholas Frankovich and Susan Gordis for editorial support, and Mark Inglis for his brilliant designs.

Eleni Nikitopoulos
Robert Pollack

January 2009

Neurosciences and Free Will

Welcome and Opening Comments

Paul C. Gailey

Bob Pollack and I dreamed up the idea for this meeting a couple of years ago, but we owe the skillful work of realizing the vision to the organizer Eleni Nikitopoulos, along with Ossian Foley, Stuart Gill, Miranda Hawkins, Erin Lothes, Keely McPhearson, Weiyi Mu, Cynthia Peabody, and Andrew Sinanoglou.

The CSSR has created an excellent environment for these talented individuals to come together and generate many remarkable products, including this meeting. It is especially invigorating to engage the natural interest of the next generation in this quest.

A deep thank you to all our speakers for participating and making this symposium possible.

From the Fetzer Institute, I'm joined here today by David Addiss, senior program officer, Wayne Ramsey, Kate Olson, and Rob Lehman, chairman of the board. Fetzer has partnered with the CSSR for several years to explore topics related to Fetzer's mission including love, the nature of consciousness, and, with this meeting, our multifaceted and rapidly changing understanding of free will. Before introducing our opening speaker, I'd like to say a few words about our topic and the program.

Why reexamine free will? We know this topic as a human preoccupation for some millennia. In the past, it was mainly the province of philosophers and theologians. Why hold a public symposium on the topic now, in the early part of the twenty-first century?

I would like to make the case that this subject is of critical and immediate importance to us all at many different but interconnecting levels. No one perspective will suffice in addressing what is becoming an increasingly important issue of both scientific and human dimensions. I will go even further in stating that too rigid a grasp on any one perspective will likely lead us astray—into narrow ideologies and mere caricatures of the greater richness of human experience.

The Fetzer Institute and the CSSR hope that this symposium will serve not only to inform, but to stimulate your thinking about both the intrigue and the

importance of the question of free will in its modern incarnation. We'll explore the question from the perspectives of neuroscience, philosophy, physics, psychiatry, theology, economics, and evolutionary biology, in addition to touching on the important implications in ethics and justice.

More than one hundred years ago, William James wrote, "The whole sting and excitement of our voluntary life . . . depends on our sense that in it things are really decided from one moment to another, and that it is not the dull rattling off of a chain that was forged innumerable ages ago."

More recently, psychologist Daniel Wegner makes a good case for the increasingly popular idea that there is no such thing as free will. He writes: "This means . . . that conscious will is an illusion. It is an illusion in the sense that the experience of consciously willing an action is not a direct indication that the conscious thought has caused the action."

Many of us are also aware of the experiments of Benjamin Libet, which indicate that the body initiates an action well before a conscious decision is even formed in our awareness. I'm sure we'll hear more on these topics today and tomorrow. So, can we assume then, that the verdict is in and the neurosciences have answered our questions?

Unfortunately, no—these answers, in my opinion at least, only raise more questions. And we will be wise to consider some parallel perspectives. Conclusions based on the Libet experiments and similar work follow from simple logic: A cause must precede an effect.

What is our concept of free will? Is it that we humans are able to originate independent causes? Are we "white holes," as it were, sources from which causation appears in the universe?

Already the problem begins to engage the disciplines of physics and philosophy. In physics, we are faced with an interesting problem: That is, in a mechanistic model of the universe, there are no new causes after the Big Bang. The rest happens as a consequence.

But again, the plot thickens. We know from the newer disciplines of nonlinear dynamics and self-organization that nonlinear systems with instabilities—they represent most of nature—evolve according to physical law but are intrinsically unpredictable. That is, the future does not follow from the past in the limit of any finite specification of the system.

Studies of the solar system by Poincare more than one hundred years ago revealed these truths, and more recent studies—Lorenz, Haken, Prigogine, and many others—have only expanded on this paradoxical story. They've proven that we were right about the weatherman all along—now we know for sure that the weather cannot, even in principle, be predicted.

But therein dwells yet another layer of mystery. Self-organizing or emergent systems, such as a hurricane, your heartbeat, or, for that matter, the activity of your brain, twist our logic into a Mobius strip. Our conclusions about free will were based on the simple linear logic of a cause leading to an effect. What could be more unassailable?

Yet, in the self-organizing systems mentioned, causality takes on a very substantial topological twist. The model of linear causality fails because in these systems, the causality is circular—something like a hermeneutic circle.

It is the interaction between air molecules that gives rise to a hurricane, but it is the large-scale structure of the hurricane itself that entrains and organizes the air molecules. Giving a gift may represent part of the process of developing a friendship, but the friendship can also be the reason for giving a gift.

While we normally think of bottom-up causality in science—for example, neuronal activity giving rise to mental activity—self-organizing systems demonstrate inescapably that top-down causality is equally important.

There is no little man inside a galaxy running from star to star telling them each how to behave in order to form the beautiful spiral structure we see, any more than there is an independent agent telling the molecules of the hurricane how to organize themselves. We can't identify a cause for these self-organizing systems, just as we can't find the beginning of a circle.

Now what does this new but highly relevant and demonstrable geometry of logic do to our question of free will? On first thought, it may force us to question the structure of our questions rather than finding contentment with our tentative answers.

Perhaps it is also fair game to ask what this implies about the entire scientific enterprise. If we in fact do not have free will, what is the meaning of a scientific experiment? Is the entire process not predicated on the belief that the experimenter has a choice in how he or she sets up the experiment?

If we maintain that the subjects of our experiments do not have free choice, must we not also admit that neither the researcher, the journal reviewer, nor we as readers are bound by the same limitations? How then can we understand our own scientific findings? And who or what is the watcher? Such questions are surely incomplete if we fail to mention quantum physics.

Einstein, Bohr, Heisenberg, Bohm and others struggled with the strange finding that the choice of the experimenter determines the nature of what we previously thought of as immutable, objective reality. Physicist John Wheeler states that we as observers are free to decide in which way we will bring a quantum phenomenon to its conclusion. In choosing our measuring devices, we decide which phenomenon can become reality and which one cannot.

Wheeler goes so far as to interpret individual quantum events as elementary acts of creation. Are there indeed fresh causes in the universe? Is this a sort of elementary "free will"?

These are not "backwater" ideas from physics. In "The Free Will Theorem," a recent paper in the journal *Foundations of Physics*, two Princeton researchers explore the implications of both possibilities—free will on the part of the experimenter and free will on the part of the quantum phenomenon itself.

But let's leave the deeper thinking about these scientific issues to the speakers who follow and consider for a moment what all these new findings mean to us on a human level. In just the past few years, major efforts have begun in the new fields

of neurolaw, neuromarketing, neuroethics, and neurotheology, to name a few.

We, as human beings, are in the process of redefining ourselves and the implications are stunning. If there is no conscious self originating our actions, if we are not sovereign sources of our own will, does the door open wider toward "brain engineering"?

Thomas Metzinger of the University of Mainz asks, "What is a good state of consciousness?" What is the best state of the human brain for a global society? Should human beings leave behind concepts of the sanctity of the individual? Shall we engineer ourselves to better get along?

According to Metzinger,"Neuroscience is now quickly transformed into neurotechnology. I predict that parts of neurotechnology will turn into consciousness technology…. Whenever we understand the specific neural dynamics underlying a specific form of conscious content, we can in principle delete, amplify or modulate this content in our minds."

Will human beings resist using such technologies? And if not, with what motives will they be used? We need not stretch our imaginations very far to guess how they will be used by marketers, governments, and others who strongly wish to induce one group or another to conform to their desires.

And all this may be closer than you imagine. The March 20 issue of *Nature* includes a paper entitled "Identifying natural images from human brain activity." The researchers are successfully reconstructing from fMRI data what you are seeing mentally. These technologies are being developed rapidly.

We will be faced by many questions in the coming years. Shall we reengineer the brains of criminals? Shall we change our system of justice that is based on the concept of choice and self-responsibility? What will be our ethics?

I hope this brief introduction piques your interest and persuades you that it is indeed time to revisit the question of free will in a serious way. Nothing less than our vision of ourselves as human beings and the basis for the way we live together is at stake.

Opening Remarks

Jeffrey D. Sachs

WHY AM I HERE, YOU MAY WANT TO KNOW. I AM AN ECONOMIST IN A room of neuroscientists, biologists, philosophers, and theologians. Am I here of my own free will? Or is this a compulsion that I obey as director of the Earth Institute? Am I in a reverie to think that I know something useful about this topic?

At one level, the answer is easy. Bob Pollack asked me, and I always say yes to Bob. But of course that just pushes the problem back one level without resolving it. Why do I say yes? Here, I would insist, free will is truly at play. Whenever Bob asks, my prefrontal cortex (PFC) jumps into action. Yes, I could imagine in my mind's eye today's conference. I knew that it would be rewarding. No doubt, my dopamine began to jump. I'm sure that my limbic system jumped into play as well. Fear, after all, could not be far away. What on Earth could I talk about? Here came the adrenalin surge, and the beginnings of the fight-or-flight response, underline *flight*. But then the hippocampus, and its long-term memories of the Columbia campus, kicked in. I remembered that, when Bob asked me to speak about love, I ended up loving the occasion and learning a lot as well. In the end, the prefrontal cortex ended the discussion with my amygdala. The adrenalin subsided. The PFC's executive command issued orders to move my fingers on the keyboard. "Yes, of course, Bob, I'll be delighted to come," I typed. And here I am.

The issue of free will is of course an age-old question, but we can now approach it with breathtaking, if still limited, scientific advances. In a general sense, I believe that today we are engaging in consilience, E. O. Wilson's concept of the jumping together of knowledge. Like Ed Wilson, I believe that neurobiology has the potential to provide one of the great breakthroughs of our time, perhaps the best chance to improve our understanding of human nature and to act usefully on that knowledge. Our human consciousness and our human conscience are being opened up to dazzling scientific inquiry. The evolutionary and physiological bases of human behavior are being elucidated before our eyes. And our belief, as ancient as the Buddha and Socrates, that by knowing ourselves we can lead richer lives and have more productive societies can, I also believe, be brought closer to fruition.

Free will is partly about the ancient mind–body problem: Is there a mind separate from the brain? Is the mind the "soul"? Can the mind shape the brain? Can the mind cause action? It is, of course, also about basic questions of cause and effect. If the mind can cause action, what causes the mind to make decisions that cause action? I will use the term *free will* in one main sense: actions that are taken after conscious self-reflection, even if, or particularly if, those decisions are based coherently on goal-oriented, cause-and-effect motivations. In human terms, free will, I would suggest, does not mean a lack of preceding causes but rather a grounded and functional self-awareness of those causes.

Cognitive neuroscience, with the added perspective of evolutionary psychology, can help us to make much better sense of these ancient questions. Moreover, growing experimental evidence, including through powerful instruments, such as functional magnetic resonance imaging and the studies of brain lesions, are uncovering the very physical states of our brain that correspond with our mental states and hence with our decision making, emotions, and behaviors. Free will can be studied fruitfully in this context. Indeed, such productive opportunities have never before existed.

Here are a few of the things I think the sciences of mind and brain are helping us to see. First, the brain is the seat of the mind, and brain structures shape the functioning of the mind. The world of science has largely abandoned, for compelling reasons, the brain–body dualism of Descartes. Neural systems correspond with modes of cognition, emotion, and other conscious and unconscious repertoires of mind.

Second, the human brain has been built in the course of evolution, through an accretion of levels of function and structure. Famously, we still have our reptilian brain. Elliot Spitzer just proved it again. We have overlays of ancient, almost abandoned brain functions, such as the visual centers of the midbrain, which have been mostly supplanted by the visual centers of the frontal cortex. The human brain has been built up mainly by adding new parts to older working models.

Third, like many complex systems, and for reasons outlined by Herbert Simon, Nobel laureate in economics and noted for his work in decision science, the brain is indeed a hierarchical and semi-decomposable system of subsystems, including the cognitive and sensory components of the prefrontal cortex, the emotional mechanisms of the limbic system, the memory functions of the hippocampus, the sexual urges and homeostatic feedbacks of the hypothalamus, the reward centers of the midbrain, the social cues of the anterior cingulated cortex, and countless others. This is the only way for a complex system of 100 billion neurons and 500 trillion synapses to have evolved.

Fourth, in this context, who we are, our self and sense of "I", our very consciousness, is best understood as an emergent property, in that it is built up by the highly complex interactions of these subcomponents. Consciousness and the "sense of self" is a recent addition to nature—essentially human traits, made possible by the vast increase of our frontal cortex.

Fifth, our sense of an integrated self—together with the closely related sense

of consciousness—yields our species huge advantages in natural selection and cultural transmission. They lie at the core of successful problem solving, goal attainment, and social cooperation. The old Bantu proverb, "I am because you are," is not only good village ethics but also good evolutionary psychology. Mental health is marked by the successful integration of these components. When they disintegrate, we say that a person has decompensated. Then help is urgently needed.

Sixth, even though the self is an emergent property, there is also a meaningful sense in which the self can integrate the subsystems and then loop back to instruct these same subsystems. The neurological evidence points to the special role of the prefrontal cortex as the main integrative center, which is hardwired to bring information from a range of sources—the senses, the emotions in the limbic system, the long-term memory, and the unconscious—into an attentive working memory and then confronts that information with goals and possible behavioral responses. The PFC then sends back instructions to the rest of the brain for implementation of decisions.

Seventh, free will, I believe, emerges when our conscious selves are successfully integrating knowledge and coherently making goal-based decisions. This, we now better understand, does not mean overriding our emotions by our cognition, an earlier viewpoint that has proved to be fallacious. Rather, it means integrating our emotions, cognition, and instinctive reactions in a highly functional manner, consistent with our human nature and our sociability.

Eighth, free will, it seems to me, is a matter of degree. We become more free the more we understand our own minds and brains, our conscious and unconscious motivations, our instincts and our problem solving. A conference like this, I believe, can indeed help to set us free. Ninth, one of the key functions of consciousness is "gap-filling," meaning that our brains fill in the gaps of what we see, hear, think, and believe about the environment in which we live and move. Our consciousness, indeed, creates narratives that make sense of a vast amount of sporadic information. In the words of neurologist David Linden, our consciousness creates "coherent, gap-free stories." This is a remarkable feature of an efficient, highly adaptive, and goal-oriented decision-making system, but of course it can cause trouble as well.

Tenth, the mind can easily be tricked in countless ways—evidenced, for example, by our assuming that we have conscious will for decisions which were really taken unconsciously; attributing causes to patterns when none exist; misperceiving objects and people according to cues and priming; being vulnerable in countless ways, including the placebo effect, to misattribution of cause, suggestibility, and biases.

Specifically, the sense of free will itself can be illusory, in the ways described by Daniel Wegner in his famous study, *The Illusion of Conscious Will*. We may believe that we are consciously integrating knowledge to pursue our goals when in fact we are responding to unconscious processes. The famous work of Benjamin Libet demonstrated that unconscious signals precede conscious knowledge in many decisions. Similarly, it is entirely possible to induce experimental subjects to make

decisions, such as to raise a right or a left arm, that are controlled by the experimenter while all the time the subject thinks that the decisions are being freely made. Wegner terms this the "illusion of control." Similarly, he points to remarkable cases of "automatism," such as hypnosis, in which individuals engage in complex behaviors with no conscious willing of their actions.

These extraordinary cases exemplify the truth that "consciousness," the "self," and "the will" are all emergent properties and that it is possible to trick, or substitute, our brains by hijacking one or more of the underlying components of our brain functions. But this does not mean that *all* is illusion. The fact that our senses can be tricked does not mean that our eyes and ears *always* lie. Nor does the ability to trick our consciousness to believe that we've caused something outside of our control mean that our conscious will is always an illusion.

Why does all of this matter, and matter urgently? For three critical reasons, I believe. First, we can better understand ourselves. Second, we can hope to improve ourselves as individuals. And third, of much interest to me as a social scientist, we can help to build social institutions more attuned to our human nature and therefore more adept at avoiding some of the traps of human nature, most notably violence, war, and discrimination between "us" and "them," all of which seem to be hardwired to some extent as a result of our species' long sojourn in the African savannah. Yet hardwired does not mean immutable or impervious to moderation.

On the individual level, we are better off to see our struggles between temptation and rationality not as the work of the devil but as the work of ingrained tendencies in the brain stem, the limbic system, and the cortex. That's not an idle observation, I believe, but an operational one. By better knowing the reasons for our actions, by understanding that we are indeed guided by overwhelming unconscious urges as well as conscious ones, and by uncovering those in a scientific way that Sigmund Freud could not hope to do, we can indeed hope to find some respite from the hard struggles of life.

In a recent book, *Train Your Mind, Change Your Brain*, science journalist Sharon Begley describes how patients with obsessive-compulsive disorder were, for the first time, able to confront and overcome their disorders when they watched their limbic systems light up under an fMRI. The feedback from monitor to mind to behavior was rapid and life-improving, at least for some of the patients. Self-knowledge was power. And indeed, this is a sense in which free will was regained.

This leads more generally to my second point, neurobiology as liberation, and free will as a progressive human goal rather than simply a matter of human nature. By understanding the wonders as well as the limits of our brains, by recognizing how we are easily duped and how easily we dupe ourselves, we have an opportunity to overcome much avoidable pain. What is especially exciting, I believe, is that in doing so we can combine ancient wisdom and cutting-edge knowledge. When it comes to understanding the brain, the partnership of the Dalai Lama and the MIT neuroscientists provides a wonderful service to us all. Buddhist meditation and philosophy, Jewish, Christian, and Muslim teachings on justice and ethics, and nuclear magnetic imaging will all play their role.

As a social scientist, I am persuaded of a third point. Understanding human nature in its neuroscientific complexity will give us new tools for social life. We learn, for example, how our limbic system, our brain's fear and aggression centers, are primed by hunger and deprivation. We learn how the inhibitory impulses of the cerebellum induce us to respond to pressure with greater force than we understand we are applying. Unwanted escalation can be hardwired in certain circumstances. We learn, again and again in psychological studies, how we are prone to magnify tiny differences into great divides of "us" versus "them." In all of these ways, we are not free at all but gripped by unconscious forces that we need to understand in order to control.

In his preface to my new book, *Common Wealth*, E. O. Wilson put the human predicament in the following way. As we grapple with our massive ecological and geopolitical challenges, Wilson notes that "we exist in a bizarre combination of Stone Age emotions, medieval beliefs, and god-like technology. That, in a nutshell, is how we have lurched into the early 21st century." Or, as he concluded *Consilience*, "It is worth asking repeatedly: Where are our deepest roots? We are, it seems, Old World, catarrhine primates, brilliant emergent animals, defined genetically by our unique origins, blessed by our newfound biological genius, and secure in our homeland if we wish to make it so."

We are, I believe, most importantly, the progeny of a shared evolutionary path, all Africans, and now all citizens of a crowded, conflict-ridden, and environmentally threatened planet. We have an incredible capacity for reason and joy but also for panic, fear, and aggression. And we are potentially free. Today's conference can help us on that quest.

The Volitional Brain?

Darcy B. Kelley

THE FIELD OF NEUROSCIENCE—THE STUDY OF NERVOUS SYSTEMS—IS relatively young. Its birth is usually marked as the first meeting of the Society for Neuroscience here in New York City in the fall of 1975. The meeting brought together scientists from a variety of disciplines—neurology, psychology, biophysics, psychiatry, development, ethology—to forge a combined approach to understanding the brain.

At the time of that first meeting, we already had a considerable amount of information about that portion of the human brain whose elaboration is pronounced in our own species, the cerebral cortex (fig. 1).

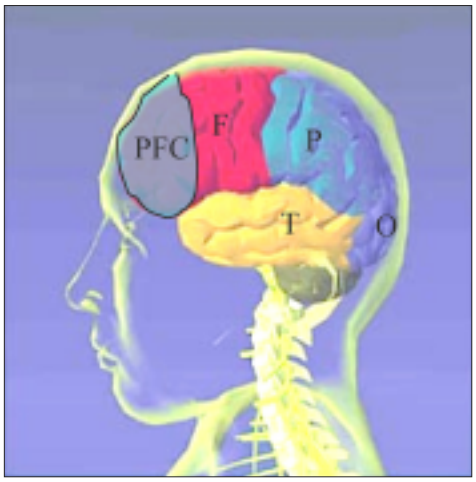

FIGURE 1. The human brain viewed from the left side. The lobes of the cerebral cortex are the temporal (T), the occipital (O), the parietal (P), and the frontal (F). The prefrontal cortex (PFC) is the most extreme anterior portion of the frontal lobe.

We knew that information on sound, including human speech, is processed in the temporal lobe, that vision reaches the occipital lobe, that sensations from the body are represented in the parietal lobe, and that control of movements involves the frontal lobe.

More mysterious then, however, was the extreme anterior portion of the frontal lobe, the prefrontal cortex. What we knew of its function was largely wrapped up in the study of a singular neurological case, that of a railway man who received a shocking wound to his brain in the fall of 1848: Phineas Gage. Gage led a crew of workers who were blasting a railroad bed for the Rutland and Burlington line in Vermont. The blasting operation involved drilling a hole into rock, inserting

explosive powder, and plugging the hole with sand. To direct the explosive force into the rock, the sand was compressed with a tamping iron. On September 13, 1848, Gage was charging the hole, gently tamping the powder before adding the sand. He had turned away from the hole to check on his crew when the rod hit a rock. The explosive ignited, and the rod was propelled through his face, entering under the left cheekbone and exiting through the top of the skull to land some thirty yards distant.[1]

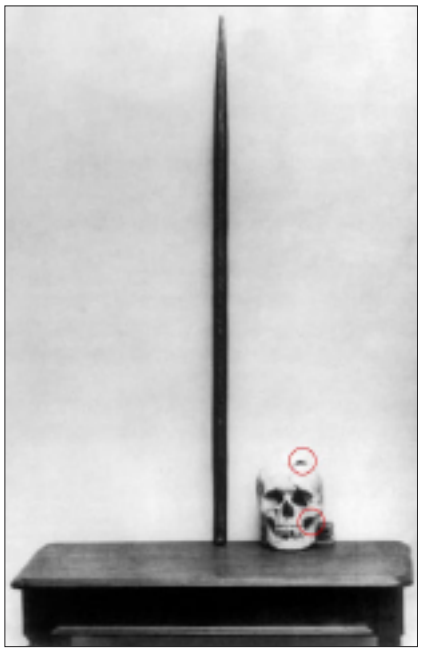

Figure 2. The tamping iron and the skull of Phineas Gage. I have circled the entry and exit wounds made by the spike (cheek and the top of the skull) in red. Collection of the Warren Anatomical Museum, Harvard University.

After his death in 1860, his family allowed Gage's body and the tamping iron to be exhumed in 1867 at the request of his physician, Dr. Harlow. These were subsequently donated to Harvard and are now on view in the Countway Library of Medicine (fig. 2). Remarkably, Gage walked away from the scene of the accident and, having survived a subsequent infection, his motor, sensory, and memory skills were intact.[2] It soon emerged, however, that he had undergone a change in personality, described by his physician as follows:

> His contractors, who regarded him as the most efficient and capable foreman in their employ previous to his injury, considered the change in his mind so marked that they could not give him his place again. The equilibrium or balance, so to speak, between his intellectual faculties and animal propensities seems to have been destroyed. He is fitful, irreverent, indulging at times in the grossest profanity (which was not previously his custom), manifesting but little deference for his fellows, impatient of restraint of advice when it conflicts with his desires, at times pertinaciously obstinate yet capricious and vacillating, devising many plans of future operation, which are no sooner arranged than they are abandoned in turn for others appearing more feasible. Previous to this injury, although untrained in the schools, he possessed a well balanced mind, and was looked upon by those who knew him as a shrewd, smart business man, very energetic and persistent in executing all his plans of operation. In this regard, his mind was radically changed, so decidedly that his friends and acquaintances said he was "no longer Gage."[3]

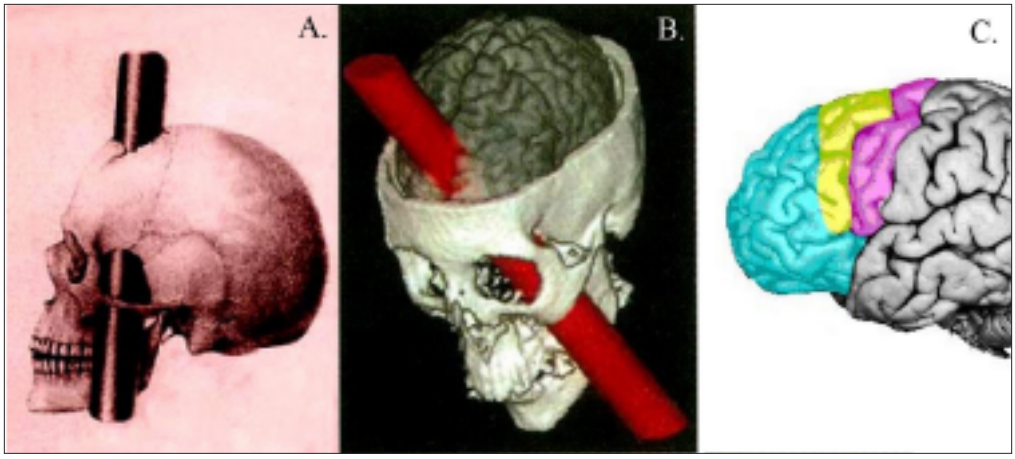

Figure 3. Reconstructions of the injury to Phineas Gage's brain. A. The passage of the tamping rod through the skull as reconstructed after exhumation by Dr. John Harlow (1868). B. The passage of the tamping rod through the left and a portion of the right prefrontal cortex as reconstructed by Dr. Hannah Damasio and colleagues using the original skull and morphometric algorithms.[4]. C. The region of frontal cortex (ventral prefrontal cortex, in turquoise) damaged by the tamping iron.

Hannah Damasio attributes the relative neglect of Harlow's finding to a lack of autopsy findings.[5] John Harlow did not hear of Phineas Gage's death (in San Francisco, apparently brought on by epileptic seizures) until five years later, and so there was no opportunity to examine Gage's brain. To fill in the missing information, albeit more than a hundred years later, and because of a particular interest in the ventral medial aspects of the PFC, Damasio and her colleagues have reconstructed the neural damage produced by the tamping rod in 1848 (fig. 3).

That the case of Phineas Gage was not lost to medical obscurity is generally attributed to David Ferrier, the noted British physiologist, who, in the Gulstonian lectures for 1878, seized on Harlow's findings to support his ideas on the localization of function within the cerebral cortex.[6] Included within Ferrier's first lecture are assertions that remain the bedrock of a modern neuroscientist's view of the link between brain and behavior. "That the brain is the organ of the mind, no one doubts; and that, whenever mental aberrations, of whatever nature, are manifested, the brain is diseased organically or functionally, we take as an axiom." These assertions have a strong bearing on the relation between neuroscience and the concept of free will, a subject that I return to later in discussing diminished responsibility and the legal system.

Thus the case of Phineas Gage, while reinforcing the idea that the PFC is specialized for executive functions, raised the possibility that this region is also involved in emotional responses. Since the late nineteenth century, with the advent of experimental animal model systems and of functional magnetic resonance imaging (fMRI), our view of the functions of the PFC has increased in complexity (fig. 4).

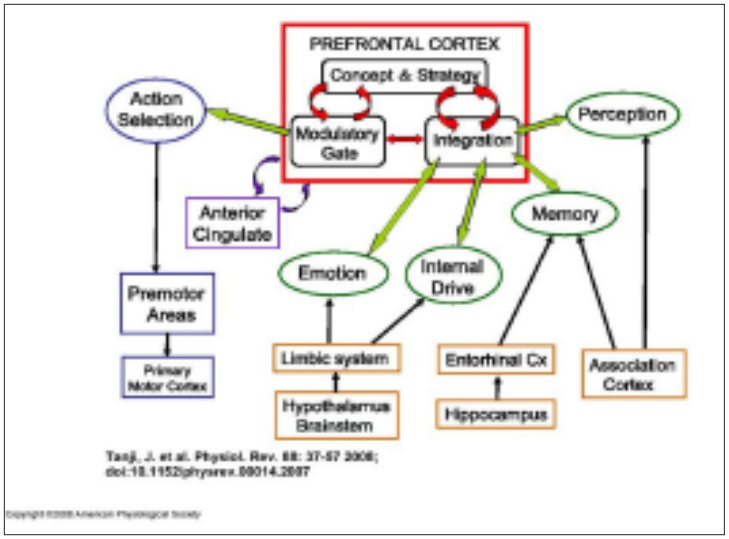

Figure 4. Diagram summarizing the flow of information requiring the executive function of the prefrontal cortex.[7] Areas of the brain are indicated within boxes; functions are indicated within ovals.

Or, to summarize more succinctly: "On a certain metaphorical level, the PFC is the closest thing we possess to a superego . . . it is the job of the prefrontal cortex to bias an individual towards doing the harder rather than the easier thing."[8]

What is the source of information used to produce diagrams of the sort illustrated in figure 4? To address this question, we need to know something about what has been discovered since 1848 about how the individual components of the brain—the nerve cells—work. This knowledge has led to the current techniques for imaging the living, human brain in action, particularly fMRI, a method whose results are germane to uncovering the functions of the PFC.

If we were to draw out, from the cortex, a small slab of brain (boxed in red) and stain that slab with a dye that recognizes nerve cells, we would see the image in figure 5A.

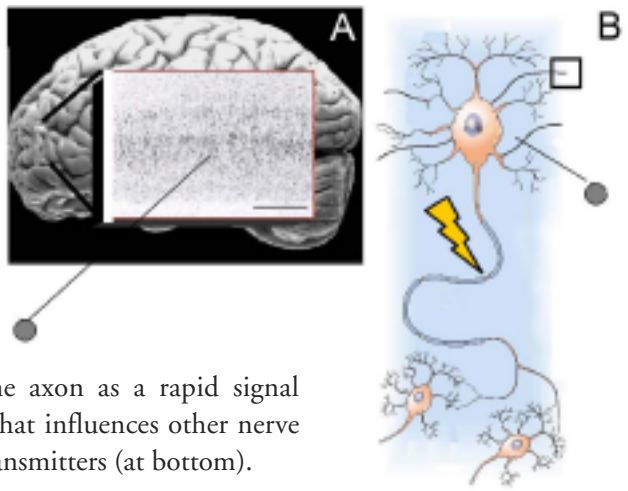

Figure 5. *A.* Side view of the left hemisphere of the human brain. A small slab (boxed in red, 3mm high) has been brought out, enlarged, and stained to reveal nerve cells (small grey dots). *B.* Schematic diagram of a nerve cell. Information is received by the nerve cell dendrites (black box, upper right) and transmitted down the axon as a rapid signal (indicated by a lightening bolt) that influences other nerve cells via the release of chemical transmitters (at bottom).

The transmission of information from one nerve cell to another requires energy and oxygen as the circulation of blood to brain areas with many active nerve cells expands. The oxygen is carried by a blood protein called hemoglobin; magnetic

signals from oxygenated hemoglobin are different from those of hemoglobin that has given up its oxygen to active nerve cells. This difference in signals forms the basis for fMRI, a current method used in visualizing activity in the human brain.

Let's say that we want to find out which part of the cortex is active when you see a checkerboard pattern. We slide you into a scanner and show you the checkerboard pattern (experimental) followed by a blank (control). The scanner calculates the ratio of deoxygenated to oxygenated hemoglobin for every voxel (a very small volume about the size of a grain of rice) in the brain and displays the result as a color-coded brain map in which very active areas are yellow, less active areas are red, and so on (fig. 6).

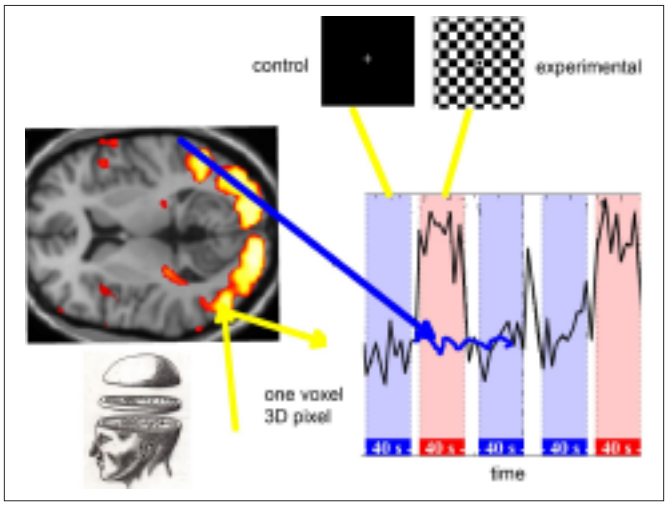

Figure 6. Functional magnetic resonance imaging (fMRI). The checkerboard pattern activates a region at the back of the occipital lobe (fig. 1) of the cortex. If we image an area outside (blue arrow) of the visual cortex, there is no difference in activity when the checkerboard is displayed.[9]

Now let's find out what areas of your brain are active when you try to bring your reaction to a frightening face under control, a study actually carried out by Kevin Oschner and his colleagues.[10] Under these conditions, the left frontal and prefrontal areas are especially active, suggesting that these regions are selectively involved in theFunctional brain imaging can also be used to visualize brain damage more subtle than the insult to Phineas Gage's cortex as well as to compare the spectrum of activity in various brain regions across individuals. One consequence of this new information is that fMRI scans are now quite widely used as a legal defense, particularly in death-penalty cases. In the law, neuroscience links to the question of free will via the idea of diminished capacity or responsibility. Let us suppose that, as the result of an accident, you experience an epileptic fit and strike a bystander. The chances of your being charged in the United States, at present, with assault and battery as a result of your action are very low.

The fit was inadvertent, and your responsibility for your action, even though that action harmed another human being, is diminished. The idea of diminished responsibility is not tied strictly to injury but is also applied to illness (insanity), to developmental disorders (mental retardation), and even to early developmental stages (childhood). We believe that it is wrong for society to seek retribution from individuals who either physically (as in the case of epileptics) or by virtue of recognition that the action is prohibited (as in the case of madmen and children)

cannot control their actions. And so in the United States we may render a verdict of "not guilty by reason of insanity," whereas in the United Kingdom the verdict is "guilty but insane." The idea that guilt relies on sanity is so ingrained in our legal system that madness upends culpability.

But what if some feature of brain function can affect an individual's moral decisions? Is there any evidence from neuroscience that brain activity can predict radical departures from societal norms for moral judgments? This question was addressed in a study of ethical choices made by people who had all suffered damage to the ventral, medial prefrontal cortex (fig. 7A).

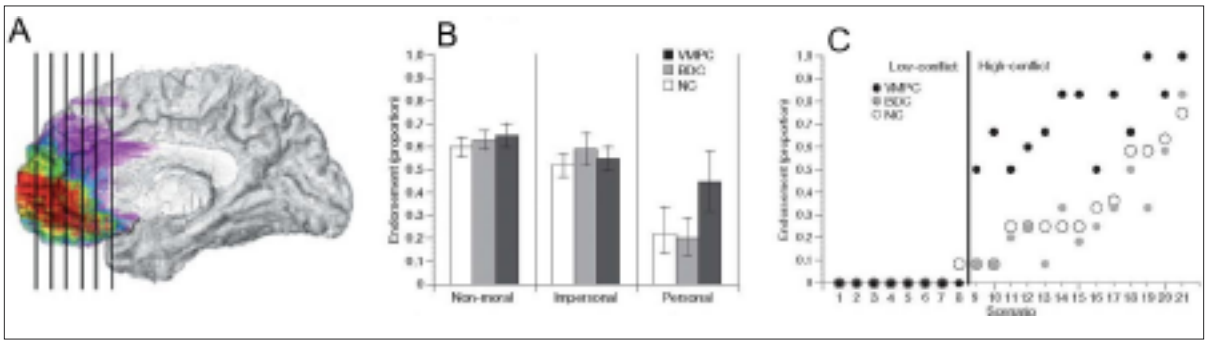

Figure 7. Effects of damage to the PFC on utilitarian moral judgments. *A.* Area of PFC damage in common between all individuals is shown in red; side view of the brain, anterior is to the right. *B.* Effect of damage (VMPC) on endorsement of a pragmatic solution to a moral dilemma; VMPC-lesioned individuals were more likely to endorse than normal controls (NC) or individuals with damage to other brain areas (BDC). *C.* The effects of lesions of the VMPC was especially marked when the moral dilemma included a difficult choice (high conflict).[11]

Patients with damage to the VMPC experience loss of emotional responses and feelings of guilt and empathy, but their cognitive skills are intact. Figure 7 describes their brain lesions (A) and their readiness to choose a difficult approach to the resolution of a moral dilemma (pushing one person in front of a runaway boxcar to save a crowd—B and C). For difficult choices (in which reason and emotion are in conflict—fig. 7C), the patients with VMPC damages more readily adopt the choice that is emotionally difficult. Is it that they experience no emotions fully, or just the emotions aroused by a moral dilemma? These same individuals were tested on the Ultimatum Game, a scenario in which one person is given a sum of money and told to offer a portion to another. If the offer is accepted, both individuals receive money; if rejected, neither is the richer. Control subjects typically reject the offer at a threshold value of ~20 percent of the total. Patients with VMPC damage reject at much higher thresholds; they are more readily angered by the perception of a shabby offer.[12] Thus the deficit in emotional response of VMPC patients is not global but instead confined to situations in which the individual must choose between doing the "harder" rather than the "easier" thing.[13]

The legal concept of diminished responsibility is tied to the idea of free

choice (and thus to free will). We accept that there are circumstances where, in the usual sense of the term, individuals are not responsible for their actions; they have no choice. This is a relatively easy distinction to draw if someone having an epileptic attack strikes another; can the idea also be applied to behaviors that reflect changes brought about by brain damage? Are the changes sufficiently dramatic such that someone who normally would conform to social norms now cannot help himself and commits a crime? Here we can consider another neurological case study, that of an employee of a car dealership who, after suffering a cerebral aneurysm, began to take cars from the lot and drive them to his neighborhood.[14] He would then lock the doors and abandon the car; over the period after his aneurysm he borrowed as many as one hundred cars. He was prosecuted and convicted for theft. Jail did not erase the compulsion; subsequent behavioral therapy was, however, helpful. In both examples above—the epileptic and the aneurysm victim—we can make a reasonable case for diminished responsibility.

Note, however, that the concept of responsibility reflects the retributive aspect of the law, the idea that, when an individual can choose between actions but acts to harm others or society, he should be punished. If not capable of distinguishing between right and wrong (the M'Naughton doctrine), he should not be jailed for his actions. Interestingly, although the aneurysm victim stated that his actions were wrong, that knowledge did not prevent him from stealing cars. Patients with VPMC damage also have a good working knowledge of societal norms and yet have few qualms about difficult moral dilemmas. The neurological evidence suggests that a cognitive appreciation of distinctions between right and wrong may not be the only thing standing between the upright citizen and the sociopathic criminal. An emotional response to producing harm is certainly another factor. If so, the protective and more pragmatic approach of preventing individuals from harming others—when the evidence suggests a neurological basis for the compulsion—makes more sense.

The slippery slope, of course, is that, even without brain damage, there is considerable individual variation in brain structure and function that results from genetic differences as well as individual experience and there is some evidence that these differences influence behavior.[15] For example, individuals in whom the PFC is underactive are more likely to exhibit behaviors characterized as antisocial.[16] Even if we adopt a protective rather than a retributive legal philosophy, at what point does the compulsion engendered by a particular wiring pattern in one part of the brain become resistant to change produced by deterrents—for example, incarceration or execution? The chances are good that neuroscience will provide more information on this topic. The legal system, however, is under no compulsion to actually incorporate this new information, but it would be surprising if the information were completely ignored, especially in those cases exemplifying the most extreme variant of retribution: the death penalty.

Beyond legal implications, does anything in neuroscience address a broader understanding of free will? Does the idea that all our actions are determined by brain functions negate our strong impressions that we are free to choose those

actions? The bedrock principle articulated by Ferrier in 1978—"the brain is the organ of the mind"—is not only widely accepted today but forms the basis of our understanding of mental disturbances.

Let's consider the case of a schizophrenic patient who is hearing voices when none are present. If brain activity is the source of the impression that someone is speaking, brain activity during auditory hallucinations should parallel activity produced by listening to speech. Again we can use fMRI to image brain activity and test this idea.

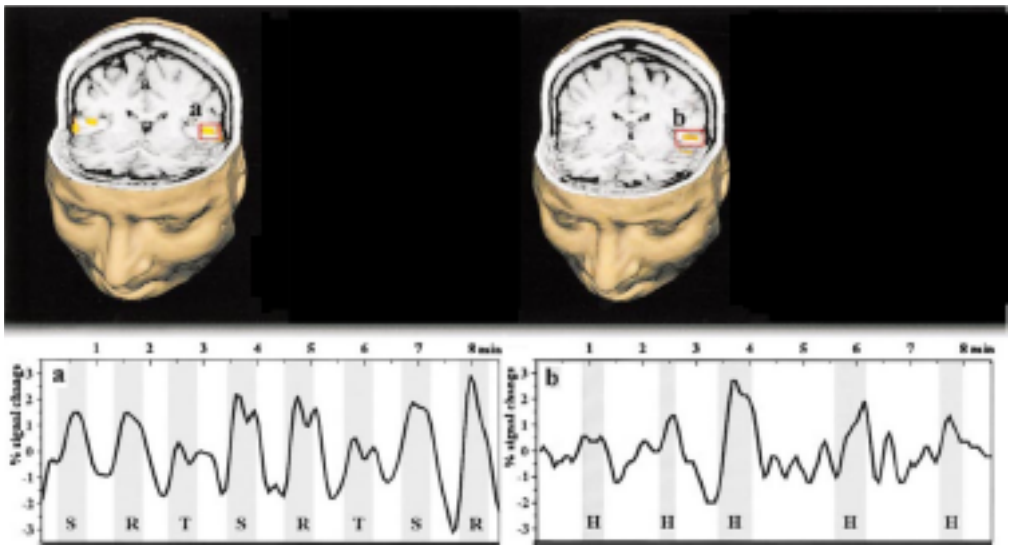

Figure 8. Brain activity in the temporal lobe of a schizophrenic patient (T in fig. 1) while listening to (graph a) speech (S), reversed speech (R), or a tone (T) and (graph b) during self-reported auditory hallucinations. The locus of activity is shown in a cutaway view of the brain in the upper panels, while the activity summed over the voxels that comprise the speech area is shown in the lower panels.[17]

The same region of the left auditory cortex that is active during speech and backward, or reversed, speech (but not during tones; fig. 8a) is active when the patients report hearing voices (fig. 8b).[18] These and other studies, together with changes in personality, thinking, and mood associated with brain damage, all support the idea that all of our distinctive characteristics are embodied in our brain.

So, if what we are is determined by the characteristics of our brains, is every action then predetermined by brain biology? The answer here is clearly no. The traffic between the world and the brain is a two-way street; every experience that we have changes the brain in some way, and that changed brain then interacts with the world in a new way. After reading this paper, your brain is different than it was beforehand; my brain has also changed in preparing and delivering these comments. How we are raised has a particularly profound effect on brain function, because nervous-system development includes periods of great sensitivity to outside influences (such as parental care) and the internal milieu (hormones associated with sex and stress).

A powerful example of the interaction between experience and biology is exemplified by the case of variants of the gene for monoamine oxidase, an enzyme that breaks down the chemicals used by nerve cells to communicate with each other (fig. 1). The gene comes in two forms, one of which is associated, through genetic linkage, with a propensity for violence as manifested across several generations in a large family group. However, when individuals with the associated gene are followed in detail, it is only those who also have a family history of abuse in which the linkage appears.[19] We cannot say that good parenting protects individuals from the effects of the variant of the gene any more than we would say that abuse allows the properties of the gene variant to encourage rage. There is no gene "for" violence. However, violent behaviors are the product of the brain, and the brain is shaped by the condition and experiences of the body in which it resides. We can thus expect that the interaction of genetic makeup with the environment will be the rule rather than the exception.

Neither our genes nor our brains "make" us do something. The determination of our behaviors is complex and involves a large number of factors, many of which interact. Imagine that we could, in principle, know everything about the biology of the brain and know everything about the experience of that brain. Even were this possible, the probability of accurately predicting a particular action by an individual at a particular time is vanishingly small, small enough to create the defensible illusion that each particular choice is unconstrained. In everyday life, the sense that we are free to choose is not challenged. Damage to the brain, such as is evidenced by the compulsion of the man who borrowed cars,[20] reveals an underlying determination of behavior very much at odds with the idea of choices that are perfectly free. Neuroscience has provided a deeper understanding of the factors that constrain what we do. How this understanding will be incorporated into the way we treat each other remains to be seen.

NOTES

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[2] Ibid.

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[17] Modified from Dierks et al., 1999. (See note 18)

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[20] Cohen et al., 1999.

I'm Not a Heretic, I'm a Pagan

David J. Helfand

My appearance here this afternoon represents a spectacular failure of free will. When first invited to participate in this symposium, I politely declined on what to me were the rational grounds that I had nothing intelligent to say on the subject. Nonetheless, the organizers persisted, and I guess I relented at some point. Later, when I was told I needed a manuscript, I saw a new opportunity to beg off (never having written out a talk in my life), and I tried again to demure—and again failed. So here I am. The only saving grace is that, since I got back from a meeting in Arizona at 1:00 a.m. and have only had the morning to work on this, I'll waste only about thirty minutes of your time instead of the allotted forty.

I should perhaps begin with an explanation of my title. It is a line in Tom Stoppard's latest play, *Rock 'n Roll*, which features a Cambridge don as an unreconstructed communist defending the Soviets to his young Czech graduate student during the Prague spring of 1968. When the somewhat confused young man offers a weak defense of the new Czech government while attempting to maintain his fealty to communist ideals, his professor thunders at him, "You're not a heretic, you're a pagan." From my first days in college in that same year of 1968, that's what I have always felt like in discussions of free will—a pagan. Basically, I just don't get the point. I suppose this may have something to do with the fact that my motto is "The examined life is not worth living." But it may also have something to do with my scientific outlook on the world.

The cosmologist Ted Harrison has divided the history of human views of the universe into three eras: the anthropomorphic, the anthropocentric, and the anthropometric. The anthropomorphic universe is an Age of Magic. There is no boundary between the self and the external world; natural phenomena are regarded as manifestations of human emotions. Some of this persists in our language: We talk of angry storms and gentle breezes. We imagine this to be the cosmology of prehistory, although pockets of anthropomorphic cosmology remain prevalent in such places as Southern California and certain university English departments.

The anthropocentric view is the Age of Myth. It saw the creation of a

pantheon of powerful gods to explain natural phenomena, although it is noteworthy that those gods were driven by human emotions and obsessed with human concerns. It is, in a profound sense, an Earth-centered universe, and it remains the predominant view in most of the world today.

The anthropometric universe is the Age of Science. It is not, as Protagoras would have it, that "man is the measure of all things," but it assumes that he can take measurements of an external reality. This age began with Copernicus's removal of Earth from the center of the universe. It leads to a profoundly powerful model of nature and an entirely new perspective on the cosmos and, more importantly, our place in it.

As will become clear, I subscribe to this latter view: that there exists an objective, material universe of space, time, matter, and energy, that we are *fully*, and I underscore fully, a part of this materialistic universe, and that our brains, having evolved an adaptive capacity of considerable power in the service of the survival and reproduction of our species, can, in their spare time, be put to work to understand this universe. But I think part of my difficulty with concepts such as free will—and religion, for that matter, which I regard as falling within the same domain—lies in my definition of what the anthropometric mind is seeking to accomplish.

I do not believe that science represents a quest for "Truth" with a capital *T*. Mathematicians, having carefully designed—not discovered, but designed—a system of logic, can seek truth within that system. Mathematics has turned out to be a useful tool for modeling the physical universe in which I am interested, and so it is often envisioned as somehow entwined with science, but it is a fundamentally different pursuit. At my meeting in Arizona, I got into a little dust-up with Paul Davies, a winner of one of the first Templeton Prizes, when he repeatedly presented mathematics as something we have "discovered" and science as our quest to "uncover the scheme" behind the layout of the universe. Science is not about revelation; science is about building models. It makes progress not by proving things true but by falsifying its models and replacing them with better ones. Over the past four hundred years, it has a pretty good track record with that approach, with an ever increasing ambit and ever greater explanatory power.

Philosophers, I am told, also seek truth, but I confess to never having gotten through an entire book of philosophy, so I cannot confirm they have ever succeeded. If they did, I suppose, it would lead to mass unemployment in the philosophical community, so perhaps there is a powerful incentive to make sure the search continues for a few thousand more years. To illustrate how deeply pagan I am, and how divergent from the interests of the vast majority of this audience who, I presume, are here because they are interested in probing deeply into the topic of free will, I will confess that I simply cannot understand why philosophers dream up this stuff to worry about. I see it as a largely uninteresting byproduct of our impressive reasoning abilities coupled with too much free time—sort of like sudoku.

Having revealed myself as a genuine heathen, let me attempt to offer a modest contribution to the discussion of the next two days from my perspective as a physical scientist. Many of the other speakers in this symposium, being both more

organized and more scholarly than I, have generously shared their remarks in advance with their fellow speakers, so I know some of what's coming. It seems that determinism, and quantum mechanical departures therefrom, form one of the themes. And determinism, in this context, seems often to be associated with the assassination of John F. Kennedy. I will eschew a pop-psychological analysis of why 50-something academics harken back to this sharply remembered, unexpected marker of their youth in attempting to render absurd a deterministic model. Suffice it to say, the argument usually goes: Determinism means that the assassination of President Kennedy was foreordained by the precise locations and velocities of all the particles in the universe when it was only one second old. This would exculpate Lee Harvey Oswald for pulling the trigger. Since this is morally offensive, a deterministic universe is unacceptable.

Now, it turns out we know quite a lot about the conditions in the universe when it was only one second old. Indeed, we know a lot about what it was like when it was less than one millionth of a second old, and the Large Hadron Collider in Switzerland, when it is turned on next year, will recreate the conditions of the universe when it was but one trillionth of a second old, pushing back our knowledge even further (and, yesterday's *New York Times* article notwithstanding, you needn't worry that this will create a black hole that instantly consumes Earth, because, if such conditions produced such black holes, we wouldn't be here to discuss it). When I say we know the conditions at those early times, I mean we know physically meaningful quantities such as the temperature, the ratios of neutrinos to photons and of photons to quarks, the fraction of quarks in each family, and so on. Since this is a philosophically attuned audience, I suppose I should be more careful with my words: we don't "know" these quantities—we have a model from which we can infer estimates of these quantities. That model has been developed over the past sixty years based on our observations of the universe. Direct observations can, in principle, take us only to within 380,000 years of the Big Bang, but, from the image of the universe at that time (the maps of which are becoming more exquisitely precise with each passing month of observation) and from a variety of other observations such as the ratio of heavy to normal hydrogen, we have developed a model that allows us both to infer the earlier conditions and to make predictions of what future observation might reveal. This is science.

Does my detailed knowledge of the earliest moments of the universe lead me to determinism? Absolutely not. I can predict the ratio of hydrogen to deuterium from my model, and I can then go out and measure it (a nontrivial, but now tractable, undertaking). I cannot, and never will be able to, predict the assassination of anyone from my model, and find it an absurd notion to think that one could. There are at least two reasons for this. One is that "prediction" implies—to a scientist—calculating an expected outcome. There are 10^{78} particles in the universe, each of which has three associated numbers representing its position in space, three more associated with its velocity through space, and several additional digits defining its quantum mechanical state. Each of these numbers would need to be followed in timesteps of picoseconds over 13.73 billion years to "predict" a shooting. This is

demonstrably undoable, even with a computer containing all the atoms in our space-time. I could not even do the unimaginably simpler problem of predicting the birthplace and birthdate of the Sun. And, indeed, there is no reason whatsoever for me to do so—I can measure the age of the Sun, I know how it works, I know how long it will live (to a considerably greater fractional accuracy than I know how long I will live), so it is of no conceivable interest to calculate its birth from first principles. For me, this practical impossibility renders the question of determinism completely uninteresting; I suppose this disinterest in unknowable things explains my irreligiousness as well.

The second reason I cannot predict Kennedy's assassination from the conditions shortly after the Big Bang is the fundamentally probabilistic nature of matter at the atomic scale. Einstein's objections to God playing dice notwithstanding, quantum mechanics is the most precise physical model ever invented, and it mandates an inherent randomness in the behavior of subatomic particles that makes deterministic predictions at this level impossible. Given the conditions in the first millionth of a second of the universe, these indeterminate interactions were dominant. However, I hesitate to raise the specter of quantum uncertainty lest it serve as the crutch to avoid a materialist, rational inquiry into the brain and its most interesting manifestation, the human mind. Much (of the little) I have read on this subject grasps at quantum mechanics as the scientific justification for "free will." This, in my view, is arrant nonsense. Or, to be slightly more generous, this is statistically unjustifiable in terms of our current physical models for the behavior of the atoms that compose our brain.

The average thermal velocity of molecules in our brain is roughly 250 m/s, and the interaction scale is 10^{-9} meters. This translates to over a hundred billion interactions per second (roughly the number of stars in the galaxy). While any one such interaction has an associated quantum uncertainty—e.g., a molecule might tunnel through a neighbor and emerge on the other side rather than bouncing off it—the statistical distribution of these interactions is perfectly well defined. Multiplying by the roughly hundred billion molecules per neuron and the hundred billion neurons in the brain, we find that there is *no* quantum uncertainty involved—you need not worry about your brain molecules *all* suddenly deciding to quantum-mechanically tunnel out of your skull and end up in your lap. Quantum mechanics is irrelevant to discussions of free will.

It did occur to me that there is one statement about free will a physicist can make based on our models of reality: Tachyons do not have free will. Tachyons are particles, invented by my late Columbia physics colleague Gary Feinberg; their salient property is that they travel faster than the speed of light in free space. Contrary to much popular science writing, the existence of such particles is not forbidden by relativity. The properties of faster-than-light travel are, however, well defined within that model. And it is not difficult to show that, if anything does travel faster than light, one is required to accept a situation in which a window breaks before the kid who throws the tachyon rock through it is born. For a tachyon, the past unfolds before it; thus, it is difficult to see how a tachyon could have free

will. However, since tachyons have never been discovered, this could be considered an academic point.

In the metaphysical discussions of free will I have been reading recently, I have encountered terms such as "robust responsibility" and "inherent morality." I find these terms disturbing, as I do all antimaterialist, antirational arguments about subjects such as free will and religion. Insisting on transcendant, nonphysical properties of humans divorces us from the tree of life and of our, to me, inspiring connections with the cosmos. It seems to me that, to return to Harrison's epochs of human understanding—and this is the essence of my position—we seek "meaning" when we lack understanding.

The anthropomorphic caveman may reasonably believe that the wind is blowing because the air is angry. Once we have a model of air molecules and atmospheric-pressure gradients, we can abandon this anthropomorphic explanation of the wind. The wind has no metaphysical meaning—it is a natural phenomenon explicable in the context of widely applicable physical models for matter and energy, models that our brains have created. Once we have these predictive models we no longer feel a need to imbue the wind with "meaning." As I believe Dave Krantz will discuss tomorrow morning, our models for the human brain are considerably less well developed than thermodynamics. It should perhaps not be surprising, then, that we seek "meaning" in the operation of the brain. Unsurprising, but worth resisting.

There was an article in yesterday's paper about a couple whose three teenage children were removed from their parent's care after a younger sibling had died from undiagnosed diabetes. The parents, it turned out, believed prayer for their child's recovery was preferable to taking her to a doctor. Two thousand years ago, this would have been a totally rational expectation and, given the state of medical knowledge at the time, equally efficacious. Today we consider it criminal. Most people do not consider it acceptable for these parents to create their own reality in which mantras are preferable to medicine in caring for a child. In this instance, some would "blame" religious blindness, although for others this situation represents a difficult moral issue. For the latter group, I must ask: What do you mean by "moral"? From whence does your moral model spring?

It should be noted here that the postmodernist conceit of individually constructed realities is little different from the views of these parents. To give a more trivial example, I had a student some years ago who was having difficulty in my class and came to office hours for help. The lesson of the week was on the phases of the Moon. Now, I do not consider it essential for life as an intelligent citizen to understand why the Moon has phases. However, I include this topic in my course for two reasons. First, most people have an incorrect model of why phases occur, and it is a useful example to illustrate how it is sometimes necessary to unlearn incorrect knowledge before acquiring new knowledge. Second, it is a good example of a simple physical model against which one can compare reality—or so I thought. After an hour with this student, using my basketball Earth and a tennis-ball moon to illustrate the three-dimensonal essence of the problem, I finally asked, "OK, so at

what time of day would I expect to see the waning crescent moon overhead in the sky?"

"At 9 a.m.", she replied.

"Yes! Excellent, I think you've got it."

"Oh", she said, "but that must be wrong."

"No, you are correct!"

"No, no, it can't be right."

"Why not?" I asked.

"Because the Moon isn't up in the daytime."

"Yes, it is sometimes," I assured her.

"No, it isn't."

"Well, as a matter of fact, if you come here tomorrow morning abut 10 a.m., I'll show it to you right outside my window."

Her parting response: "I don't have to, I know the Moon is not up in the daytime".

You giggle or you gasp. Why? Because you have "seen" the Moon in the daytime, so you "know" it is there? But she hasn't seen the moon in the daytime, and so it is consistent with her worldview, her cosmology, that the Moon is up only at night and, furthermore, that the model I was trying to sell her must be wrong. I am hopeful that most of you prefer my model to hers. But why do you? Not because of any appeal to authority, I trust: "He's an astronomer so he should know about the Moon." Is it because my model is predictive and consistent with tests of its predictions? If so, that's good. But then why not apply the same rational rigor to examining questions of morality? Why fly to untested—and untestable—abstractions like free will for a basis for assigning moral responsibility?

Keith Stanovich, an evolutionary psychologist from Toronto, in his book *The Robot's Rebellion* argues passionately for a rationalist approach to developing a modern morality. He demonstrates convincingly that the automatic neural circuits that have served our species well over the first 135,000 years of its existence are largely ill-suited for life in the technically sophisticated modern world. Our president's frequent reference to his "gut" instincts in formulating policy is but one of the innumerable examples of how premodern thinking can lead to disaster in the current era. The sooner we stand back from a pre-rationalist, instinctual construction of morality and begin to address this important component of human society from a rational point of view, the sooner we are likely to come to terms with what it means to have 6.5 billion large mammals on this planet. This situation has never existed before. How effectively—and how rationally—we address the issue will determine how long we will last in this state.

I can summarize my position simply: I prefer understanding to meaning.

While it may be some time before we understand our general compulsion to discuss free will, I will continue striving to avoid a craving for meaning and to expend my energies toward the goal of understanding.

Blame It on My Genes
Behavioral Genetics and Free Will

Paul S. Appelbaum

ADVANCES IN BEHAVIORAL GENETICS, ALONG WITH FINDINGS IN OTHER areas of neuroscience, have led to challenges to long-held concepts of free will and personal responsibility. My goal in this paper is to explore the implications that recent and anticipated discoveries in behavioral genetics have for these concepts, especially as they are applied in the criminal courts. To lay the groundwork for this discussion, I will first review some of the underlying principles of genetics and of neurotransmitter function that are essential to understanding the new behavioral genetic data. (Readers familiar with the basics of genetics and neurobiology can skip the following section.)

Genetics, Neurotransmitters and Behavioral Genetics

Genetic information, which shapes the development and function of living organisms, is embodied in humans on 23 pairs of chromosomes, each containing thousands of genes. Chromosomes themselves comprise long strands of DNA surrounded by proteins that regulate their function. Because chromosomes are paired, with one copy from each parent, every person has two copies of each gene. These copies are not necessarily identical, since mutations over time lead to variation in their structure and sometimes in their function as well. Each gene variant is commonly referred to as an allele. Genes generally exert their influence through a process known as transcription by coding for another molecule called messenger RNA (mRNA), which in turn is translated by the machinery of the cell into proteins.[1]

Proteins are the workhorses of the body. They may have structural roles (e.g., constituting the matrix in which bone will form) or functional ones (e.g., synthesizing or breaking down other molecules—such proteins are referred to as enzymes—or transporting molecules across membranes). Different alleles of a given gene may produce more or less of a protein, or they may produce proteins with varying levels of function. Genes and proteins, of course, do not directly produce

behavior; All behavior is ultimately effected by the brain. So we need to consider some basics of brain function before looking at how genetic influences can impact behavior.

Brain systems, responsible for interpreting sensation, initiating movement, and more-complex functions such as appreciating art or finding humor in a joke, interact in complex ways. These interactions are accomplished by transmission of electrical impulses from neuron to neuron, the human brain comprising roughly 3 billion such cells. To move electrical impulses from cell to cell, the transmitting neurons release packets of small molecules called neurotransmitters across the intracellular gaps or synapses. Neurotransmitters, the best-known of which include dopamine and serotonin, are then detected by receptor molecules on the receiving neurons, where they trigger a process that results in the propagation of a new electrical signal. Taken in the aggregate, this electrical activity embodies the function of the brain.[2]

One final nuance regarding the transmission of electrical signals from cell to cell: whether a signal is triggered and its intensity are controlled, in part, by the number of neurotransmitter molecules in contact with the receptors. Hence, the more rapidly such neurotransmitters are degraded in the synapse by enzymes that exist specifically for that purpose, the weaker the signal that results. Similarly, the more rapidly neurotransmitters are taken back up into the terminus of the transmitting neuron—another natural regulatory process—the more diminished the signal. It follows that changes in the proteins that control neurotransmitter degradation and reuptake will affect the number and intensity of nerve impulses and can alter behavior. And such differences will result from alterations in DNA sequences coding for these proteins that yield variant alleles.

The evidence that genetic variation impacts behavior comes, in part, from studies comparing the behaviors of identical (monozygotic) and fraternal (dizygotic) twins. Identical twins develop from the same fertilized egg, which splits early in its development, and thus have identical genetic endowments. In contrast, fraternal twins derive from two different egg/sperm pairs and therefore, even though they have the same parents, are no more similar in their genetic makeup than any other two siblings. Numerous studies have shown identical twins to be much more highly correlated than are fraternal twins in their behaviors, including such presumably innate characteristics as early-life sociability.[3] However, no behavior has been found to be determined entirely by genetic factors: Even monozygotic twins show correlations well short of perfect. Other factors, residing in the surrounding environment, are almost certainly involved. And even when genetically transmitted traits are highly influential in behavior, it will be rare for a single gene, as opposed to a combination of genes, to play a substantial role.[4]

Somehow, then, genes and environmental factors interact to produce behaviors, perhaps by means of gene products that heighten or reduce a person's sensitivity to environmental occurrences. With this quick overview as background, we arrive at the data of direct relevance to our concern with responsibility for behavior, especially the kind of deviant behavior that is likely to end up being addressed in the criminal courts.

The MAOA Story

The story begins in the Netherlands in the early 1990s when researchers reported on an extended family in which many of the males appeared to manifest a common pattern: borderline mental retardation and antisocial behavior ranging from mild (e.g., exhibitionism) to severe (e.g., arson and attempted rape).[5] Because animal studies had suggested that altered metabolism of the neurotransmitters serotonin, dopamine, and noradrenaline was associated with aggressive behavior, the research team looked to see if there might be deficits in the affected men in monoamine oxidase A (MAOA), one of the enzymes that degrades all three neurotransmitters. They found that affected males in the kindred under study had undetectable MAOA levels. They traced the deficit to a mutation in the gene coding for MAOA, a mutation that rendered the resulting protein inactive. (Women were much less likely to be affected by the mutation because the gene is carried on the X chromosome, of which women have two but men only one. And so the women in the kindred who carried and transmitted the mutation were likely to have another normal copy of the MAOA gene on which to rely.)

With this evidence that MAOA levels may contribute to the regulation of aggression in humans, a second set of researchers a few years later looked at a very different population. A team led by behavioral geneticist Avshalom Caspi capitalized on an ongoing longitudinal cohort study in New Zealand.[6] Many years before, epidemiologists had recruited a birth cohort from the city of Dunedin, comprising 1,037 children, just over half of them male. Beginning at age 3, this sample had been assessed every two to three years on a variety of health and developmental measures. For the age 26 follow-up, the Caspi team collected from the males genetic samples that were analyzed for their MAOA alleles. Since the mutation reported by the Dutch group is extremely rare, the researchers were looking not for a genetic variant that rendered the enzyme inactive but for more-common alleles known to be associated with greater and lesser MAOA activity. They found that roughly a third of the males in their cohort had alleles reflecting mutations in the promoter region of the gene (which controls the rate of transcription) that resulted in lower MAOA levels.

As their outcome measure, the researchers created a composite index of antisocial behavior: diagnosis of conduct disorder as an adolescent, court records of conviction for a violent crime, score on an aggression scale, and symptoms of antisocial-personality disorder at age 26. However, when they compared their subjects' MAOA alleles with the antisocial-behavior index, they found no significant relationship. That is, MAOA activity per se did not appear to influence rates of antisocial behavior. But Caspi and his colleagues were interested in exploring a more sophisticated hypothesis as well, namely that MAOA levels combine with early adverse experiences to produce a propensity for antisocial behavior—an example of a gene–environment interaction. And so they also constructed an index of what they referred to as childhood maltreatment (including observed mother–child interactions at age 3, harsh discipline at ages 7 or 9, multiple changes of primary

caregiver, exposure to physical abuse, and unwanted sexual contact—the last two before age 11).

With these more-elaborate data available, the researchers examined the combined impact of low MAOA and childhood maltreatment. Subjects with probable maltreatment (one indicator present) and low MAOA had modestly higher levels of antisocial behavior than those who were not maltreated, and those with severe maltreatment (two or more indicators) had significantly higher levels of antisocial behavior than either of the two other groups. Indeed, although subjects with both low MAOA and severe maltreatment comprised only 12 percent of the sample, they accounted for 44 percent of the convictions for violent crime. Moreover, 85 percent of the subjects in this category manifested some form of antisocial behavior on at least one of the four measures.

A number of efforts have been made by other groups to replicate these findings. Most analyses have been confirmatory, although some were not; a meta-analysis of studies suggested that the relationship was valid.[7] But the use of different measures of maltreatment and antisocial behavior by the various research teams complicates the interpretation of the data. However, for our purpose here, I will assume that the findings of Caspi et al. are valid, for two reasons. First, that conclusion is supported by the weight of the existing data; and second, even if these findings are some day disproved, it seems highly likely that other genes that have similar consequences for behavior will be identified. Thus, the challenge to our ideas of free will and personal responsibility manifest by the MAOA data and outlined in the next section will have to be faced sooner or later in any event.

Behavioral Genetics and Determinations of Culpability

If antisocial behavior by that portion of the Dunedin cohort with low MAOA and childhood maltreatment could be predicted with impressive accuracy from knowledge of their allelic status and childhood experiences alone—which the data suggest is true—then the challenge to our usual understanding of free will is clear. How can these young men be said to have freely chosen to engage in such behavior when their genetic endowment and childhood history appear to have played so influential a role in their conduct? Indeed, it was not long after the publication of the Dutch data, but well before the New Zealand study appeared, that law reviews began carrying papers speculating about the impact of the MAOA findings on legal concepts of responsibility for criminal behavior,[8] a trend that only intensified with publication of the data from Caspi et al.[9]

From the perspective of the criminal law, the dilemma is straightforward. Anglo-American law has created categories to excuse defendants from culpability when their capacity to choose or control their behavior is substantially impaired. The best-known example is the insanity defense: One influential standard holds that a defendant is not responsible for his behavior if, as a result of mental disease or defect, he lacked substantial capacity to appreciate the wrongfulness of his

behavior or to conform his behavior to the requirements of the law.[10] Both the inability to appreciate wrongfulness and the lack of capacity to control one's behavior indicate that the defendant was unable to make a meaningful choice about whether to engage in the criminal act. Thus, if mental disorders that impair the capacity to choose negate culpability (resulting in a finding of not guilty by reason of insanity [NGRI] or its equivalent), why should genetic determinants that seem to operate independently of conscious awareness not have a similar effect?

Within five years of the Dutch MAOA study, a law-review note was proposing a defense of "genetic determinism" for defendants who met the following set of criteria:

> An actor is excused for his or her conduct constituting an offense if, as a result of genetic predisposition, the actor: a) does not perceive the physical nature or consequence of his or her conduct, b) does not know his conduct is wrong or criminal, or c) is not sufficiently able to control his or her conduct so as to be held accountable for it.[11]

Although (a) and (b) are unlikely situations, (c) is arguably the circumstance presented by a person with low MAOA and childhood maltreatment.

Some hint of how the courts may respond to such claims comes from an earlier series of attempts to introduce genetic data to negate culpability.[12] In the early 1970s, several studies offered evidence (later disproved) that men with an extra Y chromosome (so-called XYY syndrome) were at increased risk to commit acts of violence. The claim made some intuitive sense, since the Y chromosome determines maleness and males are much more likely to engage in violence than are females. And so men with two Y chromosomes could be seen as "supermales" who were even more likely to be violent than the average man. If their propensity for violence resided in their chromosomes, it was claimed, it would be unfair to hold them responsible for their behaviors. The similarity to the arguments now being made in relation to MAOA is striking.

It is interesting, therefore, that the courts hearing these claims uniformly rejected the defense, albeit on a variety of grounds. One court held that only a showing of legal insanity would excuse the defendant and that XYY did not constitute a "mental disease or defect." Another court ruled that the defendant's behavior could not be causally linked to the genetic abnormality, while a third rejected the claim because the evidence demonstrating a link between XYY and violence was not sufficiently certain to be admissible.

All these rationales reflect a deep-seated legal skepticism about non-culpability defenses, perhaps best exemplified by Justice Hugo Black in his concurrence in *Robinson v. California*:

> Almost all of the traditional purposes of the criminal law can be significantly served by punishing the person who in fact committed

> the proscribed act, without regard to whether his action was 'implied' by some elusive 'irresponsible' aspect of his personality.[13]

This approach is not limited by any means to genetic defenses. Indeed, it can be seen equally well in the law's reaction to defenses alleging non-responsibility because of multiple-personality disorder.[14] Those cases as well have seen judicial resistance to innovative claims involving a fracturing of the underlying personality. As Justice Black suggested should be the case, the legal person (i.e., embodied by the physical defendant) who committed the crime is in fact punished for it.

Few reports up to now have surfaced of attempts to use genetic data for purposes of exculpation. So any conclusions about the likelihood of success must inevitably be based on extrapolation from the general attitudes of the judiciary and from decisions in analogous circumstances. But it seems clear that the nature of genetic evidence itself will make it difficult to meet existing standards for exculpation. Most genetic data—and MAOA is a good example—at best will demonstrate an association with an increased predisposition to criminal behavior, but they will not be able to demonstrate a causal link to the act in question. This is probably not enough to meet traditional standards for legal excuses (as in the insanity defense) or even to satisfy the criteria of the proposed genetic defense mentioned earlier. Indeed, such evidence may run afoul of traditional standards for admissibility, which have tended to exclude evidence intended merely to establish a propensity to |commit or to avoid committing an offense.

An example of just how difficult it is to link genetic data to a particular criminal act comes in this excerpt from the transcript of a sentencing hearing in California. The witness is a psychologist who has testified under direct examination that the defendant has an MAOA allele associated with reduced activity and was maltreated as a child. Here questions are being posed to him by the cross-examining prosecutor:

> *Prosecutor:* "Are you saying that the defendant, because he has the MAOA gene [sic] and because in your opinion he suffered maltreatment, was unable to control his behavior and that caused him to commit these 3 murders?"
> *Witness:* "No, I'm not."
> *Prosecutor:* "And, in fact, the defendant could easily have made a choice as to whether or not he wanted to commit 3 murders, couldn't he?"
> *Witness:* "I don't know how easy or difficult his choices are."
> *Prosecutor:* "But there's nothing in the MAOA gene or the severe maltreatment that could make him commit these murders, is there?"
> *Witness:* "I don't know."[15]

An honest witness, as in this case, will be able to testify about an association that may have increased the defendant's propensity to commit criminal acts. But it is unlikely such a witness could ever be able to say that the defendant's genetic makeup *caused* him to commit to crime. In other words, genetics may be accepted

as an influence on behavior but will not be seen as having deprived a defendant of free will.

Behavioral Genetics and the Punishment of Criminal Acts

Even if genetic influences on behavior are not exculpatory, perhaps they should be seen as mitigating and taken into account as a reason for leniency at sentencing? The argument would be that a gene–environment interaction such as demonstrated with the MAOA alleles impairs, even if it does not negate, a defendant's ability to choose. Perhaps not surprisingly, soon after the link between MAOA and criminal behavior was suggested by the report of the Dutch kindred, a convict in Georgia attempted to lay the groundwork for such a claim.[16]

Having been convicted of murder and sentenced to death, Mobley appealed the sentence on a variety of grounds, including that the new information about MAOA might provide a basis for mitigation. He petitioned the court for funds to test his MAOA alleles, though there was no a priori reason to believe that it was abnormal in any way. His request was dismissed, along with his other claims, on the grounds that scientific evidence of a link between enzyme levels and behavior had not yet reached "verifiable certainty." Putting aside the question of whether that is the appropriate standard to apply to new scientific evidence (no other court to my knowledge has ever suggested that it is), the opinion, although not helpful to the appellant, holds open the possibility that, if the link ever becomes sufficiently demonstrable, the court would agree to hear (and perhaps fund the acquisition of) such evidence.

Although attempts up to now to introduce genetic data at sentencing have been uncommon,[17] at least one team of forensic evaluators has begun gathering such information routinely—including MAOA alleles—on behalf of the defense in death-penalty cases.[18] And so we can expect to see an increase in the utilization of such evidence in the future.[19] Whether a genetic propensity to commit criminal acts should mitigate punishment, however, is less clear. Indeed, evidence that a person's criminal tendencies are embedded in his very nature, which is how such testimony may be viewed by judges and jurors, could have exactly the opposite effect. Consider, for example, this excerpt from the opinion of a federal appellate court rejecting the claim that a death sentence should be overturned because the prisoner had not had the opportunity to be tested for his MAOA allele:

> [We find it] highly doubtful that the sentencing court would have been moved by information that Landrigan was a remorseless, violent killer because he was genetically programmed to be violent. . . . Although Landrigan's new evidence can be called mitigating in some slight sense, it would also have shown the court that it could anticipate that he would continue to be violent. . . . On this record, assuring the court that genetics made him the way he is could not have been very helpful.[20]

Defense counsel who make arguments for mitigation based on MAOA data face a difficult challenge. Although a sentencing judge or jury may be sympathetic to the claim that a defendant's free will was influenced by impulses beyond his control, they are also likely to be sensitive to the public-safety implications of such a situation. Defendants with propensities to commit criminal acts that are based in their genetic makeups and early developmental histories may be more likely, sentencers may reasonably conclude, than other defendants to recidivate—an odd basis for a plea for leniency. Only the development of effective means of reducing the risk they present, which at this point has not been demonstrated, may alter what is likely to be the understandable reluctance of sentencers to view such requests for leniency with skepticism. (A similar situation obtains for defendants with mental illness, information regarding which is often withheld from sentencers by defense attorneys, who fear that it will have a paradoxical effect—despite the availability of treatment for mental illness.)

Recognition that genetic data may constitute a "double-edged sword" raises the question of whether prosecutors could begin to seek its introduction as aggravating evidence, that is, as a basis for more stringent punitive measures. For example, in Texas, where imposition of the death penalty requires a determination that the defendant is likely to commit future acts of criminal violence,[21] could the prosecution argue that MAOA data (especially for defendants with histories of maltreatment as children) are relevant to that question and should be admitted? This prospect likewise raises a set of subsidiary questions: Could a prosecutor compel a defendant to provide a sample of genetic material (which may require nothing more than a cheek swab)? Or, if the prosecution already has or can obtain a genetic sample (e.g., from a drinking glass used in jail by the defendant), could a test be conducted without the defendant's knowledge or consent? At this point the answers to all of these questions are unclear.

Behavioral Genetics and the Prevention of Crime

Data on MAOA alleles and early maltreatment appear to identify a population that is at high risk for antisocial behavior and that accounts for a substantial proportion of violent crime. Indeed, a comparison of the percentage (44) of convictions for violent crime attributable to low MAOA plus maltreatment in the study by Caspi et al. to the best estimate of the percentage (3 to 5) of acts of violence in the United States attributable to serious mental disorders[22] points out just how potentially impactful this combination of vulnerabilities may be. How should this information, and similar data that are almost certain to follow in coming years, be used—if at all—in the prevention of crime?

One suggestion that has already been made is that male victims of child abuse should be screened for low MAOA activity. If the less active MAOA allele is detected, there should be a lower threshold for removing a child from the home.[23] Of course, an approach of this sort is scientifically dubious and fraught with

problems. Since the causal mechanism for the gene–environment interaction in the case of MAOA is unknown, once abuse is detected it is possible that the damage has already been done. That is, removing the abused child from the family may have no impact on his later propensity for crime. Moreover, the proposal assumes that alternative, non-abusive placements will be available, which may not be the case in the patchwork, poorly supervised foster-care systems that exist in many states.

A further problem with screening children for MAOA alleles, whether in the course of a child-abuse investigation or at some other point, is the risk of labeling children as "high risk" for violence, which could have negative consequences for them in placement and schooling decisions or when a court is deciding on juvenile-justice interventions. It seems unlikely that such information, once available, will not also become known to the child himself, with the risk of negatively impacting his self-esteem and of having a paradoxical effect on his behavior. A child labeled "high risk" or "unable to control his impulses" may simply decide that there is no point in even trying to restrain himself, since his fate is sealed in his genes.

An example of just how highly stigmatizing MAOA data can be comes from the following article, which originated in a British newspaper, reporting on a researcher's presentation at a scientific meeting. Under the headline "Warrior Gene Slur Makes Maoris Angry," the article began:

> Maori leaders reacted furiously yesterday after a scientist said their race carried a "warrior gene" that predisposes them to violence and criminal behavior.
>
> A genetic epidemiologist, Rod Lea, told the International Conference of Human Genetics in Brisbane, Australia, that Maori men were twice as likely as Europeans to bear monoamine oxidase, a gene that is also connected with risk taking behavior such as smoking and gambling. He was reported as saying the discovery went "a long way to explaining some of the problems" that Maoris had in New Zealand.
>
> Maoris are convicted of more than 65% of all offenses, despite making up only 15% of the population.[24]

Note how the relationship between violence and childhood maltreatment disappears from this account (although the article quoted the researcher as saying that "lifestyle and upbringing were also 'relevant' to whether violent traits developed"). As the possibility of social, including socioeconomic, determinants of violence or of other causal factors is downplayed or ignored, the role of genetics is reified. In addition, the evolutionary value of a "warrior gene" that only increases aggression when a man has been maltreated as a child apparently goes unconsidered. Most remarkable of all is the photographic image accompanying the article, which shows a muscular Maori in traditional dress brandishing a large club, with the caption "A Maori Rhys Peakman lays down a traditional indigenous challenge."

The clear implication is that this threatening figure carries the "warrior gene."

Despite the huge risks associated with screening for alleles that may predispose to violence, pressure to do so could increase at some point in the future if detection were possible before exposure to environmental risk factors or if effective treatment (or other prophylactic interventions) were available. In such circumstances, among the questions that will need to be addressed is the point at which screening should occur. Should it happen at birth, just as every state now screens for an array of genetic diseases? On entry to school? On first contact with the criminal-justice system? And if a problematic allele were found, what interventions would be permissible? Could children be compelled to accept prophylactic treatments, whether medical or psychosocial? Or if that seems too extreme, could such interventions be mandated at the first sign of deviant behavior? At this time, these questions have an element of science fiction to them: No one has proposed widespread screening and, even if such a plan were adopted, no prophylactic interventions are available. But there may be value in thinking through the answers to these questions before we face the situation in reality.

Perhaps closer on the horizon is the prospect of genetic-testing companies, which already offer a bewildering array of tests directed to consumers on the Internet, pitching an MAOA test to parents so they can determine their children's ostensible predispositions to crime. I am aware of one company contemplating such a move, and it would not be surprising to see this occur by the time this paper is in print. Needless to say, it is difficult to imagine most parents making positive use of such information, but not hard to envision them interpreting little Johnny's normal stubbornness as a toddler as an early indication that he is embarking on a life of crime.

Conclusions

Genetic knowledge of the bases of behavior, including criminal behavior, will undoubtedly increase in coming years. We will be able to identify genes and alleles that—alone or in combination with environmental influences—put persons at substantial risk for violence and other crimes. This knowledge will raise many questions about how we respond to and prevent violence, and, in conjunction with other advances in neuroscience, it will challenge our traditional notions of free will.

At a philosophical level, the issues raised by the new genetic data are far from novel. The twelfth-century Jewish philosopher-physician Maimonides was already grappling with ideas abroad in his day that something innate in a person's makeup predetermined his behavior, rendering concepts of free will irrelevant:

> Let not the notion . . . pass through your mind that at the beginning of a person's existence, the Almighty decrees that he is to be either righteous or wicked. This is not so. Every human being may become righteous like Moses our Teacher, or wicked like Jeroboam; wise or foolish, merciful or cruel; niggardly or generous; and so with all other qualities.[25]

Many contemporary philosophers, aware of the scientific data pointing to a variety of influences on human behavior, from genetic to environmental, have suggested that the presence of behavioral determinants is nonetheless compatible with a role for human choice—a doctrine known as "compatibilism." And this has certainly been the dominant trend in legal philosophy and practical jurisprudence. That behavior may be determined by a variety of influences does not imply to these theorists that persons should not be held responsible for their actions. Were it otherwise, all behavior that could be explained would be excused—surely not a salutary approach to maintaining an orderly society.[26]

And so the new data being generated by behavioral genetics are not likely to have a dramatic impact on our rules for excusing criminal behavior. These data may come to play a greater role in determining appropriate punishments, but whether genetic propensities underlying behavior will be seen as primarily mitigating or aggrevating remains to be seen. In part, the availability of effective treatment or other interventions is likely to affect that determination.

The new genetic knowledge will give us the ability to screen for predispositions to violence and other crimes well before such acts occur. This is an ability that could result in the creation of a stigmatized class of "high-risk people." Pressures to initiate screening measures, with all their resulting problems, are likely to grow if and when it becomes clear that preventive interventions are available.

In sum, as the law has affirmed to date, the data reviewed here and similar findings that are sure to follow do not require us to abandon traditional approaches to free will and personal responsibility. Genetic predispositions that influence behavior may lead some people to have greater difficulties in conforming to social expectations. But there is no evidence yet, and genetics is unlikely to provide such evidence in the future, that it is beyond a person's power to shape his or her own behavior.

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Freedom Perceived, Freedom Analyzed

David Krantz

Partly in response to the preceding papers, and in response to my placement under "Right and Wrong" today, I'm going to make a few unscripted remarks about the relationship of psychology to knowledge of free will.

To avoid misunderstanding, I would like to preface those remarks by saying that I have worked in a lot of different areas of science and I have come to view natural science as a gigantic tapestry that includes particle physics and condensed metaphysics but also psychology and sociology and, obviously, many other topics. And I think that, even though the tapestry changes—it changes somewhat from condensed metaphysics to particle physics, and it looks drastically different when you come over to sociology—it's a seamless tapestry. If you try to set up any boundary and say that this belongs to that group of people, you are essentially making a tear in an interesting part of the tapestry and perhaps ruining it, or at least spoiling your chances to understanding some part. I don't really believe in boundaries or in trying to define myself as a psychologist and somebody else as something else.

Nonetheless I noted, and I agreed with, Paul Gailey's remarks yesterday about the need for a variety of disciplines and a variety of points of view about free will. I noted that psychology wasn't among the topics he included, and that seems a little odd, because a case can be made that psychology ought to be one of the lead disciplines in thinking about free will.

Now, I admit that it's a little hard to make that case as a practical matter because psychologists, including myself, have been uncomfortable with the concept of free will. We're uncomfortable in part because the concept raises the specter of a kind of dualism, mind–body dualism, which is deeply imbedded in English and many other languages and deeply imbedded in the way people think about biology and behavior. Most psychologists, including me, find it a very unfortunate perspective. And things that remind us of that perspective make us uncomfortable.

Nonetheless I'm going to start by talking about perception, which is a psychological topic, and I'm going to argue that our evidence for free will, the reason that we talk about free will at all, comes from perception and needs to be analyzed

in the same way that we analyze perception of color, perception of size, perception of beauty. These are all topics within psychology, and perception of free will is subject to similar analysis. Free will is also obviously connected with choice in a way that I'm going to try to make clearer as I talk about perception. Choice is another major topic in psychology. In my career I've gone from research on perception, largely color vision, to research on reasoning, to research on choice, largely the role of social goals and norms in choice.

To analyze free will behaviorally is to analyze the perception of one's own free will and the attribution of free will to others. Certainly the question of moral responsibility in connection with free will is closely connected to perception. One views moral responsibility for an action to be diminished in oneself or others when one perceives that action as other than freely chosen. Disagreements about moral responsibility can in part be disagreements about perception of free will, engendered sometimes by differences in the evidence that gives rise to such perception.

My analysis of perceived free will leads me to deny that there is any sharp opposition between free will and determinism. Indeed, people perceive themselves to exercise free choice even, or especially, in situations where their actual choices are highly predictable to themselves and others. Perceived free will is associated with the perception of choice options, even when the option chosen is strongly determined by a person's goals and sense of self. This leads in turn to a close examination of the concept of choice options.

My recent work on choice theory emphasizes plans as the basic unit of decision making. *Plans in the Structure of Behavior* is the title of a book that was published almost fifty years ago and is famous in psychology. I'm going to use the title here but not really so much in reference to the book. I'm going to assert that perceived free will is equivalent to the perception, however fleeting, of alternative plans.

Now what does this have to do with neuroscience and the question of whether neuroscience can explain free will? I think it has a lot to do with potential agendas for neuroscience, because neuroscience right now does not give us a very good account of plans, and therefore it doesn't give us an account of the perception of a choice between plans or of alternative plans. I think that these things, and also an understanding of random choice, are important topics to be tackled and might lead to new directions in neuroscience.

That's the outline of the paper, and I will conclude this section with a summary. I'm going to begin discussion of perception with a negative example. Suppose we perceive a salient external event as the principal or even the sole cause of an action. Suppose that a loud noise at a person's left produces a strong orienting response; the person moves eyes and head to the left. Not only that person but any observer who hears the noise and sees the orienting response is likely to perceive the response as externally driven. The leftward turn is not perceived as an exercise of free will. Correspondingly, neither the person herself nor an observer is likely to criticize leftward turn as highly blameworthy, assuming some negative consequence ensues. One might be tempted to generalize from this example by saying that we perceive freedom as the opposite of external situational control, but this generalization

creates two difficulties. First, one might suppose that there is always situational control and that the only question is whether this control is exercised by a single salient event or by events that are hidden or too numerous to grasp. If there is external situational control, are we to say that the perception of freedom is just an illusion?

The second difficulty is that the effect of a so-called salient event is not intrinsic to the event itself. Rather, it depends on a person's experience with past similar events. Again, the orienting response provides an example. Repeated exposure to the same or similar loud noises produces habituation of the orienting response, which gradually weakens and may disappear. One can place two people in the same immediate situation—person *A* habituated to the noise, person *B* not. One would observe two quite different responses to the noise. An external observer who did not know about *A*'s habituation might wonder whether *B*'s leftward turn could in fact have been freely chosen rather than externally driven, since the noise did not produce any response in *A*. In this situation, however, person *B* would perceive herself as not free and not responsible for her leftward turn, while person *A*, who heard the noise and did not react, might recognize that she had the choice to turn left and might thus perceive herself as having chosen freely not to do so. Apart from habituation, which is a learning process simple enough to be observed even in planarian worms, people have much more complex learning processes, and they filter events through complex perceptual and cognitive mechanisms that depend on their entire developmental histories. Thus a person's full history, or some sufficient summary thereof, must be included in any account of situational control of action.

From the standpoint of perception, however, these difficulties can be resolved by noting that people often perceive themselves and others as highly predictable yet nonetheless free. In the preceding example, person *A*, who is habituated to a loud noise, might well know in advance that she would not react to it, and likewise others who knew her history and habits might predict the same with near certainty. Because her nonreaction is a product of learning, it is part of who she is. She perceives herself as free in that situation. She can choose to turn toward the loud noise or not, and, since she has no purpose in turning, she does not turn.

Let's consider briefly a much less trivial example: a person who faces a strong sexual temptation and either resists it because of who she is or seizes the sexual opportunity, again because of who she is. Her behavior may be highly predictable both to herself and to others, yet both she and others perceive the choice as free.

In short, for perception, free choice and determinism are not sharp opposites. A person perceives herself as free even when the action she takes is strongly controlled by the situation and by her past history of learning, provided that she is aware of an alternative plan that could have been selected. Her chosen action is perceived as determined by her goals and self-control and yet nonetheless is freely chosen. The sense of conforming to one's goals and self-concept can be an essential part of the perception of free will.

Consider one more example, which leads me toward plans. A person reaches up to catch a ball. She perceives her attempt to catch the ball as freely chosen, but

the action of reaching up may be an automatic consequence of the plan to catch the ball rather than a separate choice. Certainly her detailed muscle movements in reaching up—triceps, biceps, deltoid—are part of a movement plan, and they are not separate free choices. That's why I emphasize that the perception of free will arises from a choice among plans—for example, to catch or not to catch the ball, or perhaps a very rapid choice between reaching up or jumping up—but whatever actions occur automatically within a chosen plan are not perceived as separate occurrences of free will. Only the choice of the plan is perceived as free.

This also applies to moral responsibility. If I am trying to put something onto a high shelf and reach up and drop it and injure somebody, all sorts of bad things may ensue, but I won't be accused of assault. The injury that I caused with a hard, heavy object was caused pursuant not to a plan to injure but pursuant to a plan to put something up on a high shelf. I may have been irresponsible or careless in the plan, and I could be accused of that, but I can't be accused of assault. So plans are at the core.

This discussion of plans draws on a recent paper that I published with Howard Kunreuther in the 2007 issue *Judgment and Decision Making*. There we emphasize plans as the basic unit of decision making. This choice of unit is central to the argument.

Prior theories of choice have created the concept of choice option, superficially equating the concepts of strategy, action, and plan. We distinguish between two concepts—game-theoretic strategies that specify a choice of every possible node in an extended decision tree, and then plans that can demand additional choices among subordinate plans at various points. We also distinguish plans from actions.

For example, in the game of chess, human players do not even have one reasonable strategy, because they can't conceive of the decision tree and grasp it as a whole and plot out a strategy, but good chess players often consider alternative plans, recognizing that, in carrying out a plan, they are likely to be confronted with further choices of subplans at various junctures.

When it comes to actions, we distinguish between selecting a plan versus executing an action pursuant to carrying out a plan. I've already used the example of catching a ball, where muscle contractions are not plans. In chess you might think that every move you have is a choice, so that the distinction between plan and action disappears, but this is superficial. Some moves are very much under the control of a larger plan. The commentaries of David Bronstein, the famous chess writer, tell us a lot about people's plans. For example, in discussing the famous Averbakh–Kotov game from the 1953 Zurich Candidates Tournament, Bronstein comments that Averbakh's fatal choice to open the G file cannot be called an error because it was made as part of a plan previously selected. There was an extraordinarily subtle oversight in his plan, but, given his plan, the choice of move was just a matter of adjusting the timing. It's like walking across ice that one is confident is firm and solid; the step that plunges one into icy water is made pursuant to the plan. Perhaps only the detailed timing and length of each step is adjusted in response to surface irregularities, but such adjustments are part of the execution of

a plan by a skilled walker. Not every step is a choice point.

And so I am claiming here that free will derives from the awareness of having selected a plan out of two or more available. It does not matter that the selection of a particular plan is highly predictable to the person or to other observers. Only the perceived availability of alternatives matters. Of course, this means that observers may disagree in particular cases, because the availability of alternatives may be uncertain and different individuals may have different information about the case.

A broad class of interesting disagreements arises in connection with apparent failures to choose obvious alternatives in problematic interpersonal relationships. Why, for example, do people remain in relationships where they are subjected to severe verbal or physical abuse? Why do women risk disease and pregnancy via unsafe sex with male partners? Some actions that appear to involve choice and, indeed, selection among alternative plans by people in similar situations but with different background experiences are actually taken under the control of a previously selected plan and without awareness of any alternative plan. Understanding that the victims perceived no choice leads one to blame them less, if at all, for the negative consequences that ensue.

So what does this have to do with neuroscience? If neuroscience is to explain the perception of one's own free will and the attribution of free will to others, it is necessary, perhaps also sufficient, to explain the brain mechanisms underlying consideration of alternative plans. It is natural, then, to ask what sorts of neural mechanisms underlie plans. There is a widespread impression, fueled by advances in brain imaging, that neuroscience has made great progress in recent years. Thinking about the neural correlates of plans should serve as a wet blanket for those who believe that science is well launched toward understanding the brain.

From a behavioral standpoint, not a neuroscience standpoint, simple motor plans are ubiquitous and centrally important. Locomotive plans have long been studied: swimming by jellyfish, planarian worms, octopi and eels, the gaits of quadruped mammals and of human infants and adults, specialized human locomotion in athletics and dance. The great psychologist Lashley back in 1951 emphasized the importance of a hierarchical planning structure for skilled movement—for example, in musical performance. Broca's area in the human brain seems to be essential for organizing the plans underlying fluent speech. Communication about motor plans is difficult; the coaching of dance or various forms of athletic performance is a specialized skill.

There is also a vast literature on plans underlying human speech. Apart from the analysis of speech, there are many demonstrations of the ubiquity and importance of hierarchically organized motor plans in human performance. Leaders in the field include Steven Keele, Richard Ivry, David Rosenbaum, and Saul Sternberg. Rosenbaum and his collaborators have demonstrated that even very simple actions are influenced by larger movement plans.

To show more clearly the kind of evidence that exists for motor programs, I will briefly describe some findings by Sternberg. Sternberg and his collaborators examined the rapid production of short sequences of both speech and typewriting.

In a representative experiment the subject was asked to repeat a short, easily remembered sequence of words as quickly as possible following a signal. The length of such sequences varied between one and five words. The basic finding was that both the latency after the signal to start speaking the words and the onset delay between successive words spoken in the sequence increased linearly with the sequence length, approximately 15/1000ths of a second per additional item in the sequence. Exactly the same results—with the same increments for additional items, for both additional latency and inter-item delay—were found when skilled typists were asked to type short sequences of letters as quickly as possible after a signal. The authors interpreted these results as indicating that motor programs of different lengths are assembled in preparation for speaking or typing. The retrieval of the next needed subprogram takes place by means of a serial scan of the main program, and therefore there's a time increment for each extra subprogram that must be scanned. Sternberg and his collaborators amassed, in a series of beautiful papers, considerable converging evidence in support of this interpretation.

What is the neuronal counterpart in the human brain for an assembled motor program manifest in behavior? Modern brain research asks where, but I believe the research needs to focus on *what* rather than *where*. If we do not know what, how do we know how many different places may be involved in the *where* question? Brain imaging lends itself to learning where, but the answers from that method may be irrelevant to behavior in the absence of a theory that states *what*.

Can neuroscience explain free will? This seems to me to be the wrong question just now. We should ask instead whether perceptual and behavioral phenomena, such as the perception of alternative plans, that are related to free will could provide useful starting points for learning more about the brain. Perhaps this is possible. I believe that the question of where has been overemphasized in brain research to the point that it severely impedes progress. There is place differentiation, and much has been learned about it, but as a consequence of this emphasis we have no good models of the emergent brain processes that correspond to activation of motor programs, much less the processes involved in mixed cognitive-perceptual motor plans.

From the standpoint of decision mechanisms, motor plans are just the beginning. Plans assembled by chess players might or might not be quite different in character. I've emphasized motor plans because they are ubiquitous among animals and seem a good starting point for the understanding of brain processes involved in plans, and thus also for the understanding of brain processes involved in recognizing and selecting among alternative plans.

In the interest of getting back on schedule, I am going to shorten this next section greatly. Suffice it to say that sometimes people seem to choose not only freely but also randomly. The places where this occurs most often are in competitive situations. In playing paper-scissors-rock against an opponent, you withhold your decision as to what you'll choose—paper, scissors, or rock—until the last moment. Similarly, if you're in a shootout in soccer against a goalie, you have choices of shooting high or low, left or right, and you may not even know your own decision until you

find yourself making it as the shooter.

Christian Schade and I have examined quite carefully random behavior in the game paper-scissors-rock. We find, surprisingly, that people are able to generate sequences that look random from the point of view of statistical tests. When they're offered the chance to do this by using a randomizing mechanism, an explicit randomizing mechanism, they mostly do not use the mechanism. They'll use the mechanism quite happily in situations where there is no real competition, but when they get into competition they prefer to use their own internal randomization. So what is this internal random-generation mechanism? I don't think we have any idea what it is. The mechanism is unknown. It seems inaccessible to introspection.

Within the field of mathematical psychology there has long been a focus on choice probability as a theoretical variable that is affected by situational factors and by learning that in turn generates observed choices. It is historically interesting that the first such mathematical model was formulated by Thurstone in 1927, contemporaneous with the probabilistic interpretation of quantum mechanics, which I do not believe he could have known about. A good many models of choice probability postulate specific internal stochastic processes underlying the probabilities. A broad class of such models consists of random walks with absorbing states corresponding to different choice options. There are many mathematical discussions of this topic, including those by Link, by Luce, and by Busemeyer and Townsend. Whether any of the stochastic processes discussed in the literature represent internal mechanisms that are accessible to voluntary utilization for random choice is unknown to me. Most of these are formulated using neural mechanisms as metaphors and therefore might represent starting points for neuroscience modeling.

To summarize: I believe the experience of free will corresponds to the perception that alternative plans are available. It occurs even when selection of one of the plans is predictable or determined. The challenge for neuroscience is to understand the neural correlates for plans. This may require sharp departure from place-oriented thinking. Ability to choose randomly might also stimulate thinking in neuroscience.

Free Choice and Determinism in Jewish Thought — An Overview

Alan Mittleman

All is foreseen, yet freedom of choice is granted.
—Avot 3:19

Others apart sat on a hill retired,
In thoughts more elevate, and reasoned high
Of Providence, Foreknowledge, Will, and Fate,
Fixed Fate, Free Will, Foreknowledge absolute,
And found no end, in wand'ring mazes lost.
—Milton, *Paradise Lost*

THE PROBLEM OF FREE CHOICE AND DETERMINISM IS AS DAUNTING AS it is ancient. The late philosopher Robert Nozick writes that the "problem is so intractable, so resistant to illuminating solution" that no approach to it "turns out to be fully satisfactory."[1] The determinist case seems ineluctable. Once one admits the universality of causation it is hard to arrest the slide from universal causation to universal necessity—that is, not only does everything have a cause but the cause determines the effect. If exactly the same causes were present at another time, the same effects would be produced. Furthermore, this cause-and-effect nexus is governed by a law such that, if one were to have knowledge of all of the relevant conditions and of the law, one would be able to predict what would happen. Such a view surfaces first among the Stoics.[2] Everything that happens has a cause, and, given cause *x*, effect *y* necessarily had to happen as it did. The cumulative condition of the universe at any instance constitutes the cause and the determinant of its condition in the next instance; nor could that new condition be otherwise than is given as a result of its antecedent condition. There are, of course, many technical arguments against the ineluctability of this progression, many ways of calling a halt to the slide toward determinism. One early approach was that of the Alexandrian

Jewish philosopher Philo, who held that God gave humans the gift of free will, the exercise of which amounted to a miracle, similar to God's own miraculous overcoming of the causal laws of nature. Causality does determine natural events, but both divine miracle and human freedom, a gift of God, suspend causality. Philo's name was lost to Jewish memory, but solutions such as his reoccur. We will consider some, in the Jewish context, below.

The problem of determinism arises within the context of ancient physics and metaphysics, but it likely would not have been felt as a problem were it not for its moral entanglements.[3] The most compelling reason to doubt universal necessity is the desire to preserve human agency. It is not only that we want to preserve the deployment of praise and blame on which reward and punishment rest; we want to preserve agency per se. If humans are simply instruments of forces beyond their control, then their dignity, not only their culpability, is fatally compromised. In arguing against determinism, thinkers have sought to secure the uniqueness and value of the human. The anti-determinist enterprise is axiological from the get-go. If it were simply a matter of adequate physical description and explanation, we would probably incline toward some version of determinism, at least for systems above the quantum level. But as it is minimally a matter of an adequate description and explanation of the human, we cannot quite succumb to the appeal of determinism. Even the Stoics were forced to deny the most stringent consequences of their position. The clever critique of Stoic necessity found in the lazy argument (*argos logos*) compelled the Stoics to nuance their account of cause such that some causes entailed a dimension of human agency more than others. Fate set the basic framework of the causal network within which humans exist. Human assent to fate, however, codetermines what occurs. (Human assent is an "auxiliary cause.") Human assent is not compelled by outward circumstances but comes about through its own nature. In this sense, universal necessity operates on two levels: the level of external antecedent causes and the level of internal, self-generated causes. But precisely why the internal expression of necessity is any more compatible with a coherent account of human agency than is a purely external causality is not resolved. The Stoics had to confront the problem of free choice but could not, given the inexorable logic of their determinism, resolve it.

The moral interest—the affirmation of the unique value of the human—is arguably the constant in the many iterations of the problem of free choice and determinism across cultures and ages. The metaphysical environment of the problem is the variable. For the Stoics and their ancient philosophical critics, the problem was constructed in terms of concepts of causality as well as of logical necessity. (Aristotle first raises the logical problem in *De interpretatione* when he analyzes whether statements about the future, famously about whether a sea battle will take place tomorrow, can be truth-functional.) It is Augustine, following Philo, who shifts the problem into a theological register. Universal necessity becomes personified, so to speak, in divine omniscience. Given an all-knowing God, how can God's knowledge of future events not necessitate the occurrence of those events? How can human free choice be reconciled with divine foreknowledge or providence?

That theological construction of the metaphysics becomes typical of how Jewish thinkers, following Muslim precedent, framed the problem.

In this paper I want to trace briefly some of the main options for framing and addressing the problem of free choice and determinism in Jewish thought. I will begin with the problem as it appears in the Bible and then look at its refraction through a rabbinic lens. I will then examine three medieval Jewish thinkers, Saadya Gaon, Maimonides, and Bachya ibn Pakuda, who represent somewhat different approaches to the problem. Saadya represents an indeterminist (or libertarian) approach. Maimonides, at least in the esoteric strata of his work, has been held to represent a soft determinism. Ibn Pakuda represents a view strikingly anticipatory of Kant: Both determinism and indeterminism hold within their own frameworks.

The degree to which the biblical authors were aware of the problem is questionable. At crucial points, the Bible assumes freedom of choice as criterial for moral accountability. Deuteronomy affirms:

> See I set before you this day life and prosperity, death and adversity. . . . I call heaven and earth to witness against you this day: I have put before you life and death, blessing and curse. Choose life—if you and your offspring would live—by loving the Lord your God, heeding His commands, and holding fast to Him. (Deut. 30:15, 19)

On the other hand, the Bible envisions a sovereign God who can rightly be thought to control everything:

> Unless the Lord builds the house, its builders labor on it in vain; unless the Lord watches over the city, the watchman keeps vigil in vain. In vain do you rise early and stay up late, you who toil for the bread you eat; He provides as much for His loved ones while they sleep. (Psalm 127:1-2)

Or, in the formulation of 1 Samuel 2:6–7: "The Lord deals death and gives life, casts down to Sheol and raises up. The Lord makes poor and makes rich; He casts down, He also lifts high." These texts surely do not exclude human agency in any consistent theoretical sense. Nonetheless, they limn the dimensions of a potential problem.

The locus classicus for the problem in the Bible is the narrative in Exodus in which God hardens Pharaoh's heart. When God commissions Moses to go before Pharaoh and demand that he release Israel from bondage, God announces that

> I will harden Pharaoh's heart, that I may multiply My signs and marvels in the land of Egypt. When Pharaoh does not heed you, I will lay My hand upon Egypt and deliver My ranks, My people the Israelites, from the land of Egypt with extraordinary chastisements. And the Egyptians shall know that I am the LORD. (Exod. 7:3–5)

The abstract issue that so exercised Augustine and the medieval theologians —God's foreknowledge of events—is still inchoate here. The dilemma is more immediately moral than metaphysical. God appears to deny Pharaoh freedom of choice; even if Pharaoh wanted to repent, he would not be able to do so. He would not have, in philosophical jargon, liberty of indifference; that is, he would not be able to choose among possible options. He would be constrained to choose only one—refusal to let Israel go. Does this not count against God's justice? Furthermore, God intends to use Pharaoh, as Kant might put it, as a means rather than an end. God will make a display of Pharaoh so that the Egyptians will know Who is really in charge. God has not only removed Pharaoh's freedom of choice; He has made Pharaoh an unwilling tool of divine pedagogy.

The text seems innocent of the moral complications it engenders, as if the loss of Pharaoh's moral agency were not an issue. Or perhaps not. As Jewish exegetes medieval and modern have noticed, the motif of heart-hardening is artfully arranged, and the arrangement is no doubt significant. It occurs precisely twenty times. Pharaoh hardens his own heart ten times (Exod. 7:13, 14, 22; 8:11, 15, 28; 9:7, 34, 35; 13:15) and God hardens it (or announces He will harden it) another ten (4:21, 7:3, 9:12, 10:1, 20, 27; 11:10, 14:4, 8, 17). Crucially, God's hardening of Pharaoh's heart does not begin until the sixth plague. "For the first five plagues," Nahum Sarna writes, "the pharaoh's obduracy is a product of his own volition."[4] Even after the first instance where God directly hardens Pharaoh's heart (9:12), we read that once again Pharaoh is responsible for hardening his own heart (9:34–35). Only afterward does Pharaoh's agency decline. Shall we infer from this schema that the biblical author acknowledged the moral problem and implied a solution to it? It is certainly possible. That, at any rate, is how the rabbis read the story. Only when Pharaoh, through his own malfeasance, proved incapable of moral behavior did God choose to curtail his choices. The die was already cast and Pharaoh had cast it. Thus, in the formulation of a midrash as cited by Nachmanides:

> *For I have hardened his heart* (Exod. 10:1) Rabbi Yochanan said, "This provides a pretext for the heretics to say that God did not allow Pharaoh to repent. Rabbi Shimon ben Lakish said, "The mouths of the heretics be closed! Only, *at scoffers, he scoffs* (Prov. 3:34). When He warns one on three occasions and he does not turn from his ways, He closes the door of repentance on him in order to punish him for his sin. Such was the case with wicked Pharaoh. After the Holy One, blessed be He, sent him five times [to request that Pharaoh let His people go] and he paid no attention to His words, the Holy One, blessed be He, said to him: You have stiffened your neck and hardened your heart; I will double your defilement."

On the view of the midrash, as amplified by the medieval exegete Nachmanides, the hardening of Pharaoh's heart is a justly deserved punishment. Rather than raising a question about the justice of God, it underscores it. Pharaoh's

previous actions warranted his punishment, which consisted of depriving him of the means for repentance. This deprivation, rather than the drowning of his charioteers and the destruction of his army, *was* his punishment. He had earned, through his sins, the inability to repent of them.

This is a canny acknowledgment of the moral problem resident in the biblical text as well as an elegant solution to it. The background, still an inchoate metaphysical issue, however, complicates the picture. The wrinkle is that God had already told Abraham (Genesis 15:13–14) what was to come in the matter of his descendants and their descent into Egypt:

> And He said to Abram, "Know well that your offspring shall be strangers in a land not theirs, and they shall be enslaved and oppressed four hundred years; but I will execute judgment on the nation they shall serve, and in the end they shall go free with great wealth."

God's announcement, centuries before the events narrated in Exodus, suggests that the distinction between Pharaoh's self-hardened heart and God's hardening of it is irrelevant: Both occurrences were part of a predestined plan. Here, the medieval philosophical and theological focus on whether God's omniscient foreknowledge is compatible with human freedom of choice is anticipated. Let us turn then directly to the medieval engagement with the problem.

The first systematic treatment of the problem is found in *The Book of Doctrines and Beliefs* by Saadya Gaon (892–942). Saadya adapts Kalam, the philosophical theology of Islam, to rabbinic Judaism. Although not a mere epigone of Mutazilite expressions of Kalam, he is nevertheless indebted to them.[5] The problem of free choice and determinism had long exercised the Muslim world. As in the case of biblical and rabbinic Judaism, so too pre-philosophical Islam struggled with how to reconcile God's knowledge, power, and wisdom with the human freedom necessary for moral action. Some Muslims, both pre-philosophical and from the Asharite school of Kalam, dissolved the tension and denied freedom of choice. The Mutazilites did not. They wanted total divine knowledge and control and, at the same time, human freedom of choice. Saadya has the same aspiration. He is convinced that Judaism must affirm both. His arguments, alas, are less than convincing.

Saadya's opening gambit is essentially a Kantian move: *Ought* implies *can*. That we ought to do *x* implies that we can do *x*. The Torah commands us to do some things and to refrain from doing other things. If we did not have the ability to respond to the commands of the Torah, then the Torah would be senseless.[6] Furthermore, it would have been senseless for God to have given it. As God does not do senseless things but wants to benefit His creatures in a just and merciful way, He gave them freedom of choice so that they could do His will. (Saadya then details some features of this divinely granted freedom of choice, e.g., that it is a disposition that precedes the choosing of any course of action and that its ideal form is |intentional and voluntary.) This plainly does not solve the problem. It does little

more than reframe it. Granted, God gave humans freedom of choice, but how does that stipulated freedom comport with God's omniscience and omnipotence? What space would omniscience (in the sense of foreknowledge or providence) and omnipotence (in the sense of control over all possible events) leave for human agency?

Saadya marshals several arguments. First, he appeals to experience. We sense, as subjects, that we typically have, as contemporary philosophers say, "liberty of spontaneity," that is, given a lack of external constraint, we can speak or not, move or not—we can control our bodies. (Of course, we could be merely brains in a vat imagining that we are doing all of these things because a mad scientist is causing us to imagine them. Appeal to the first-person case, as Wittgenstein has shown us, does not provide the certainty that Saadya, or Descartes, would like.) Second, Saadya argues that one action cannot be attributed to more than one agent. To ascribe a divine role in a given human action, *x*, is to ascribe two causes, one human, the other divine, to a single effect—a condition that Saadya thinks is untenable. (Can two persons not bake a cake?) Finally, Saadya falls back on the unfairness of punishing someone for something he did involuntarily. This would impugn the justice of God, which is unacceptable. (But even if you are a determinist, you still have to account for the distinction between [apparently] voluntary action and [apparently] involuntary action. The distinction remains cogent, whatever the theory might be that purports to explain it. On the atomic theory, my desk is mostly empty space. The theory must still explain the apparent hardness of the wood.) None of these arguments do much to advance Saadya's defense of freedom of choice in the face of divine omniscience and omnipotence.

Saadya's final argument confronts the problem of divine omniscience head-on.

> Perhaps, someone will ask further: "If God knows that which is going to be before it comes into being, He knows in advance if a certain person will disobey Him; now that person must by necessity disobey God, for otherwise God's foreknowledge would not prove to be correct."[7]

Saadya replies that the questioner has uncritically assumed that God's knowledge is causative; the questioner believes that God's knowledge of *x* causes *x*. Saadya rejects this supposition. Since God has known *x* from all eternity, *x* would, on the knowledge-as-cause account, have had to exist from all eternity. But that is absurd; *x* would be coeval with God. *X* would be Godlike; it would share God's eternity. The most we can assume is that the *idea* of *x* existed, so to speak, in the mind of God from all eternity, but *x* did not. Saadya draws a distinction, without naming it, between logical necessity and causal necessity.[8] It is logically necessary that an omniscient being know everything that there is to know, past, present, and future. (That is what the concept of omniscience logically entails.) Thus, God knows in advance that someone, *N*, will choose *x*, but God's knowledge does not cause *N* to choose. God knows His own mind; He knows the connection of ideas about *x* (that He will create *x* at a certain time, that *N* will choose *x*, etc.). His knowledge does not constrain *N*'s choice of *x*.[9]

It is still hard, however, to see why God's foreknowledge should not constrain, should be immaterial to, *N*'s choice. Maimonides, when faced with the same objection, introduces a radical dichotomy between what we mean by *knowledge* and what *knowledge* can mean when applied to God. (Gersonides, the fourteenth-century Provencal Aristotelian, goes even farther and denies divine omniscience of particulars.) Saadya does not share Maimonides' negative theology to the same degree. He does, however, gesture in the same direction. In response to the objection "If God knows that a certain person will speak, is it possible for that person to be silent?" Saadya answers that, if the person were to keep silent, we would have to say that God knew that he would have been silent. We would not have been entitled to say that God knew he would speak. Whatever a person does, *that* is what God antecedently knew he would do. At first glance, it looks like Saadya is simply practicing, flagrantly, the fallacy of *post hoc ergo propter hoc*. But his reasoning is more subtle than that. He is telling us, I think, that we are not *entitled* to assume God's point of view and so are not entitled to frame the question in this manner. The objector supposes that he can postulate what God knows—namely, that a certain person will speak—and how God knows it. But no one is ever justified in postulating something as if from God's point of view. The most we can say is that whatever has actually occurred was antecedently known by God. We cannot assume the stance of an omniscient knower, even as a thought experiment. But this is not to win the argument; it is to disown it. It is as if Saadya is saying, Let's argue over metaphysics and talk about divine causation and the like but only up to a point. At a certain point we have to say that the question is impious and reject it. It was for this sort of reason that the Muslim and Jewish Aristotelians did not have high regard for the Kalam thinkers as philosophers.

Does Maimonides do better? Maimonides' views on free choice and determinism are not quite straightforward. Maimonides is an esoteric thinker. Scholars differ over the extent to which Maimonides masks his own views and over what precisely those views are. In his exoteric writings on this topic, found in the Laws of Repentance in his code, the *Mishneh Torah*, and in the final chapter of his ethical treatise, the *Eight Chapters*, Maimonides stringently upholds freedom of choice. He uses arguments familiar from Saadya. In the *Guide for the Perplexed*, however, the situation is murkier. Maimonides appears to give more play to constraining features and may arguably endorse a soft determinism.

In the *Mishneh Torah*, an exoteric codification of the entirety of Jewish law ensconced in a philosophical perspective, Maimonides is explicit about freedom of choice:

> Freedom of choice is bestowed on every human being. If one desires to turn toward the good way and be righteous, he has the power to do so. If one wishes to turn toward the evil way and be wicked, he is at liberty to do so. "Behold, the man is become as one of us, to know good and evil" (Gen. 3:22)—which means that the human species has become unique in the world—there being no other

> species like it in the following respect, namely, that man, of himself and by the exercise of his own intelligence and reason, knows what is good and what is evil, and there is none who can prevent him from doing that which is good or that which is evil.[10]

He grounds freedom of choice—the Hebrew term is *reshut*, meaning primarily permission—on divine bestowal (*reshut l'chol adam netunah*) although, strangely enough, the incident by which the first humans gain freedom of choice is through an act of rebellion and transgression. Adam and Eve are lifted from their original animality by eating of the tree of the knowledge of good and evil. That aboriginal transgression ruptures the continuum between human beings and other creatures and establishes the uniqueness of the human species. Henceforth, "there is no one that coerces him or decrees what he is to do, or draws him to either of the two ways; but every person turns to the way which he desires, spontaneously and of his own volition" (Laws of Repentance 5:2). Maimonides is unequivocal that this great principle (*ikar gadol*) is the "pillar of the Law and the commandment" without which the rationality of the Torah would collapse. Hence, he fiercely opposed astrology, which he considered fatalism in the garb of pseudoscience (see Laws of Repentance 5:4). None of this, however, is an argument. It is only a fuller statement of the cryptic rabbinic statement, to which Maimonides alludes through use of the term *reshut*, that "everything is foreseen, but freedom of choice [*reshut*] is given" (Avot 3:19).

Where Maimonides does begin to argue, as in the final chapter of the *Eight Chapters*, his view becomes more nuanced. Maimonides continues to assert the fundamental ontological and moral importance of freedom of choice. He shows greater awareness, however, of the natural factors that constrain choice. Maimonides comments on one of the key Talmudic citations that bear on this topic: "All is in the power of heaven except for the fear of heaven" (Berachot 33b; Niddah 16b; Megillah 25a). The capacity to have fear or awe of heaven (that is, of God) is a function of one's freedom. Everything else ("all"), however, is "meant to designate only natural phenomena which are not influenced by the will of man, as whether a person is tall or short, whether it is rainy or dry, whether the air is pure or impure."xi God predestines the condition of the physical world for all times; only free will escapes the lattice of causes. "The Divine Will ordained everything at creation and . . . all things, at all times, are regulated by the laws of nature and run their natural course." Thus, the rabbis say in the Talmud "everything follows its natural course" (Avodah Zarah 54b). By this they mean that such statements as "a man rises or sits down in accordance with the will of God" can be analyzed into "God created man as a being whose physical nature is such that he can rise and sit down and whose mental nature is such that he has freedom of choice to do so." Unlike the Mutakallimun, who were occasionalists and did not believe in a stable universe governed by physical laws, Maimonides affirms universal causality and necessity. These stop short, however, at the threshold of the human will.

In the last chapter of the second book (2:48) of the *Guide of the Perplexed*,

Maimonides comes close to subsuming free choice under general patterns of causality. In the view of some scholars, he actually does subsume it. He writes of three kinds of cause: natural, free, and volitional. He means by *natural* such things as snow always melting when the air becomes warm or waves being stirred when the wind blows. All of those expressions in the Torah, where God appears to cause natural effects through commanding or speaking or calling to things in nature, must be understood in the sense of *God establishing natural laws at the time of creation*. It is merely a matter of rhetorical style for the prophets to leave out enumerating secondary, intermediate, or proximate causes and instead to invoke the First Cause in the relevant instances. Maimonides wants to free God from the micromanagement of earthly affairs.

The picture becomes complicated when we move to the second and third kinds of causation. What is the difference between free choice in a rational being and volition in a nonrational animal? It is perhaps not as much as we would have expected given the commitment of the exoteric Maimonides to indeterminism. The crucial passage—which is far from lucid—reads as follows:

> For inasmuch as the deity is, as has been established, He who arouses a particular volition in the irrational animal and who has necessitated this particular free choice in the rational animal and who has made the natural things pursue their course—chance being but an excess of what is natural, as has been made clear, and its largest part partakes of nature, free choice, and volition—it follows necessarily from all this that it may be said with regard to what proceeds necessarily from these causes that God has commanded that something should be done in such and such a way or that He has said: Let this be thus.

Maimonides appears virtually to equate the causation of irrational animal "volition" with the rational animal (i.e., human) "free choice." God "arouses" a volition in animals (*he'ir ha-ratzon*)—the desire of a fish or insect to do *x*—in the same way that He "necessitates" a particular free choice (*hiyyev ha-behirah*) in a human being. The point of Maimonides' analysis is to show that in all cases of causation God is not directly involved but involved only as a First Cause. But where does that leave free choice? Is not it too reinserted into the causal matrix of creation, on a par with natural and animal-volitional causation? If one were able to sustain this interpretation, Maimonides' position would be determinist to some degree.[12] Perhaps his view would accord with what is currently called compatibilism: Freedom is thought to be compatible with both causation and determinism. This position is often secured by defining freedom down (Hume) or radically reconceptualizing it (Spinoza).[13] Ultimately, Maimonides' philosophical anthropology appears to leave us with human beings who are essentially like animals in all but one respect. Their capacity for abstract reasoning enables them to fuse at least momentarily with the Active Intellect. When they do so, this purely intellectual transcendence constitutes

individual divine providence (*Guide* 3:17). Otherwise, the existence of human beings is not fundamentally dissimilar from that of irrational animals, who are not subject to providence but who are subject to causation. How we read Maimonides on this particular point depends on how we read him in general. Do we ascribe immense weight to one or two phrases, as if they disclose his "true," esoteric view in a subtle, fleeting manner, or do we look for continuity in his views across all of his works? These are unsettled questions.

Bachya ibn Pakuda, author of a classic text (*The Book of Direction to the Duties of the Heart*) in the tradition of Jewish virtue ethics, treats our problem in the context of an extended philosophical dialogue between the mind and the soul. Bachya's purpose is to persuade his readers that the Torah requires a life of mindfulness, intention, and inner purification. The "duties of the heart" are higher than the "duties of the limbs." The mind, through grasping true knowledge of God and of the nature of reality, directs the soul, which in turn directs the body.[14] In the dialogue, the soul seeks guidance about metaphysical matters from the mind so that it can conduct itself appropriately in sub-metaphysical, that is, moral matters. The problem of freedom of choice and determinism greatly troubles the soul, who appeals to the mind to cure it of its "worst illness." Its anxiety stems from the belief that the Bible affirms both divine governance of all things and freedom of choice but that these positions are mutually exclusive. The soul cites Scripture to document its dilemma. The mind responds that the dilemma is not only generated by biblical texts; it inheres in human experience per se and has long been a topic of philosophy. Human beings know themselves to be, as modern philosophers say, subject both to causes and to reasons.

As the mind reviews prior Jewish opinion, it claims that there were rabbis who believed in strict indeterminism as well as strict determinism. The indeterminists, of course, had no problem with affirming God's justice, since reward and punishment are fully contingent on free human choice. The determinists, however, had to assert that God's justice, given the absence of freedom of choice, is opaque to us. Nonetheless, we must agree that God is just but "our minds are too weak" to make sense of that justice (and wisdom, and grace). Bachya then makes a surprising assertion:

> Still others decided to believe in both schools, that is, to believe in both divine justice and in predetermination, claiming that whoever examines these matters too closely cannot escape sin and failure, no matter how he does it. They said, "The right way is to act in the belief that man's actions are entrusted to him, so that he earns reward or punishment, and to try to do everything that may benefit us before God both in this world and the next. On the other hand, we should rely on Him with the submission of those who know that all actions, movements, benefits, and misfortunes lie under God's rule and power and depend on His permission and decree, for He has the decisive argument against man, but man has no argument against his Creator."[15]

At first it seems that Bachya's rabbis are simply hedging their bets: Either view could be the correct one, so it is prudent, if incoherent, to maintain both. His position is deeper than that, however. Bachya believes that both views are necessary; both are powerful, if irreconcilable, descriptions of the way things are. Our ultimate situation vis-à-vis the way things are is one of ignorance, but this ignorance is blessed. Coming up against the limits of pure reason, to use a Kantian term, we turn back to practical reason. Our metaphysical ignorance frees us to pursue a moral path, to work on the duties of the heart. Bachya's view thus seems to be similar to Kant's, albeit within his own medieval pietistic idiom. For Kant we are both organisms, subject to mechanical causality, and persons, subject to the "causality of freedom." For Bachya, we are both part of a great chain of divinely regulated beings and individuals who must develop their own interior bond with God.

Bachya's view, although less philosophically developed than those of Saadya and Maimonides, points more clearly toward the human matter that is at stake in the perennial discussion of our problem. The *anxiety* that attends the thought of diminished agency and of the personhood related to agency arrests us. That the organic creature defined by causes can overcome the one who is a person—that Parkinson's or Alzheimer's or cancer can swallow what one is—is a fundamental fear. A person asserts personhood through action in accord with reasons, shaped in a space that may or may not be free but must, at least, be thought of as free in order for reason to be true to itself. Perhaps freedom is a necessary illusion. Perhaps the causality that embraces the human is as inexorable on every level as that which embraces "the grass that withers, the flower that fades." Or perhaps a miraculous grace pervades the domain of the human and lifts it out of the causal matrix, granting it permission to interrogate and shape its own momentary life. The mystery to which Bachya (and Kant) point may be the last word, if we are simultaneously to affirm the universality of causation and the integrity of reason.

NOTES

[1] Robert Nozick, *Philosophical Explanations* (Cambridge: Harvard University Press, 1981), 292

[2] Anthony Kenny, *Ancient Philosophy*, A New History of Western Philosophy, vol. 1 (Oxford: Clarendon Press, 2004), 194

[3] It is possible that a purely epistemological concern has driven perplexity about free choice and determinism as well. That concern is the tension between our internal perception of ourselves as voluntary choosers, movers, etc. and our knowledge that we are also moved, stimulated, coerced, etc. by external factors (as well as by internal factors beyond our control, e.g., twitches, shooting pains, thirst, etc.). We feel ourselves to be beings that both think and act on the basis both of reasons and of causes—beings that are dichotomous. Even this entails a moral dimension, however. Our status as beings that can direct and control themselves is at stake.

[4] Nahum M. Sarna, *Exploring Exodus: The Heritage of Biblical Israel* (New York: Schocken, 1986), 65

[5] Sarah Stroumsa, "Saadya and Jewish kalam," in *The Cambridge Companion* to Medieval Jewish Philosophy, ed. Daniel H. Frank and Oliver Leaman (Cambridge: Cambridge University Press, 2003).

[6] Saadya offers a *modus tollens* argument. If we do not have the ability to respond to the Torah, then the Torah is senseless. The Torah is not senseless; therefore we do have the ability to respond to it. Of course, what is at stake is precisely whether the Torah is senseless. Simply assuming that the Torah's claims, such as "Choose life!" are coherent amounts to begging the question. Saadya's discussion is found in sections 2 and 3 of chapter 4 ("On Obedience and Disobedience; Compulsion and Justice") of his *Book of Doctrines and Beliefs*. The version used here is found in *Three Jewish Philosophers*, ed. Hans Lewy, Alexander Altmann, and Isaak Heinemann (New York: Athenaeum, 1969), 118–25.

[7] Lewy et al., *Three Jewish Philosophers*, 122

[8] Richard Taylor, *Metaphysics* (Englewood Cliffs, N.J.: Prentice-Hall, 1974), 46

[9] Perhaps Saadya is making a case similar to Aristotle's with respect to the sea battle in the ninth chapter of *De interpretatione*. To use Anthony Kenny's formulation: "Everything is necessary-when-it-is, but that does not mean it is necessary, period. It is necessary that there should or should not be a sea-battle tomorrow, but it is not necessary that there should be a sea-battle and it is not necessary that there should not be a sea-battle (9.19a30-2)." That is, there is a logical necessity that either x or –x be true, but there is no real necessity for x or –x to take place. Kenny, *Ancient Philosophy*, 134.

[10] Laws concerning Repentance, 5:1 in *A Maimonides Reader*, ed. Isadore Twersky (West Orange, N.J.: Behrman House, 1972), 75. I have changed "free will" in Twersky's translation to "freedom of choice" to render Maimonides' *reshut*.

[11] *A Maimonides Reader*, 382.

[12] Scholars who hold this view include Shlomo Pines and Alexander Altmann. For an analysis see Arthur Hyman, "Aspects of the Medieval Jewish and Islamic Discussion of 'Free Choice'," in *Freedom and Moral Responsibility: General and Jewish Perspectives*, ed. C. H. Manekin and M. Kellner (College Park: University Press of Maryland, 1997), 133–52.

[13] Roger Scruton, *Modern Philosophy* (New York: Penguin, 1994), 231.

[14] Bachya is an eclectic thinker. One of his influences is neo-Platonism, in which the mind represents a higher emanation of divinity than does the soul. Bachya ben Joseph ibn Pakuda, *The Book of Direction to the Duties of the Heart*, trans. Menachem Mansoor (Portland, Ore.: Littmann Library of Jewish Civilization, 2004), 199.

[15] Ibid., 211–12.

A Buddhist View of Free Will
Beyond Determinism and Indeterminism

B. Alan Wallace

Determinism and Indeterminism, Ancient and Modern

THE DIVERSITY OF INDIAN VIEWS CONCERNING CAUSALITY AT THE TIME of the Buddha was representative of the broader philosophical pluralism that marked that society as much as it does our world today, and the Buddha's novel responses to those views remain as intellectually challenging and pragmatically provocative as ever. Then as now, philosophers tended to fall into one of two general camps, of determinism and indeterminism. Among the former, some asserted that all pleasant, unpleasant, or neutral experiences are due either to past karma (*pubbe kata-hetu*) or to the will of God (*Issara-nimmāna-hetu*).[1] The Ājīvikas maintained the fatalistic doctrine that all actions are predetermined by the external force of destiny (*niyati)*, over which people have no control.[2]

This view coincides closely with the modern deterministic view that there is at any instant exactly one physically possible future.[3] This implies, for example, that the precise condition of the universe one second after the Big Bang causally sufficed to produce the assassination of John F. Kennedy in 1963.[4] The Buddha rejected all such fatalistic views regarding human action and experience.

Other ancient Indian philosophical schools rejected determinism in favor of the view that all experiences occur as a result of pure chance, with no prior causes or conditions (*ahetu-appaccayā*).[5] In some respects, this view parallels that of some contemporary libertarians who argue that the indeterminism demonstrated by quantum mechanics at the subatomic level carries over to the everyday world of human experience under various specifiable conditions. For human beings to be the ultimate source of our decisions so that we are truly morally responsible, they insist, there can be no earlier influences that were sufficient to determine our subsequent actions.[6]

In response to all of the above views, the Buddha rejected on pragmatic grounds any theory that undermined the sense of moral responsibility. On the one hand, he rejected determinism as supporting "inaction" (*akiriya*)—if one is not

responsible for one's actions, the will to act in a wholesome way, and not an unwholesome one, is stifled. On the other hand, he rejected the indeterminism of asserting that all experiences and events arise due to pure chance, without reliance on any causes or condition (*ahetu-appaccayā*).[7] In addition, he concluded on empirical and rational grounds that there is no autonomous self that exists *apart* from and controls the body and mind, and he equally denied the existence of such a self *among* the psychophysical aggregates.[8] In taking this position, he refuted all notions of the self as an unmoved mover, as an agent that causes certain events, with nothing causing it to make its decisions.[9] Thus, the sense that each of us is an autonomous, nonphysical subject who exercises ultimate control over the body and mind without being influence by prior physical or psychological conditions is an illusion.

Volition and Action in Early Buddhism

At first glance, this Buddhist position may seem identical to that of certain contemporary cognitive scientists and philosophers of mind. For instance, in his book *The Illusion of Conscious Will*, psychologist Daniel M. Wegner writes: "It seems to each of us that we have conscious will. It seems we have selves. It seems we have minds. It seems we are agents. It seems we cause what we do . . . it is sobering and ultimately accurate to call all this an illusion."[10] Nowhere in the brain do neuroscientists find any control center that might serve as the neural correlate of an autonomous self, nor do they find any evidence of an independent self that causally influences brain functions. On the contrary, the brain appears to function according to its own internal mechanisms, with no independent self acting as a king or presiding judge governing and evaluating the brain's activities. According to this materialistic view, all the causal influences on mental processes occur in the complex machinery of the brain, beyond the range of introspective awareness.[11]

But these apparent similarities conceal fundamental incompatibilities between Buddhism and scientific materialism. Whereas many materialists believe that brain activities precede and causally generate all mental processes and that those processes themselves consist of brain activity, the Buddha turned this supposition on its head by declaring, "All phenomena are preceded by the mind, issue forth from the mind, and consist of the mind."[12] Central to this Buddhist emphasis on the primacy of the mind in relation to behavior is the role of the mental factor of volition, or will (*cetanā*), which determines which actions have moral consequences. Indeed, the Buddha virtually equated volition with *karma* when he declared, "It is will, O monks, that I call *karma*; having willed, one acts through body, speech, or mind."[13]

Only voluntary actions produce karmic results, and the magnitude of the moral consequences of one's actions corresponds directly to the degree of one's mental balance, intelligence, and understanding. Thus, the moral consequences of the actions of a person who is intoxicated, deranged, or brain-damaged are relatively light, while those of a person of sound mind and clear understanding are relatively heavy.[14] This corresponds closely to modern principles of jurisprudence. Moreover, it is incorrect to think that previous karma determines *all* of one's experiences and

feelings. Although all feelings that arise *together with* one's initial awareness of sensory stimuli are the result of past karma, the feelings that arise following such stimuli are not predetermined by past karma but are rather the result of fresh karma associated with the way one responds to those stimuli. And so acts of volition are conditioned both by *prior* influences as well as by other factors, such as the quality of one's awareness, that are *simultaneous* with it.[15] In this sense, Buddhism asserts a measure of free will insofar as one can reflect on one's options and decide on the best course of action in terms its moral suitability.[16]

Determinism and Moral Responsibility

Some contemporary scientists and philosophers assert that determinism—defined as the view that there is at any instant exactly one possible future—is compatible with moral responsibility. Daniel Wegner, for instance, argues that our actions are completely determined by brain activity prior to the conscious experience of making decisions, so that consciousness doesn't really do anything. For this reason, conscious will is an illusion, but it is nevertheless the person's guide to his or her own moral responsibility for action, and moral action is quite real.[17] But he fails to provide any cogent explanation for how something that is an illusion and doesn't do anything can be responsible for moral action. It should also be noted that his fundamental premise that conscious will is an epiphenomenal, causally ineffective illusion has been scientifically and philosophically shown to be inconclusive.[18]

Philosopher Daniel C. Dennett takes a virtually identical position, and his arguments face this same fundamental dilemma. On the one hand, he declares that each human being is nothing more than an assemblage of roughly a hundred trillion cells, each of them a mindless mechanism, a largely autonomous microrobot functioning in strict accordance with the laws of physics and biology. On the other hand, he writes, "Human freedom is not an illusion; it is an objective phenomenon, distinct from all other biological conditions and found in only one species, us."[19] In an elaborate but fundamentally specious series of arguments, he tries to assert the existence of "autonomous human agents" who exercise free will as their ability to control action whenever there are no constraints, coercions, or compulsions that limit their behavior. Yet nowhere does he provide any compelling argument for the existence of a human agent either among or apart from the mindless robots that totally make up a human organism.

Those who argue for a "compatibilism" between determinism and moral responsibility seem to be moved to by independent motives. Intellectually they have persuaded themselves that the entirety of human existence, and even reality as a whole, can be thoroughly explained in terms of the human categories of physics and biology. This is the basis for their determinism. But they also feel a psychological imperative to affirm moral responsibility, without which human civilization is virtually inconceivable. Caught on the horns of this dilemma, they are forced to illegitimately introduce morality and purpose into the mindless, deterministic

activities of atoms and cells, which is unwarranted by all that we currently know about physics and biology. This conundrum makes for bad science and bad philosophy.

As noted previously, according to materialistic determinism, based on classical physics, the precise condition of the universe shortly after the Big Bang causally sufficed to produce the assassination of John F. Kennedy in 1963, which implies that Lee Harvey Oswald was a passive cog in the deterministic machinery of the physical world. Since his actions were predestined billions of years before he committed them, it is absurd to speak of his having any kind of free will, and it is irrational to assert that he was morally responsible for his actions.

Some contemporary Buddhist scholars, while shunning materialism, do argue for the compatibility between determinism and moral responsibility, citing the Buddhist principle "When this exists, that comes to be, with the arising of this, that arises."[20] Whether the universe is deterministic in accordance with purely physical causality (materialism) or in accordance with mind–matter causality (Buddhism), it is still deterministic, implying that the present is thoroughly conditioned and determined by the past. If this is true, then Lee Harvey Oswald had no more of a choice to kill or not kill John F. Kennedy in the world according to Buddhism than he had in the world according to materialism. If at any instant there is exactly one physically possible future, as determinism maintains, then the present is absolutely predetermined by the past. This offers no wiggle room for any kind of freedom or moral responsibility whatsoever.

As noted previously, the Buddha rejected any theory—either deterministic or indeterministic—that undermines our sense of moral responsibility and our inspiration for abandoning vices and cultivating virtue. The causal relations between actions and their moral consequences are so complex and subtle that they cannot be fully comprehended by the conceptual mind.[21] So it is vital not to become immobilized by one's current lack of decisive understanding of the scientific or philosophical rationale for asserting the existence of moral responsibility. The important thing is first to recognize here and now the myriad ways in which we are *not* free to make wise choices and follow courses of action that are truly beneficial to our own and others' well-being, and then to devote ourselves to the cultivation of such freedom.

The Buddhist Ideal of Freedom

In light of a modern definition of freedom as the capacity to achieve what is of value in a range of circumstances,[22] the Buddhist tradition clearly emphasizes that ordinary sentient beings are *not* free, for we are constrained by mental afflictions such as craving, hostility, and delusion; and, insofar as we lead our lives under the domination of these afflictions, we remain in bondage to their resultant suffering. But the Buddha posed the truly astonishing hypothesis that suffering and its internal causes are not intrinsic to the mind, for in every being there exists a "brightly shining" (*pabhāssaram*) dimension of awareness that, though veiled by adventitious

defilements, may be revealed through spiritual practice.

Theravāda Buddhist commentaries identify this radiant mind as the naturally pure "ground of becoming" (*bhavaṅga*), the resting state of the mind that is not included among the six modes of consciousness, namely the five physical senses and then ordinary mental consciousness. The dimension of consciousness manifests in dreamless sleep and at death, and during the waking state the mind momentarily reverts to it between periods of engaging with its objects of cognition.[23] Under normal circumstances, one generally has no clear recognition of this relative ground state of awareness, but it can be vividly apprehended with the meditative achievement of highly focused, stable attention (*samādhi*), in which awareness is withdrawn from all objects, sensory and mental. The ground of becoming described in early Buddhism bears a strong resemblance to accounts of the substrate consciousness (*ālaya-vijñāna*) in the Great Perfection (*rdzogs chen*) tradition of Tibetan Buddhism.[24]

This brightly shining mind may alternatively be understood as the unconditioned state of awareness that is present after an arhat, one who has achieved *nirvāṇa*, passes away, never to take rebirth again. Such consciousness, which transcends the five psychophysical aggregates, is said to be nonmanifest (*anidassanaṃ*), timeless, and unconditioned.[25] Since it is unborn—not newly created by prior causes—and is not the consciousness of someone or something other than oneself, it must already be present in each sentient being before the achievement of *nirvāṇa*. This realm of consciousness is beyond the scope of the conceptual mind, so its possible influence on the minds of ordinary sentient beings is unimaginable.

Such transcendent, pristine awareness appears to be similar to the Buddha nature (*buddha-dhātu*) presented in Mahāyāna Buddhism and to the pristine awareness (*vidyā, rig pa*) taught in the Great Perfection. This primordial dimension of consciousness is said to be the deepest source of our yearning for happiness and liberation, and this may be the ultimate ground of freedom for all beings.[26] But since its nature transcends the domain of the conceptual, rational mind, it does not lend itself to rational analysis, and its way of impacting the mind and the rest of the natural world likewise lies beyond the realm of philosophy. It may be known directly through nondual awareness, but it cannot be an object of the intellect.

The path of spiritual practice may be likened to the process of refining gold ore that is contaminated by impurities. The first step on this path is to cultivate a wholesome way of life, avoiding behavior that is injurious to one's own and others' well-being. On this basis of ethics, one proceeds to balance the mind through the cultivation of focused attention, for, as the Indian Bodhisattva Śāntideva cautioned, "a person whose mind is distracted lives between the fangs of mental afflictions."[27] When the mind is subject to attentional imbalances such as laxity and excitation, it is as if one's psychological immune system is impaired, and so all kinds of mental problems can easily overwhelm it.

The cultivation of focused attention has a direct and important bearing on morality and the freedom of will. William James declared in this regard, "'*In what does a moral act consist* when reduced to its simplest and most elementary form?' . . . *it consists in the effort of attention by which we hold fast to an idea* which but for that

effort of attention would be driven out of the mind by the other psychological tendencies that are there."[28] And the French philosopher Charles Renouvier, greatly admired by James, defined free will as the sustaining of a thought because one chooses to when one might have other thoughts.[29]

With the development of sustained, vivid attention, one's awareness may be introspectively focused on one's own feelings, desires, thoughts, and intentions as they arise from moment to moment. As the Indian arhat Nāgasena taught King Milinda, the Buddhist practice of mindfulness entails directing one's attention to wholesome and unwholesome tendencies and recognizing them as such so that one may cultivate the former and reject the latter.[30] Such discerning, metacognitive awareness allows for the possibility of freely choosing whether or not to allow a desire to lead to an intention or to let an intention result in verbal or physical action. In short, freedom of will depends on the ability to recognize the various impulses that arise involuntarily in the mind and to choose which among them to accept or reject.[31]

Without such internal monitoring of one's mental states and processes, the mind is bound to fall under the domination of detrimental, habitual conditioning, with the attention compulsively focusing on attractive appearances (*subha-nimitta*), thereby reinforcing craving, and on disagreeable appearances (*paṭigha-nimitta*), thereby reinforcing hostility.[32] Such misguided attention is also prone to lead one to view as permanent what is impermanent, as satisfying what is unsatisfying, and as a self what is not-self.[33] To overcome such delusional ways of viewing reality, one must add to the cultivation of meditative quiescence (*samatha*) the development of insight (*vipassanā*) through the close application of mindfulness (*satipaṭṭhāna*) to the body, feelings, mind, and phenomena.[34] Only through the unification of meditative quiescence and insight can one gain complete freedom from mental afflictions and their resultant suffering, thereby revealing the innate purity of the brightly shining mind.

The Middle Way Beyond Determinism and Indeterminism

One may devote oneself to the path to freedom from suffering and its causes without knowing whether one can actually exercise freedom of will that is not totally determined by prior circumstances. However, it may be helpful to have a working hypothesis for free will to be actualized. One of the main sticking points for any Buddhist affirmation of free will is the nature of the self, or agent, that possesses it. We have already noted that no autonomous, controlling self can be found either among or apart from the dynamic processes and constituents of the body and mind; and this is the basis for the Buddhist assertion of "no-self."

The same type of analysis that is applied to the self can be equally applied to all other phenomena. For instance, the Buddha asserted that a chariot, like the self, does not exist as a substantial thing independent of its individual components. It is not equivalent to any of its individual parts, nor does the entire collection of those parts constitute a chariot.[35] The term *chariot* is something designated of an

assemblage of parts, none of which, either individually or collectively, is a chariot. The chariot comes into existence only when the label *chariot* is designated on the basis of those parts. In the same way, the term *I* is designated of the body and mind, which are not, by themselves, a real self. "I" come into existence only when I am conceptually designated as such. When most of us use these concepts and conventions, including the words *I* and *mine*, we grasp onto the referents of those labels as being real, independent of our conceptual projections; and this is the delusional basis for all mental afflictions, such as craving and hostility. Those who are free of delusion still use those concepts and words, but they are not fooled by them.[36]

Such ontological analysis can be applied to the body and mind and all their constituent parts in the same way that it is applied to the self, so that the self is no less real than any other phenomena.[37] Therefore, just as we can meaningfully speak of a chariot performing certain functions, so can we refer to the self as an agent who makes decisions and engages in voluntary activity. But the challenge of determinism remains: If all decisions and actions in the present moment are completely determined by prior causes and conditions—be they physical or mental—how can any kind of free will be posited?

As I have proposed earlier, the definition of determinism allows for no such freedom. Fatalism is the unavoidable implication of determinism as surely as later events are inevitably set in stone by prior conditions according to determinism. On the other hand, while some philosophers look to the indeterminism of quantum physics as a way out of fatalism, it is difficult to see how this strategy allows for a clear, coherent picture of a human agent exercising free will. Most interpretations of both determinism and indeterminism are based on the assumptions of metaphysical realism, namely that the world consists of mind-independent objects; there is exactly one true and complete description of the way the world is; and truth involves some sort of correspondence between an independently existent world and a description of it.[38]

The Middle Way (Madhyamaka) propounded by Nāgārjuna constitutes an utter rejection of the reification, of time and causality, that underlies most versions of metaphysical realism.[39] All causally conditioned phenomena arise according to a process of dependent origination (*pratītya-samutpāda*) in dependence on three factors: (1) prior causes, (2) their own constituent parts and attributes, and (3) conceptual designation. A chariot, for instance, arises in dependence on (1) the materials that were used to make it and the carpenter's work of assembling it, (2) its individual components, and (3) the conceptual designation of "chariot" that is imputed to this assembly of parts. The first mode of dependence entails prior causes and conditions resulting in a subsequent product. The dependence of the chariot on its parts is simultaneous: The whole and the parts exist simultaneously. And the chariot as a designated entity comes into existence simultaneously with its conceptual designation as such.

For all phenomena the basis of designation is never identical to the object that is imputed on that basis. To take the same example, a chariot is imputed on its chassis, wheels, axles, and shaft, but none of those parts—either individually or

collectively—constitute a chariot. The carriage as a whole comes into existence simultaneously with the imputation of that label on those parts, but they could have been designated otherwise. What this implies is that the entities that make up the world we live in arise in dependence on our conceptual designations, and those designations are predetermined by prior causes and conditions. There is freedom in the present moment to view the world in accordance with different conceptual frameworks, and this is where free will may enter into our experience. By shifting our way of framing appearances and making sense of them within our cognitive framework, we alter the very nature of the world as it arises from moment to moment relative to our way of viewing it.

The relativity of all phenomena with respect to the cognitive frame of reference from which they are experienced is put to use in many Buddhist practices in order to overcome mental afflictions and cultivate wholesome mental states and behavior. The Tibetan Buddhist genre of "mind training" (*blo sbyong*) is explicitly designed to help one transform all circumstances, felicitous and adverse alike, so that they arise as aids to one's spiritual growth and maturation. By conceptually designating events in ways that support virtue rather than habitual mental afflictions, one alters the world one inhabits; and this constitutes a fundamental freedom of choice.[40]

According to the Middle Way, even time itself has no inherent nature of its own, independent of conceptual designation. While past events certainly influence the present, the way we now designate the past also determines how it arises to us relative to our present cognitive frame of reference. Obviously, there is an asymmetry between the past and present, according to both Buddhism and modern physics. We can think whatever we like about a piece of rotten fruit, but it won't reverse the process of decomposition. More generally, we cannot change the past as it exists independently of our modes of perception and conception. But we can shift it *relative* to our cognitive frames of reference, and, according to the Middle Way, there is no past, present, or future independent of all such frames of reference. And so the past may impact us in any number of ways, depending on the manner in which we conceptually designate it in the present. By designating the appearances stemming from the past in different ways, the very nature of past events correspondingly shifts relative to those current modes of designation.

Drawing an analogy in modern physics, the physicist Eugene Wigner commented, "We do not know of any phenomenon in which one subject is influenced by another without exerting an influence thereupon."[41] By reifying time, we assume that the past influences the present but is uninfluenced by the present; and that the present influences the future but is uninfluenced by it. Such unilateral influence runs against the grain of the current scientific understanding of the physical world. Likewise, the Madhyamaka view denies the inherent existence of all three times, supporting the view that they can all influence each other, relative to the cognitive frame of reference from which they are designated.

Physicist John Archibald Wheeler explained this principle in terms of quantum physics: "It is wrong to think of that past as 'already existing' in all detail.

The 'past' is theory. The past has no existence except as it is recorded in the present. By deciding what questions our quantum registering equipment shall put in the present we have an undeniable choice in what we have the right to say about the past."[42] For example, the systems of measurement used by cosmologists here and now serve a crucial role in bringing about what appears to have happened in the early evolution of the universe. He concludes: "Useful as it is under everyday circumstances to say that the world exists 'out there' independent of us, that view can no longer be upheld. There is a strange sense in which this is a 'participatory universe.'"

More recently, physicists Stephen W. Hawking and Thomas Hertog have likewise proposed that there is no absolutely objective history of the universe as it exists independently of all systems of measurement and conceptual modes of inquiry.[43] Instead, there are many possible histories, among which scientists select one or more based on their specific methods of inquiry. According to Hawking, every possible version of the universe exists simultaneously in a state of quantum superposition—as a set of possibilities rather than concrete realities. When we make a measurement, we select from this range of possibilities a subset of histories that share the specific features measured. To relate this to the Middle Way: This is an expression of our freedom to choose the bases of designation on which we may again freely choose to designate a history of the universe as we conceive of it, based on that subset of histories. In these ways, we may exercise our free will not only to establish our past but also to frame our present and sow the seeds of our future.

The empty, or noninherent, nature of time is also incorporated in Buddhist Vajrayāna practice, in which one "takes the fruition as the path" (*'bras bu lam 'khyer*). This means that, while one is still an unenlightened sentient being, one cultivates the "divine pride" (*lha'i nga rgyal*) of regarding oneself as a Buddha on the basis of the Buddha that one will become in the future. Likewise, one develops the "pure perception" (*dag snang*) of viewing the entire environment and all its inhabitants as manifestations of enlightened awareness (*dharmakāya*), which is an emulation of the pure perception of a Buddha. In these ways, one draws the transformative power of one's future enlightenment into the present moment, with the understanding that the future is not inherently real and separate from the present. In such practice, based on a realization of emptiness and the Buddha nature of all beings, one is free to enable the future to influence the present.

Another way of interpreting the cultivation of divine pride is to identify one's own Buddha nature, or pristine awareness, as the basis of designation for one's own identity here and now. The bases of designation of one's ordinary sense of personhood are one's current body and mind. When one refers to oneself as having past and future lives, the basis of designation for one's identity is one's substrate consciousness, which, according to the Great Perfection, provides the continuity from one life to the next. When one assumes the identity of a Buddha, as in the practice of divine pride, the basis of designation for this sense of self is one's own, timeless Buddha nature. In the practice of the Great Perfection, one nonconceptually rests in this timeless, pristine awareness, allowing actions to arise spontaneously and

effortlessly, aroused by the interplay of one's own intuitive wisdom and the needs of sentient beings from moment to moment. In this way, one realizes a kind of freedom that transcends the demarcations of past, present, and future.

As we have seen, the Buddha rejected the philosophical extremes of both determinism and indeterminism and discouraged his followers from embracing any view that might undermine their inspiration to devote themselves to an ethical life in the pursuit of liberation. In pragmatic terms, as ordinary sentient beings we do not have free will to achieve what is of value within our range of circumstances insofar as our minds are dominated by mental afflictions. But the Buddha declared that these sources of bondage are not inherent to our very existence, that they may be dispelled through sustained, skillful spiritual practice. The Middle Way shows how free will may operate within the nexus of causal relations through time; teachings on the Buddha nature reveal the ultimate source of our freedom, and the Vajrayāna tradition, including the Great Perfection, demonstrates how the freedom implicit in the teachings of the Middle Way and the Buddha nature may be fully put to use in the swift realization of liberation and enlightenment.

NOTES

[1] St. Thomas Aquinas, *The "Summa Theologica" of St. Thomas Aquinas*, trans. Fathers of the English Dominican Province (New York: Benziger Brothers, 1947), 1, 23, 5.

[2] *Dīgha Nikāya* I.53

[3] Pierre-Simon Laplace, *A Philosophical Essay on Probabilities*, trans. F. W. Truscott and F. L. Emory (New York: Dover, 1814/1951); Peter Van Inwagen, *An Essay on Free Will* (Oxford: Clarendon Press, 1983), 3; Derek Pereboom, *Living without Free Will* (Cambridge: Cambridge University Press, 2001).

[4] Daniel C. Dennett, *Freedom Evolves* (New York: Penguin, 2004), 84.

[5] P.T. Raju, *Structural Depths of Indian Thought* (Albany: SUNY Press, 1985), ch. 3.

[6] Robert Kane, *The Significance of Free Will* (Oxford: Oxford University Press, 1996); Robert Kane, "Responsibility, Luck, and Chance: Reflections on Free Will and Indeterminism," *Journal of Philosophy* 96 (1999): 217–40.

[7] *A guttara Nikāya* I.173–75; cf. *Majjhima Nikāya* II.214; *Dīgha Nikāya* I.28; *Sa˙yutta Nikāya* II.22

[8] *Majjhima Nikāya* I.230–35; *Sa˙yutta Nikāya* III.66

[9] Roderick Chisholm, "Human Freedom and the Self," the Lindley Lecture, University of Kansas, reprinted in *Free Will*, ed. Gary Watson (1964; Oxford: Oxford University Press, 1982), 32; John Foster, *The Immaterial Self* (London: Routledge, 1991).

[10] Daniel M. Wegner, *The Illusion of Conscious Will* (Cambridge, Mass.: MIT Press, 2003), 341–42; Daniel M. Wegner, "The Mind's Best Trick: How We experience Conscious Will," *Trends in Cognitive Sciences* 7 (2003): 65–69.

[11] George Ainslie, *Breakdown of Will* (Cambridge: Cambridge University Press, 2001), 40; Daniel C. Dennett, *Freedom Evolves*, 244, 254.

[12] *The Dhammapada* I.1.

[13] *Aṅguttara Nikāya* III.415

[14] *Aṅguttara Nikāya* I.249–53

[15] *Milindapañha* 134–38; *Visuddhimagga* 532, 535; *Paṭṭhāna* I.1

[16] *Majjhima Nikāya* I.415–16

[17] Daniel M. Wegner, *The Illusion of Conscious Will*, 59, 224, 241.

[18] Hakwan C. Lau, Robert D. Rogers, and Richard E. Passingham, "Manipulating the Experienced Onset of Intention after Action Execution," *Journal of Cognitive Neuroscience* 19, no. 1 (Jan. 2007): 81 –90; Daniel C. Dennett, *Freedom Evolves*, 228–42.

[19] Daniel C. Dennett, *Freedom Evolves*, 2–3, 305.

[20] Sa ̇yutta *Nikāya* II.28; Asaf Federman, "What Kind of Free Will Did the Buddha Teach?" paper given at the June 2007 conference of the UK Association for Buddhist Studies. A later version of this can be found at http://www2.warwick.ac.uk/study/csde/gsp/eportfolio/directory/pg/psrfaq; Peter Harvey, " 'Freedom of the Will' in the Light of Theravāda Buddhist Teachings," *Journal of Buddhist Ethics* 14 (2007).

[21] *Aṅguttara Nikāya* II.80

[22] Nicholas Maxwell, *From Knowledge to Wisdom: A Revolution in the Aims and Methods of Science* (Oxford: Blackwell, 1984).

[23] *Aṅguttara Nikāya* I.61; Peter Harvey, *The Selfless Mind: Personality, Consciousness, and Nirvana in Early Buddhism* (Surrey: Curzon Press, 1995), 145–46, 155–79.

[24] B. Alan Wallace, *Contemplative Science: Where Buddhism and Neuroscience Converge* (New York: Columbia University Press, 2006), 14–18, 95–96; B. Alan Wallace, *Hidden Dimensions: The Unification of Physics and Consciousness* (New York: Columbia University Press, 2007), 45–48.

[25] *Dīgha Nikāya* I.223; *Majjhima Nikāya* I.162

[26] D. M. Paul, *The Buddhist Feminine Ideal—Queen Śrımāla and the Tathāgata-garbha* (Missoula, Mont.: Scholar's Press, 1980), XIII.

[27] *Bodhicaryāvatāra* VIII.1

[28] William James, *Talks to Teachers on Psychology, and to Students on Some of Life's Ideals* (1899; New York: Norton, 1958), 126 (my italic).

[29] Charles Renouvier, "Traité de psychologie rationnelle d'après les principes du criticisme," in *Essais de critique générale* (Paris: A. Colin, 1912).

[30] *Milindapañha* 37–38

[31] B. Alan Wallace, *The Attention Revolution: Unlocking the Power of the Focused Mind* (Boston: Wisdom, 2006), 77–127.

[32] *Aṅguttara Nikāya* I.3; *A guttara Nikāya* I.200–1; *Sa yutta Nikāya* v. 64–65;

[33] *Vibhaṅga* 373

[34] *Saṃyutta Nikāya* v. 156

[35] *Saṃyutta Nikāya* I.135; *Milindapañhā*, 25.

[36] *Saṃyutta Nikāya* I.14; *Itivuttaka* 53.

[37] *Sutta Nipāta* 937; *Majjhima Nikāya* III.31; *Mūlamadhyamakakārikā* V, VIII; Gen Lamrimpa, *Realizing Emptiness: Madhyamaka Insight Meditation*, B. Alan Wallace, trans. (Ithaca, N.Y.: Snow Lion, 2002); Thupten Jinpa, *Self, Reality and Reason in Tibetan Philosophy: Tsongkhapa's Quest for the Middle Way* (London: RoutledgeCurzon, 2002).

[38] Hilary Putnam, *Realism with a Human Face*, ed. James Conant (Cambridge, Mass.: Harvard University Press, 1990), 30.

[39] *Mūlamadhyamakakārikā* I, V, XVII.

[40] Thupten Jinpa, trans. and ed., *Mind Training: The Great Collection*, compiled by Shönu Gyalchok and Könchok Gyaltsen (Boston: Wisdom, 2006); B. Alan Wallace, *Buddhism with an Attitude: The Tibetan Seven-Point Mind-Training* (Ithaca, N.Y.: Snow Lion, 2001).

[41] Eugene P. Wigner, "Remarks on the Mind-Body Question," in *Quantum Theory and Measurement*, ed. John Archibald Wheeler and Wojciech Hubert Zurek (Princeton, N.J.: Princeton University Press, 1983), 178.

[42] John Archibald Wheeler, "Law without Law," in *Quantum Theory and Measurement*, John Archibald Wheeler and Wojciech Hubert Zurek, eds. (Princeton, NJ: Princeton University Press, 1983), 194; B. Alan Wallace, *Hidden Dimensions*, 76-80.

[43] Stephen W. Hawking and Thomas Hertog, "Populating the Landscape: A Top-Down Approach" *Physical Review*, series D, 73 (2006):123527; Martin Bojowald, "Unique or Not Unique?" *Nature* 442 (31 Aug. 2006): 988 –90.

Can We Understand Free Will?

Charles Townes

Do we really have free will? If so, how is it possible, and just where in the brain is the entity that can make free choices? Almost everyone believes in some freedom of choice—we have freedom to move our hand to the left or to the right as we wish. But how this is possible has been a long-standing and unanswered question. Philosophers and thoughtful people of almost all times and all cultures have discussed it. (See a recent summary in *The Oxford Handbook of Free Will*.)[1] Generally, we simply put aside the question and move on, believing in free will. Yet it is critically important to our view of human life, and I think the problem must be faced further and quite openly, even though and because so far we have no solution.

Until about a hundred years ago, the known laws of classical physics made our world completely deterministic. Then the understanding of quantum mechanics eliminated complete determinism, giving molecules and atoms, and hence even larger objects, only a probabilistic behavior. A molecule speeding through a hole may go one way or another, but just where it goes is not unique or definite until some human observes and checks its position. Quantum mechanics does not allow any special force or object to determine the molecule's path precisely. And that implies that we are unpredictable, since a single molecular change—for example, in our genetic makeup—can in principle make a major change in our lives. Another mysterious problem is that, according to our present understanding of quantum mechanics, a device or machine cannot establish a clear-cut answer to the molecule's position unless a human uses the device. Thus science recognizes that the future behavior of molecules of which we are made—or, hence, the future behavior of us—is not completely determined by its laws. And so, based on scientific laws alone, our precise behavior is not determined. Also, we have no control over just what happens according to presently understood science.

What is the possible interpretation of our strong sense of free will or choice, at least in some of our behavior? There are several proposals that are typically discussed.

1. We actually have no free will; it is an illusion, a feeling and belief that humans have somehow developed, perhaps useful for some reason—for example, from an evolutionary point of view—but only an illusion and fake.
2. Free will is a phenomenon emerging from the large number of neurons in the brain and their complexity. It is produced by the behavior of individual molecules—behavior that we understand but, because of its complexity, simply does not enable us at present to understand this outcome, free will.
3. There is indeed a special type of force or phenomenon that present science doesn't visualize and perhaps never will very completely but that does provide the phenomenon of free will. It may be part of what we generally think of as the "human spirit."

The first proposal is quite consistent with our present scientific knowledge. But it is counterintuitive and, even if we think it must be correct, we almost all proceed believing we can make free choices. And why would such belief be useful or result from evolution? It's not clear that belief in free will improves the behavior of a mechanistic individual for whom actions are determined only by present scientific laws. Why would such a belief help in behavior that results from scientific laws that can't be changed? Perhaps such belief can be of some help in human success even through we don't understand why, or perhaps it is just an unnecessary phenomenon.

The second proposal, emergence, is attractive. But it cannot be really consistent with present scientific knowledge. It is certainly true that phenomena that are unexpected by us can arise from complex systems, and many such cases can be found. For example, weather, a result of complex phenomena, is presently unpredictable by us. But if there is nothing more than laws of science involved, whatever phenomena arise this way from a complex assembly of simpler systems must be consistent with the basic laws governing its parts that are more elementary, and freedom of choice, or free will, is not. If basic physical laws are followed, there is nothing that can make a choice even though, according to quantum mechanics, the outcome of events is not completely predictable. The behavior of a very complex system must still be consistent with the laws governing its elements. To make an assumption of free will, we must blind ourselves to what our present scientific understanding really says. Complexity in a system can indeed produce an impression of free will, but that doesn't mean the impression is correct.

The third assumption is of course parallel to and consistent with the idea that there is something like a human soul or consciousness—something in the human being that is beyond the material world and the laws of science that we presently know. This is a common human assumption and belief. But it is also mysterious. What is this spirit, and where is it located—in the brain, we generally think, but where in the brain—and what is it?

Another puzzling aspect of human life, in addition to free will, is conscious-

ness. We believe we know what consciousness is, but it is difficult to define. One possible definition of a conscious entity is that it is something that has a purpose, can sense the world around it, and take action accordingly. But a mousetrap does this. It has a purpose, senses a mouse, and takes appropriate action. Yet we certainly don't consider a mousetrap to be conscious. Of course, the mousetrap's purpose has been planned and designated by its builder, not the trap itself; it made no such choice of purpose. Hence consciousness may perhaps be closely associated with free will; purpose must be chosen by the entity itself for something like consciousness to exist. And this consciousness seems to be part of an individual's possibility of making a free choice.

To what extent do living beings other than humans have free will (if we really have it) and consciousness? Presumably microorganisms do not. Their structure is of course much less complex than ours. But perhaps anthropoid apes do. Apes are notably different from humans in some ways, such as in the use of language and tools, and presumably in abstract thought. But they are also remarkably similar to humans, with about 98 percent of the same genes we have, although with somewhat smaller brains. How far down the chain of animals can we expect free will and consciousness to go? If other animals do have free will, do they have a moral responsibility as we assume humans have? Consider such a question in the light of the three proposals, above, as to the nature of free will.

The first proposal, that free will is an illusion, can in principle give the appearance of free will to almost any living being even though free will itself does not occur. Do apes or lower animals have such a perception? This is, again, at present an unanswerable question. Consider, for example, the rabbit. A wild rabbit will flee from the presence of a human, presumably with the instinct that humans are dangerous. A tame rabbit may come toward a nearby human, hoping for food or perhaps petting. Is the rabbit making a free-will choice, or are these behaviors simply something that are ingrained and automatized in the rabbit as a result of past history? The first proposal at least presumably allows any animal to have, as do humans, the impression that they have free choice, though whether they have even such an impression is unclear.

The second proposal, relying on the complexity of brain neurons, also allows other living creatures to have free will, though how complex their brains need to be to have free will is not known. In any case, free will presumably stops at some point down the biological chain when the brain becomes sufficiently simple, because complexity is a basic assumption in this proposal.

The third proposal, corresponding to a special phenomenon assuming a "spirit" and not presently understood, can be extended to animals. But it may mean that only humans really have free will—a special property or gift to us presumably developed through evolution, but perhaps a special gift of God.

If free will is naturally built into our neural system, then other animals can be expected to have some aspects of free will. Consider language, which is quite complex and thus obviously requires a well-developed brain. Humans use it extensively and well. Some animals also make sounds whereby they communicate

to fellow animals, so something like speech is present. They also make motions that communicate. Do they similarly have free will and consciousness like humans but in a more elementary and less pronounced way? Since the phenomena allowing free will are unknown (and maybe a gift from God), it may or may not have been allocated to other animals. Thus the question as to how far down the biological chain, if at all below humans, real free will and consciousness may go is left open. But the religious viewpoint is generally that humans are unique in such respects and that free will and moral responsibility are not really shared by animals.

One can also ask at what stage in human development does free will exist and to what extent. Does a newborn baby or even an unborn embryo have free will? When does free will begin, and is it a gradual development, as seems likely in a newborn. A similar question must also be faced concerning people with mental disabilities. To what extent do they have free will? Generally, we assume that people with severe mental disabilities may not be as responsible for their actions as are normal individuals. Free will could thus have varying reality for people with mental problems and be somehow connected with the nature and health of the brain and nervous system. If it is not an on-or-off phenomenon, then this type of partial free will applies not only to newborns but may well apply to animals with less brain power than normal humans. Does this imply perhaps low-level moral responsibility on the part of animals?

The possible existence of real free will, rather than only the impression of it, is thus a basic puzzle and requires some laws or phenomena we simply don't yet know. Perhaps it takes us into phenomena outside of our presently recognized materialistic world—the spiritual and godly. However, such a conclusion is not obvious, since we must recognize that there are also many other puzzles, apparent inconsistencies and unknowns in our world. We must therefore be ready to accept unknowns and apparent inconsistencies as we actually do in science. For example, quantum mechanics and general relativity, both checked well by scientific instruments and accepted as real, do not seem consistent with each other. We believe the universe began about 13 billion years ago with a "big bang"; but how can something like that get started? Such a phenomenon is inconsistent with our present, supposedly constant laws of science. We now have physical evidence that the type of matter we know in our universe is only about 5 percent of the total matter. There is what we call dark matter, which is about 20 percent of the total, and dark energy, the remaining approximately 70 percent of matter in the universe. What these "matters" really are we don't know, but we believe they exist.

Another basic puzzle beyond how the universe was started is why, and why we ourselves are here. We don't know just how any life got started on earth, though we can imagine molecules getting together for its initiation. The laws of science that controlled development of the universe and humans seem very, very special. Nuclear physics and gravitational laws must be almost exactly as they are for a star like the Sun to be able to produce the steady and approximately constant flow of energy it has been providing over the last billion years. The fundamental particles, their interactions, and electrical forces must be almost as they are for there to be

the rich variety of chemical elements that exist and of which we are formed. Why and how did the laws of science turn out to make our lives possible? Some suggest that perhaps there are billions of different universes, each with different physical constants, and that ours is just the one that turned out to be right. But that's a curious assumption. Why would such billions of universes exist and each have different physical constants?

There are clearly phenomena, and perhaps also dimensions, that are beyond our present visualization. In science, we move ahead accepting what we think most likely correct and simply setting aside, for the moment, apparent inconsistencies and mysteries, hoping we will eventually understand. There is no reason we shouldn't do the same thing for free will, recognizing that it involves phenomena we simply don't comprehend in terms of present science. And there may be spiritual realities and dimensions involved that we cannot clearly recognize.

Free will is contradictory to some religious views. For example, if God is all-knowledgeable and hence knows just what will happen in the future, then the future is fixed and we cannot change it by free-will choices. Furthermore, if God is complete goodness, how can evil things and human suffering occur as a result of human behavior? These two anomalies can be understood if we believe that God has given humans power so that we have some godlike qualities in being able to make choices and thus determine what happens. This means that our own power can overrule what might be normally the result of God's goodness. Such an assumption represents indeed a remarkable gift of God's will to imperfect humans—the ability to choose between good and evil.

Interesting experiments on free will have been done by Libet.[2] Unconscious impulses initiating motion of the wrist were found to be consistently initiated about one-half of a second before the event, while conscious knowledge of the event occurred only about one-sixth of a second before it happened. This might seem to indicate that there was no conscious choice concerning the action. However, it was also found that, as conscious knowledge of the possible motion occurred, only one-sixth of a second beforehand, there was a conscious possibility of accepting or prohibiting the motion. This seems to indicate that, although the action was not initiated consciously, it could be controlled consciously. Such a finding is somewhat parallel to other well-known actions, such as a desire to eat, over which we have little control when we are hungry although it is still possible for us to make the conscious decision to eat or not to eat. Certainly some of our actions are simply instinctive. Libet shows that some are initiated unconsciously, with decisions made only later, which can seem reasonable for phenomena like hunger and eating. Are all our actions of this type? Libet's experimental observations maybe correct, but the actions he observed are still rather simplistic, and perhaps the results do not characterize behaviors that are complex and more important. Even if they do, the observations can allow us free will, but without free initiation. Furthermore, if directions toward any action are multiple and randomly initiated, and we can make a choice whether to proceed, we thus at least have a variety of possible free choices.

Do our composition and past experiences really determine what choices are made, or do we ourselves make the choices and have free will? In the case of moral decisions, for example, one might suppose that our past experience and training would determine our decisions. Would this represent a real free will? For simply moving the wrist one way or the other, past experiences would seem to have little influence in making the choice, so at least in such cases no obvious background can determine the outcome and perhaps we really do have a free choice, unless the motion is determined by some physical mechanism not yet understood and our free choice is only an illusion.

Our usual conception is that the body is a mechanism, constructed of atoms and molecules and hence generally obeying physical laws, but that there is some conscious element that can additionally control it. Just where is this element, and what is it? If it is made of physical particles, then it too must be controlled by the laws of science and hence has no free choice. As previously noted, our understanding of science and the existence of something with free will are simply inconsistent. Consciousness is perhaps not inconsistent with science, but it is difficult to define and puzzling. Where does all this leave us? Perhaps the simplest answer is that we really have no free will; it is only a fake feeling, regardless of how real it seems. But my own assumption and conclusion is that our knowledge is clearly incomplete and that there are remarkable additional phenomena beyond it. Perhaps there is something like a completely new dimension, e.g., the spiritual world, outside of present scientific understanding. Such should not be very surprising. Even in science, theorists are toying with ideas of new and presently unconceived dimensions. String theory, for example, generally uses eleven dimensions rather than the presently recognized four (up-down, left-right, backward-forward, and time) that we presently understand, and with these additional dimensions scientific theorists are able to solve most of the scientific inconsistencies we presently know. String theory is very attractive but involves seven additional dimensions we presently can't sense, and, while it is able to fit most scientific observations, it has not yet produced a way it can be clearly experimentally tested, as is required of normal scientific theories. This is somewhat similar to the assumed "spiritual" dimension, which seems real to me and to many others but so far has no clear-cut experimental test, nor do we know just how to make one.

Along with spirituality, the assumption of a creator God can put things in harmony and perspective. This is unprovable, as are many scientific assumptions. Some of us believe it firmly, and some will doubt. But recognition that we clearly don't understand the existence of free will, in which most people believe, should make belief in "spirituality" recognizably reasonable. Can we understand more? I believe we can, and that further scientific discoveries and human understanding will be exciting and fascinating.

NOTES

[1] R. Kane, ed., *The Oxford Handbook of Free Will* (New York: Oxford University Press, 2002).

[2] B. Libet, C. Gleason, E. Wright, and D.Pearl, *Electroencephalograph and Clinical Neurophysiology* 56 (1983): 367; B. Libet, *Behavioral and Brain Sciences* 8 (1985): 529.

Science Beyond Methods and Goals
How the Future May Surprise Us

Piet Hut

"Let's keep trying." I think that is the very theme of science. It is amazing that science has made progress for about twelve generations now. I don't know of any human activity that has made continuous progress for twelve generations without getting stuck. I think one of the wonderful things about science is that you can get credit for "crazy" new ideas, if they are interesting enough. You can also get credit for shooting down ideas that are very conservative. Somebody once said that the pleasure of science is proving other people wrong, including yourself, and, indeed, if you have a great idea it's also fun to try and poke holes in it and see that you were wrong. It's part of the game. So science is like fashion in a sense that you get brownie points for new ideas, and science is also like a more conservative enterprise—like, for example, most forms of organized religion—where you get brownie points for defending the faith and for sticking to the old ideas, maybe in new forms. In science, then, you get brownie points for being conservative and for being progressive at the same time. I think that is ultimately the key to science's record of making progress without getting stuck for the past few hundred years now.

Even so, a few hundred years is very, very short. Our written literature goes back a few thousand years, and the first cave paintings were made a few tens of thousands of years ago, and so, among human enterprises, science is really the young kid on the block. I like to tell people that science is, compared to other cultural activities, like a teenager. It has all kinds of bold new ideas. It hasn't quite found its own limits yet. It can sometimes be a little bit arrogant, which often is stimulating, and I think many of you will recognize some of these aspects in scientists as well.

I think that science at some point in the future will have a lot to say about free will, about emergence, and about the role of free will in emergence, but I don't think that in my lifetime we will get to a clear conclusion. Maybe some new developments will occur, but I don't think anything will crystallize in the near future. Since science is working on a timescale of hundreds of years, it is not something in which you can hope to see breakthroughs in a matter of a few years

or even decades. The beauty of science is in its moderation. Scientists do not try to solve everything in their own lifetime. The key of science is to attack a problem that is doable; to look at all the problems you could be interested in and taking the first problem that hasn't been solved, not number five or number ten. You don't get to go into the candy store and take the most attractive piece of candy, you must take the next, perhaps less attractive piece of candy. That is the beauty and the sadness of science. You don't get to choose the really great problems if the time is not ripe yet. If Einstein would have been born a few hundred years ago, he wouldn't have been able to do relativity theory. The time then was not ripe for that theory.

Even though free will is an interesting topic, I'm convinced that the time is not ripe for science to treat it in a scientific way. That doesn't mean we can't talk about it. I think it is interesting to speculate and to see what might happen, but I think we have to wait a bit. If I were to speculate about how free will would be addressed in the future, I would have to speculate about the future of science, the next few hundred years, maybe the next few thousand years. How do we do that?

The best way to think about the future of anything is to look back at the past, to take some main lines and try to project, to continue the dotted lines. How did science get started? Why did science get started? How could it be that suddenly people started with something extremely simple? Galileo, for example, taking a few balls, dropping them, rolling them from an inclined plane, and writing down that if you throw something away it falls in a parabola. What could be simpler than a parabola or the way things fall? What does that have to do with nature, with understanding the material world? Galileo and other people around that time, the fifteenth, sixteenth century, somehow had the intuition that, if you limit yourself to very, very simple things, you might get a deep enough insight that you can use it to build upon. It is an interesting question why the great cultures of India, China, and Islam, a few hundred years before Galileo and Newton, did not produce the type of modern science we have now.

I think the answer is probably that no culture has been as naive as the Europeans in the last millennium. No culture has had the idea that you can split the world into subjects and objects. That you can take only the objects—only simple objects, and only the simple behavior of those objects in the most simple way—and assume that it has anything to do with reality or a qualitative understanding of reality. That is so incredibly naive. I can't blame the Chinese and the Indians that they didn't even try! I probably wouldn't have tried if I had lived in a different culture. I think it is the naiveté of the Europeans that somehow got the ball rolling (literally, with Galileo) and resulted in what, surprisingly, now enables us to describe almost everything we see around us—the Higgs particle, for example. We have a very detailed theory for all the forces in nature and soon we will discover the Higgs particle as the last piece of the puzzle. Well, almost, anyway, leaving out gravity and whether string theory works—but that is so far from our bed, or from our kitchen for that matter, that it doesn't affect our life directly in any conceivable way.

This "detailed theory" has not been in existence for very long. Even a hundred years ago, if you took some salt, some kitchen salt, and threw it in an open

fire and you got a bright yellow flame, you would not know why. Nobody would know why that flame would be yellow. You could take a spectrum and get a few spectral lines, but nobody would know how or why spectral lines are produced. A hundred years ago we couldn't explain even everyday phenomena. Now we have the most detailed explanation of the phenomenology and the most detailed series behind the phenomenology of the everyday material world. That is enormous progress, which I think is absolutely phenomenal and amazing. However, the big danger in any type of progress is that you are so focused on what you have already made progress in, you forget there could be anything beyond the progress already made.

Today, when we talk about really big problems, I think it is only a nice excuse to affirm that now, for all practical purposes, we have the complete theory to explain chemistry, most of what is physics, and the basic underlying mechanism of biology, although we need a lot more study to iron out the details. Nobody has the feeling that there is a show-stopper or a big obstacle. We probably have to work a number of decades, or longer, to get systems biology sorted out, but it seems to be in full swing with little hint of any major show-stoppers. Our understanding of material reality seems to be pretty well under control. We seem to have detailed descriptions, effective descriptions, predictions, and recipes for technology.

So what is left out? Maybe it is time to go back to the time of Galileo and to see what exactly he did. Science is empirical. That means science is based on experience. You do an experiment and you see the outcome of the experiment. The experiment gives you a better theory. With the better theory you can design better experiments, the experiments help you to define the theory, and the theory helps you to ask the right questions to do better experiments. That is how science works. That is what we mean when we say that science is empirical: It is based on experiments, on what you can measure, and on what you can experience.

Let us go back even further. Let us try to go back to square one and start from scratch. What does it mean to have experience? We can start with language. Language helps us to deal with our experience. Every sentence we speak has a subject, a verb, and an object. I hold the mic and you hear something. Somebody does something. In whatever we do, there is a subject, an object, and an interaction.

If we see how science fits into this structure of everyday language, we see immediately that science is studying only one out of the three elements. If you have subject, interaction, and object, science is only studying the object ball. It has spent four hundred years making a beautiful and detailed investigation of the object ball, as if there were nothing else. On the level of the object ball, it has, moreover, limited itself to what is called objective within the object ball. If I say, "I see a dream," or "I have a memory," then the memory is the object or the dream is the object, but we don't consider that to be part of natural science, certainly not in physics or chemistry. We limit ourselves to the objects, then, to only those objects that can be shared among other people. So, in two ways, we are reducing our experience to something relatively narrow, which we have then spent a few hundred years collectively mapping out.

Now that we have done that, and now that we are filling in the last details, maybe it is time to go back and see if we can do anything like that on the level of the subject and on the level of the interaction between the object and the subject. Can we bring the subject into the picture, and can we also talk about those objects in our experience that are not so easily shared? If I analyze the physics of a table or of a glass of water, that is easy to share. If I analyze other aspects that are not so easy to share, then we need some technology that is more complex.

I would say that science has done an absolutely stunning and amazing job at getting the low-hanging fruit. I think it is right to start with the low-hanging fruit, because where else would you start? You have to build from the ground up. I think, though, that in the next few hundred years we will probably get a science not only of the object but also of the subject and of the interaction between the subject and the object. How will that work? I don't know. Galileo had no idea that there would be relativity theory, quantum mechanics, thermodynamics, etc. He had the intuition that his direction was the right direction to go in. I think that the next step is in the direction of a new science of subject, interaction, object—a truly empirical science, a science of true experience completely filled in and not looking only at the object ball.

If I were to speculate yet further, I would say at some point we will be able to go beyond subject, interaction, and object. It may be more than a few hundred years, or it may be a thousand years (as an astronomer I'm used to thinking in terms of a million or a billion years, and so from that perspective a thousand years is really nothing). I think, in time, we will be able to step back from experience to the raw material of what is given to us in the most raw empirical way—namely, our awareness—to talk about experience. When we talk about x, about something that in a way stands outside ourselves, what we really start with is the awareness of ourselves as a subject, the awareness of other things and other people as objects for us, and the awareness of the interaction. But can we look at the awareness itself? What does awareness teach us? Is there any way to talk about, or to think about, or to see, or to be aware of awareness? There might be. There might not be. Here science cannot help us. Science has made a specific decision—and a prudent, highly pragmatic decision—to take only the objective part of the object ball of experience. "What is beyond objective? What is beyond the object ball? What is beyond experience?" If I ask those questions, I am three steps away from what science has started out to define as part of its terrain.

Getting to that point of three steps away will take us three times longer—I would guess a few hundred years, if the past teaches us anything. But I think that, once we do get there, we will be able to say something about where science might want to go, say, a thousand years from now, or ten thousand, or five hundred thousand. Who knows? It's completely open. The forerunners of what science will find there we can find in various cultures, where people have studied awareness in a purely phenomenological way, not in the step-by-step multigenerational approach that science is so good at, but in an attempt to get as much insight as possible in one lifetime. Here the great contemplative traditions in Europe, in Asia, and in

other places have given us quite a bit of material about the phenomenology of awareness. There is an enormous body of literature on the subject, but nowadays we don't learn much about that. Who of us gets exposed in our education to medieval Christian mysticism? And who of us hears the word *mysticism* and thinks about anything beyond just being vague or foolish or quaint?

If you ever take a few minutes to look at the writing of, for example, a Christian medieval mystic or of anybody in the contemplative traditions in India, Tibet, China, or Japan, the first thing you will notice is the quantitative approach. That is quite shocking. It's always a talk about the seven stages of this, the thirteen steps of that, the so-many of this, the so-many of that. If you look into why they do that, you will see that what they offer is a phenomenological account. If you do the following type of exercise, then you find that you need to take this step, and then this step, and then this step. They start with phenomenology.

Science also has started with phenomenology. Any type of science starts with experience. You describe what you find. You describe it as accurately as you can, and then you go from observation to theory, and then you use your theory to refine your observation and to arrive at progressively finer distinctions. So the first step of a future science of awareness is already there. In many ancient traditions there is a great abundance of phenomenological material, which could be a basis for further scientific developments. Fortunately, more and more of this is now freely available to anyone. You can look at it from your home. Go to a website and type in a few words, and there you go. So much is there, and it's just amazing, but our educational system is not preparing young people for actually doing phenomenology —that you can gather phenomena, put them on the table, and find ways to let them speak to you, let them tell you and inspire you to find new ways to arrange them.

That is basically my view, my view of free will and my view of emergence. Both free will and what it really means for something to emerge are premature questions. They cannot possibly be answered by the current level of science, or tomorrow's science, or by the science of the day after tomorrow. I think that, for a scientific approach and a scientific answer, these questions will have to wait at least a few centuries. Science, hopefully, will continue apace.

At the same time, there is no reason for us not to try to get a preview, some sense of what might happen. It's interesting, and also, simply by imagining what might happen, we might become a catalyst for the very thing we're imagining. If we don't imagine what will happen it will take longer for the next scientific revolution to happen. Whenever an entirely new idea emerges, it takes time to convince people that it's a useful direction to move in. If we can start playing a little bit with how we can extrapolate the lines from the past, then we might be able to expedite future developments. We can lower the threshold to new ideas. For that reason alone I think it is good to speculate a little about the future of science, but there is another, completely separate reason to do so.

The completely separate reason is that those people who have an intuition and an interest in contemplation, mysticism, or spirituality—whatever term you want to use—find it extremely difficult to translate traditional teachings into the

idiom of the modern world. Science seems to be so much against all the metaphors, all the pictures, all the ideas that have been used in the past, thus making the mystical seem completely ridiculous. Many scientists do think it's completely ridiculous to hold onto an ancient faith, an ancient type of religion, because it all sounds so silly and quaint and not at all fitting with a modern contemporary worldview.

I think the way to rescue the phenomenological part, the experience part, the empirical part of the ancient traditions, is first of all to go back to the source and see what people said—not to the nearest interpreter, who may or may not be right, but to the sources. See what people said who had really deep insight. How did they describe their experience? How did they describe their empirical method? What can we take from them that we can possibly explore in our own life? I think that question goes together well with the question about what the future of science could look like. I don't see any reason why science should suddenly arrive at a border and say, "Here you stop, and here something else begins." If there is a fence on one side of which we have scientific knowledge, why not go sit on the fence and look at the other side, and why not continue? I don't think there is an island of science and an island of other human knowledge. I for one am interested in both. There is already a hinge between the two worlds, and I'm sure many of you have some experience of that connection. I don't see any reason for science to stop, but I do see many reasons for science to take a long, long time to go from objects to subjects and then to go beyond objects and subjects. That it is not yet on the horizon, not yet in the charts, just means that science is still young and growing.

If we look at the future of science in order to help lower the threshold for new developments, and if we look for spiritual nourishment and ways to express the old ideas in new presentations, we can, I think, combine the two with completely different motivations. In science, whenever you can combine two very different things, that is a sign that you might be going in the right direction. Unification, or really finding what was already unified but now unifying it in human knowledge, is the key of science. That we can follow a program of rediscovering the truth of ancient traditions in a modern way and, at the same time, help science lower the threshold for its next major breakthroughs would be highly encouraging. That is what motivates me and what I find to be the most interesting area of research.

The title of my talk is "Science Beyond Methods and Goals." What I mean by methods and goals is that traditionally we distinguish between pure and applied science. Applied science is a type of science trying to find a particular answer. You want to find a better technological application, and so you apply your science in order to get the better steam engine, a better transistor, to build a quantum computer. Then there is pure science, where you follow your own curiosity. Interestingly, the most important applications have come from pure science, not from applied science. They always came out of the purity of science, which involved completely new ideas, leading to completely unexpected applications far beyond the limited horizon of applied science. What people say traditionally is that science has a method. If you ask for an application you are limited to a narrow angle of questioning. If you just follow the method without thinking about application, you are freer. You have

a much larger horizon, allowing you to stumble on new applications.

But I would like to take this line of thought one step further. Aside from applied science, where your focus is on the application, and aside from pure science, where your focus is on the methods, there is an even purer science, where you go beyond methods. In fact, this is what scientists practice all the time. When philosophers of science talk about science, or when historians talk about science, they talk about the method that scientists use. In many cases it's an interesting description, and I think scientists can often learn from them. It is good to have a mirror: to see what scientists are doing and to have somebody else give a good description. I'm from Holland, and so, if I hear somebody making jokes about Dutch people, that experience is often like a mirror—"Oh, is that how we behave? I thought this was normal, but I guess in other countries they do it differently." For people to do sociology of science, or philosophy of science, or history of science, which contributes an outside perspective, is very valuable. We should not, though, make the mistake of assuming that the method of science as described in those disciplines is necessarily science. All we can say is that science is what scientists do.

That is ultimately the only definition: What scientists do is science. We can approximate it with a description. We can approximate it by giving it the name of a method, but, actually, scientists are opportunistic. Scientists find that they are more than happy to drop the given method, and, if necessary, to extend it, replace it, sometimes in radical fashion, as with quantum mechanics. Who cares that science officially is deterministic—officially, I mean, a hundred years ago? A hundred years ago if you were to ask "What is science?" the cornerstone of the answer would have been that it involved experiments that could be repeated. Then quantum mechanics came along, according to which you cannot repeat experiments. The same atom prepared in the same way does not decay radioactively the same way twice. The cornerstone then is gone, but who cares? Now we have quantum mechanics, which is so much more interesting and rich, and, most important, closer to reality.

The notion that there are stable foundations of science is utterly wrong. In science, while we are doing science, the foundations change. Imagine that you are sitting in your house and somebody suddenly begins to change the foundations. It would be disturbing, but science just goes on. Science floats by itself. If somebody wants to replace the foundations, that is fine. Science, where the work is done, keeps going on. It has its own way of dealing with problems.

I think science will be changing not only its applications but also its methods. If you see how much science has changed its methods in the last hundred years, you can only guess what will happen in the next thousand, ten thousand, one hundred thousand years. Why should it suddenly stop? Typically when scientists talk about science, they have in mind a snapshot of science as it is now. In the context of these discussions about free will and these sorts of grand problems and concepts, we really should consider science to have a much larger scope than that of the particular snapshot of science as it has been in our lifetime.

One way in which I am exploring this, and putting my feelers out about what the future of science could be, and what a modern way of delving into the

phenomenology of contemplation could be, is to use virtual worlds.

I would like to take a poll here. I know this is the last talk of the symposium, and so let us, in the spirit of the symposium, all wake up to the point of being able to raise our hands out of our own free will. Who has heard of Second Life? That's interesting. It doesn't seem to have changed much in the last year. Half the people have heard of it, half have not, roughly. Second question: Who has ever been in Second Life, has gotten an avatar and moved around at least once in Second Life? About eight or so people. Interesting. Third and last question and then you can switch to listening mode again: Who has been in Second Life in the last week? One? One person has been in Second Life in the last week. That's very interesting. I'm always curious about the distribution of people. There are about 300,000 people in the whole world who go into Second Life almost daily, or at least weekly. Those 300,000 people are some of the most active, interesting, and creative people, who are forming a community and a type of network that is just amazing. I had no idea until I plunged in a few months ago.

In the few minutes that I have I cannot tell you much about the whole notion. Basically, Second Life is a virtual world. It is the same software as in video games. There is the three-dimensional world you go into, and you identify yourself with a little puppet figure, an avatar. Soon you become that avatar. You fall into it. It's an immersive experience, and there is copresence with other people. You talk. You can do research. You can teach classes. You can build houses. You can quarrel whether the railroad line should go over your property or that of the neighbors. I'm not kidding. It is amazing the way that Second Life combines playing house and playing with dolls with academic research, and with you name it, with any type of normal human behavior.

In the last year in various virtual worlds, most recently in Second Life, I have organized groups of astronomers for meetings and journal clubs. They put their simulations in there. If you go into a planetarium, there is the dome, pretty much like here. This could be a nice planetarium. You are real. Your seats are real, but the stars are simulated. They are on the dome. But if you go into a virtual world you see that the chairs are simulated and that you are simulated. You're an avatar. The stars are simulated, and so there is no reason to sit in your chairs. In a virtual world you start flying, and you mingle with the stars. If it is your own simulation, you inspect your simulation. It's a much better output than just looking at a printout or at the screen, and you literally can inspect what your stars are doing, and the subject–object divide between you and the screen has dissolved. There is a deep philosophical implication of doing science in a virtual world, where the subject–object split, which started with Galileo, has fallen out. This is the topic for a whole separate talk, but I think a hundred years from now philosophers will mark 2000 as the time when science really went beyond the subject–object split. I haven't heard people talking about it. I think it's just too new, but in a few years this will become obvious.

What I am doing in that world aside from doing astrophysics, which is fun by itself, is that I am also starting a group, a group of friends, of whoever is

interested, devoted to exploring these large questions, these questions about going beyond the subject–object split, about how we can phenomenologically study our awareness. I have called this approach "play as a being." To say it briefly: In various mythologies, in various traditions, in various contemplative world views, there is talk about whatever "being" is, the totality of reality. It's playing us, and we can return the compliment by us playing "being" in whatever way we can imagine that might be. This relates to what Alan Wallace talks about as taking "the fruition as the path." Or, I would say, the goal as path—the same idea.

So, if some of these traditions are right, and if it makes sense not to reach for deep insight but to accept the working hypothesis that the insight is already here and available, then the question is: How do we act it out? How do we play as being? I don't have time to talk about it, but, if you're interested, there is a website that I started just yesterday, and we will be having daily meetings in Second Life starting tomorrow, April Fools Day. It seemed like the perfect time to start it. Here is the website: playasbeing.wordpress.com. Starting tomorrow, little groups of avatars will get together in a piece of land that I recently acquired there, and they will start chatting with each other about what it means to "play as beings." So you're all welcome to join me.

Concluding Remarks

Lee C. Bollinger

ONE OF THE THINGS THAT YOU LEARN WHEN COMING TO A NEW institution, as I did five and a half years ago, is to observe which people are active in taking up the most interesting questions, questions that must be engaged in a truly intellectual and academic way. Bob Pollack is one of those at this university whom I admire greatly for doing precisely that. This conference serves as a prime example.

Coming from a legal background, when I approach the topic of neuroscience and free will I immediately think of constitutional concepts such as freedom of speech and freedom of the press. I am steeped in a tradition of thinking that makes free will a cornerstone of society. By this I mean that one cannot read the jurisprudence of constitutional law and not feel that at its base is the assumption that we have free will.

Let me add that one of the pleasures of being a university president is that you get to talk to just about everybody. And if you don't choose to talk to them, they often choose to talk to you, so you actually don't have much choice in the matter, but it really is one of the great attractions of the role. As I began to talk to scientists, and in particular those working at the genetic and fundamental biological level, I came to understand the ability of science to challenge some of the deepest assumptions we hold—for example, what I said earlier in regard to constitutional law based on the foundation of free will. I came to realize that there would be a point in time at which we would actually be able to do more than simply have a pleasant, interesting discussion about some of the most profound questions in human existence. As a specific example, I recall the scientific experiment done on risk and addiction, where the genes of a risk-averse mouse were taken and placed into a risk-seeking mouse, thereby changing their behavior. I have also spoken with scientists who are conducting research on the genetic basis for antisocial behavior. There are some scientists I see in this room for whom I know this is old territory, but, for some of us on the outside, this seems profound. For me, as a nonscientist, the possibility that there is going to be an overlap where we can actually do more

than have an interesting discussion, realizing that reality is changing, or seems to be, is very exciting.

It was to that end that I came here this evening. I thought it would be wonderful if we did some things that would try and help us bridge the gap between people who do the kind of work I do and people who do the work you as scientists do. Columbia University is a fantastic place where this crosscurrent in mutual understanding can take place. I am excited that this process of discovering new knowledge in the neurosciences and related fields will be the focus of the Mind, Brain and Behavior Initiative, which will be one of the first facilities built in Manhattanville, the new campus.

So, in closing, I thought I would share with you that personal reflection on free will, the neurosciences, and related biological fields and the incredible enthusiasm that one feels at the new possibilities in understanding human behavior.

Again, thank you, Bob, for letting me say this tonight, and congratulations on this symposium. It is also a delight to precede Reverend Forbes, whom I have admired since I came to Columbia, as an incredibly eloquent voice, a powerful voice, when speaking on matters that touch us all. He has been a very special person in our discussions as we thought about Manhattanville and the new campus. I would like to thank him publicly for sharing his insights and wisdom on that. So, thank you very much.

Faith and Free Will

Reverend Dr. James A. Forbes Jr.
Introduced by Jeffery Slade

Jeffrey Slade

It's a distinct honor for me to participate in this conference as a representative of the Riverside Church in New York City. For more than seventy-five years our church has existed on Morningside Heights as a beacon of progressive Christianity in this city, the nation, and the world. Indeed it was John D. Rockefeller Jr. and Harry Emerson Fosdick who built this church on Morningside Heights, in part because of its proximity to Columbia University. Yet I think it's fair to say that, while relationships between the two institutions have always been at least cordial, there's not been a great deal of interaction or cross-fertilization in the past seventy-five years. One prominent counterexample was Charles Townes, who told me he was in fact a deacon at Riverside Church while he was a professor at Columbia.

Speaking for myself, though: Although I came to Morningside Heights more than forty years ago as a student at Union Seminary, and although I've been an active member of Riverside Church for more than twenty years, and although I was chair of the church council for a half decade, I have to admit I had never been in this room until yesterday. I did spend some time just outside it, in the spring of 1968, but that's another story. But now that Bob Pollack and Cynthia Peabody and the entire CSSR have come in residence to Riverside Church, I think that a whole new relationship is being born, and I for one am extremely grateful.

Now let me turn to the task at hand, to introduce my pastor, the Reverend Doctor James Alexander Forbes Jr. For almost twenty years Jim Forbes served as the senior minister of the Riverside Church, longer than Harry Emerson Fosdick himself. Dr. Forbes retired last year from that position, and he's now heading up the Healing of the Nations Foundation, continuing, in an even larger context, his work as one of America's foremost religious leaders.

Dr. Forbes has been recognized as one of the best preachers in the entire English-speaking world, and I'm sure you'll get a glimpse of why in just a moment. For

many years he was an academic colleague on Morningside Heights. He was the Joe Engle Professor of Preaching at Union Theological Seminary, whose past president, Don Shriver, is sitting back there. And I can testify that he is a well-grounded theologian as well as a distinguished preacher. But let me add one element to the mix, one that is little-known but should be particularly appreciated in this context. Before he committed himself to a life in the church, Jim Forbes was a chemistry major at Howard University.

So now I ask you to welcome our final contribution from someone well-grounded in the theological as well as the scientific worlds: Reverend Dr. James A. Forbes Jr.

James A. Forbes

I AM HONORED TO HAVE THE OPPORTUNITY TO PARTICIPATE IN A conversation that in some time past certain religious leaders would have considered adversarial. They might have resisted the mere raising of the question whether there is such a thing as free will. But today among my ministerial colleagues it is not adversarial at all. It was Elton Trueblood, the Quaker professor (he taught at Earlham College), who in a book entitled *The Conjunct Life* said that the most important word in the Bible is *and—a-n-d*. "Out of the treasure you will bring both old and new." In the discussions between science and religion I am hovering most of the time right in that space called "and." And, of course, if Don and Peggy Shriver, formerly of Union Theological Seminary, finally introduce you to meet Bob Pollack, he will invite you to become a living expression of the valuing of "and," by becoming a part of the Center for the Study of Science and Religion. Even if Bob Pollack is not present as I preach, his spirit is over my left or right shoulder, saying, "Are you sure that the claim you are making out of a faith perspective can continue to be sustained if there is a conversation with those of us who approach it from the perspective of molecular biology?"

In the tradition in which I was brought up, there was a strong emphasis on conquering the impulses of the body if one intends to live the holy life. Only then can you consent to the demands of the will of God and of the Spirit. Well, let me explain what I have done. After reviewing the papers presented here, I have tried to determine how a pastor who has to deal with the moral problems of everyday life can find help in the kind of discussion that has gone on here, what he or she might find helpful in strengthening our community of faith.

So let me tell you where I start out. If I were going to give a three-part sermon, which I will not, it would have these major points. The first point would be about the free-will assumptions informing my faith. The second point would consider the challenges from scientific understanding about free will. And the third point would be about the faith that informs my sense of freedom and responsibility.

My upbringing as a kid in Southern black Pentecostal religion was heavy on how powerful the human will can be. One of my favorite theologians, who was a pastor as well, Howard Thurman, always talked about how it was important for us to connect with the "nerve center of consent." That was a powerful Thurmanesque concept, that all of us have this nerve center of consent by which we can say yes to the good we know we ought to do and no to the things that would be destructive of our lives and of community. My faith was formed that way. The sense was that, if you get in touch with the nerve center of consent, you discover that we are hardwired for doing right instead of wrong. The problem is that the impulses of the body come between the nerve center of consent and your instinctive, hardwired moral sense of what is right to do. That is how I grew up. And so the real task is to develop enough discipline to keep the body and its impulses in check. The moral struggle is to keep the flesh from contaminating our sense of right and wrong, so that the nerve center of consent will always be on the Lord's side. However, we were taught that, if you are not careful, there's such a thing called the devil prowling around the earth and setting a trap for us. Some of you will remember Flip Wilson, the comedian who in the midst of moral failing would always say, "The devil made me do it." And so discipline involves not only controlling the impulses inside but also being watchful lest the devil creep up on your blind side and invite you to do the wrong thing.

Well, how do you do this? How do you maintain this discipline? You work hard, and you fast and pray. There is the dualistic understanding that on the one side is the devil and, on the other, the Spirit, who helps you watch out for where the devil is and gives you power to resist temptation. We are taught, in addition to personal diligence, that moral victory is greatly increased by being in community—the Wesleyan concept of being in accountability groups where the task of each member is to watch our for the souls of others. If you can't see the devil coming, or if you are not keeping watch over your impulses, the community will watch out for your soul and tell you when you are going wrong. That's the way I grew up, brothers and sisters. That sense of free will demands that you work on all of these vectors, which give you the capacity to say yes to righteousness from the nerve center of consent.

However, my education at Union Theological Seminary challenged my old view about free will. My perfectionist understanding was called into question. It was a very painful assault against my childhood assumptions. I dropped one course while I was at Union. It was the course taught by Reinhold Niebuhr. In Reinhold Niebuhr's early classes in Christian ethics, I was introduced to the concept of love as impossible possibility. He talked about our love as never fully realized in its attainment no matter how diligently we will it. He shared with us the Lutheran concept that you could be justified and a sinner at the same time. What a strange idea for a boy from Raleigh, North Carolina, who believed that the will was so strong, if reinforced by the Spirit, you would always be able to do what was right. I didn't drop that course just because the reading list was too long. It was the crisis between me and my professor, who talked about our wills not being nearly as free

as we had been taught and not as pure as we would want to suggest. Nor was it the case that, if you failed as an individual, you could elevate your moral standing just by joining a righteous group. In *Moral Man and Immoral Society*, he said that it's hard enough for individuals to have a will to do right, but collect them into some kind of grouping in the society and the group is likely to suffer ever greater moral failings than is the individual, in terms of embodying righteousness and justice.

At Union Theological Seminary I also studied Old Testament with James Muhlenberg, who said, "Forbes, there's a problem with the way you've been brought up, brother. You have the concept that there's the body here and then there's the mind over there and then out somewhere else there's the spirit." He said, "If you really understood your Hebraic roots, you would know there is an integrative system of being. And in all persons, body, mind, and spirit all work together." I remember writing down in class a new word: *pneuma-psycho-somatica* (spirit-mind-body). It's one word. It's not the sarx separated, nor the psyche separated, nor the spirit separated. Whatever we are, each piece participates with the other as an integrative system. One element may take the lead and yet the other dimensions of being are accomplices in the action.

My seminary training prepared me to take seriously the insights from science about free will. There is extraordinary complexity in moral motivation and behavior. This symposium has reinforced this understanding and has also introduced new challenges regarding the nature of the human will. I've learned that there is no distinct location or fixed center of human volition. There may be a nerve center of consent, but it is not a fixed place from which one can say "I will" and therefore it is done. When we say "I will," we do not know whether that declaration is just seconding a motion that has been made in another dimension or arena of one's life. I have learned that serious limits must be established with respect to volitional mechanisms. That's hard, but I've learned it. That is to say, whenever we finally say "I will," simple arithmetic won't do. Calculus is required. It takes higher mathematics—a term that Harry Emerson Fosdick, founding minister of Riverside Church, loved. Higher mathematics—higher than the conscious decision-making process. Multiple vectors converge before an effective "I will" has been declared. I've learned that, with respect to the sense of our willpower controlling many aspects of our behavior, we often make unwarranted claims.

If we have illusions of greater control than may actually be the case, sometimes that can be advantageous, or at other times it may be detrimental for the things we would like to achieve as human beings. All of us are highly susceptible to mechanisms of manipulation, sometimes with assent and at other times below the level of our awareness. The social context in which we find ourselves plays a more significant role than we recognize. I get the impression from the scientists that individualism, whether it's rugged or refined, is greatly overrated, that we are imbedded in a matrix of multilayered forces impacting our thinking and our behavior. But this we surely ought to know—that the Lone Ranger is not just sheer willpower, capable of being heroic all by himself. I've learned that the will to live and the will to power are sometimes contaminated, if we can use that word, by the

death wish. Honesty requires the acknowledgment that what we experience as free will is less than, more than, and other than what we might have thought before.

Now a word of thanks to neurobiologists and other scientists who explore the intricacies of the human will. Thank you, scientists, for providing updated insights about the process by which human beings make decisions and choices. You have given us a more accurate sense of the volitional mechanisms that influence the formation of values in our society. We can no longer function as if the chemical processes in the brain are somehow irrelevant to the moral and spiritual impulses we claim to live by. We deceive ourselves when we bypass neurological circuitry in attempting to account for altered states of spiritual awareness. We experience ourselves as agents of choice but we do not need to deny the impact of input from other dimensions of life. While we receive scientific insights, we need not discard the wisdom of faith traditions. But we need to know that in some matters we may never enjoy empirical verification of our most precious religious affirmation. That which nourishes our hopes, our ties of friendship, and our sense of meaning and purpose, instead of being given scientific status and cogency, may need to await the verification of personal satisfaction and human enrichment toward genuine caring communities.

If what you have taught us reduces unwarranted guilt and shame, frees us from illusions of capacities not really in our control, makes us aware of forces that are prominent factors in directing our interaction with each other, and keeps us from projecting onto God or the devil what springs from our finite, human, and animal makeup, then any loss of dogmatic assurance will be more than repaid by wisdom grounded in reality empirically discerned.

And lastly, thank you for delivering most of us preachers from an unhelpful judgmentalism. The truth is, most preachers spend much of their time seeking to inspire (or manipulate) people to use their free will to do what the community considers to be the right thing. In the light of the insights you have shared, perhaps there are more effective ways to produce more positive results in building up personal character and societal well-being.

Now I have a request to make of the Center for the Study of Science and Religion. During this year of presidential campaigning we are reminded of several patterns of behavior deeply rooted in the psychic, emotional, and spiritual dimensions of human personality. I became aware that our democracy was imperiled by the fragmenting power of racism, sexism, ageism, materialism, militarism, greed, and religious and ideological intolerance. I have spent considerable energy addressing these impediments to our well-being. In the past I have used guilt, shame, and fear as motivating prods toward change. But in the light of our conversation I believe that my efforts presupposed that people had sufficient freedom of will to change according to my admonition and our shared vision of the American dream. How might we frame a conversation to have the scientific community guide us toward deepened understanding of the policies, practices, and personal willfulness holding us hostage to social behaviors that contribute to societal malaise and destructive outcomes? What can neurobiology and social psychology offer as our nation

prepares for change under a new administration? What do our faith communities bring to the discussion that will hold promise for a revival of democratic ideals? Perhaps we have spent most of our time in culs-de-sac of thought. If *and* is the most important word in the Bible, perhaps it is the clue to what configuration of disciplines holds the greatest promise for finding the wisdom and the willpower to become the more perfect union of which our founders dreamed.

I no longer work as a congregational leader. I now work to bring about healing in the nation. It's a postretirement vocation. I am calling people from all around the world to become a leaf. The image is from both an Ezekiel passage (the leaves of the tree were for healing) and a passage from Revelation (there is fruit on the tree for every month, "and the leaves of the tree are for the healing of the nations"). I'm going to keep reading neurobiology, and I'm going to keep listening to the scientists. Can you help us figure out how we as religious leaders can best use our energy for positive change? In the light of the science that you have uncovered for us, what will incline people to be more conscientious about their health, holistically understood? What will make them willing and ready to invest in the health of others? If you can help us to find a wiser approach, then our interactions across the science-and-religion chasm will have proven to be a gift for the healing of the nations.

Participants

Paul S. Appelbaum, M.D., is the Elizabeth K. Dollard Professor of Psychiatry, Medicine, and Law, and director, division of psychiatry, law, and ethics, department of psychiatry, College of Physicians and Surgeons of Columbia University. He was previously A. F. Zeleznik Distinguished Professor of Psychiatry; chairman of the department of psychiatry; and director of the law and psychiatry program at the University of Massachusetts Medical School. He is the author of many articles and books on law and ethics in clinical practice and research. Appelbaum is a past president of the American Psychiatric Association, the American Academy of Psychiatry and the Law, and the Massachusetts Psychiatric Society, and serves as chair of the Council on Psychiatry and Law for the American Psychiatric Association. He has been elected to the Institute of Medicine of the National Academy of Sciences. Appelbaum is a graduate of Columbia College, received his M.D. from Harvard Medical School, and completed his residency in psychiatry at the Massachusetts Mental Health Center/Harvard Medical School in Boston.

Lee C. Bollinger became the nineteenth president of Columbia University on June 1, 2002. A prominent advocate of affirmative action, he played a leading role in the twin Supreme Court cases—*Grutter v Bollinger and Gratz v Bollinger*—that upheld and clarified the importance of diversity as a compelling justification for affirmative action in higher education. A leading First Amendment scholar, he is widely published on freedom of speech and press, and currently serves on the faculty of Columbia Law School.

From November 1996 to 2002, Bollinger was president of the University of Michigan at Ann Arbor, where he had also served as a law professor and dean of the law school. Bollinger is a director of the Federal Reserve Bank of New York and the Washington Post Company, a governor of the Royal Shakespeare Company of Great Britain, and a member of the Pulitzer Prize Board. Bollinger is also a fellow of the American Academy of Arts and Sciences and a member of the American Philosophical Society. Widely published on legal and constitutional issues involving free speech and press, Bollinger books include *Eternally Vigilant: Free Speech in the Modern Era* (University of Chicago Press, 2002), *Images of a Free Press* (Chicago, 1991), *The Tolerant Society: Freedom of Speech and Extremist Speech in America* (Oxford University Press, 1986), and, with John H. Jackson, *Contract Law in Modern Society: Cases and Materials* (West, 1980). He continues to teach an undergraduate course, "Freedom of Speech and Press," at Columbia each year. Bollinger has received the National Humanitarian Award from the National Conference for Community and Justice and the National Equal Justice Award from the NAACP Legal Defense and Educational Fund for his leadership on affirmative

action. He also received the Clark Kerr Award, the highest award conferred by the faculty of the University of California, Berkeley, for his service to higher education, especially on matters of freedom of speech and diversity. He is the recipient of numerous honorary degrees from universities in this country and abroad. After graduating from the University of Oregon and Columbia Law School, where he was an articles editor of the law review, Bollinger served as law clerk for Judge Wilfred Feinberg on the United States Court of Appeals for the Second Circuit and for Chief Justice Warren Burger on the United States Supreme Court. He joined the University of Michigan Law School faculty in 1973. Bollinger was born in Santa Rosa, California, and raised there and in Baker, Oregon. He is married to artist Jean Magnano Bollinger, and they have two children.

Reverend Dr. James A. Forbes Jr. is president and founder of the Healing of the Nations Foundation of New York and senior minister emeritus of the Riverside Church. Forbes completed his leadership of this historic multicultural church, after eighteen years of service, to begin a national and global ministry for spiritual renewal and holistic health. Forbes, the recent host of *The Time Is Now* on Air America Radio, was the fifth senior minister of the Riverside Church (June 1, 1989–June 1, 2007) and was the first African American to serve in this post. From 1976 to 1985, Dr. Forbes served as the Brown and Sockman Associate Professor of Preaching at Union Theological Seminary in New York. From 1985 to 1989 he was Union's first Joe R. Engle Professor of Preaching. Union named him the Harry Emerson Fosdick Adjunct Professor of Preaching in 1989 when he accepted the pastorate at Riverside. Forbes also served on the core teaching staff at Auburn Theological Seminary in New York. Born in 1935 in Burgaw, North Carolina, he is married to Bettye Franks Forbes, formerly of San Antonio, Texas. They are the proud parents of one son, James A. Forbes III.

Paul C. Gailey is a physicist currently serving as senior science advisor to the Fetzer Institute and director of research for the Fetzer-Franklin Fund. He earned his graduate degrees from the University of North Carolina and the University of Utah, and has worked in the areas of electromagnetic theory, nonlinear dynamics, and random processes particularly as they relate to living systems. Gailey has served as a research scientist for the U.S. Environmental Protection Agency, a research director at Oak Ridge National Laboratory, and associate professor of physics and astronomy at Ohio University. Parallel to his research and research management activities, he has engaged in a lifelong study of spiritual traditions and how they relate to the philosophy of science. During the past ten years he has served variously as consultant, vice president, and senior advisor to the Fetzer Institute, working to promote a deeper cultural dialogue on science and spirituality—particularly regarding how our conception of science interacts with human values and our sense of meaning.

David J. Helfand, having returned from a year as the Sackler Distinguished Visiting Astronomer at the University of Cambridge, is now professor of astronomy at Columbia University, where he served as department chair for more than ten years until liberated in 1997. Unfortunately, he was recently recaptured, and again serves in that capacity. His work has covered many areas of modern astrophysics, including radio, optical, and X-ray observations of celestial sources ranging from nearby stars to the most distant quasars. He is currently involved in a major project to survey our galaxy with a sensitivity and angular resolution a hundred times greater than currently available. The goal is to obtain a complete picture of birth and death (for stars) in the Milky Way. Helfand teaches primarily undergraduate courses for non-science majors, including one of his own design, which treats the atom as a tool for revealing the quantitative history of everything from human diet and works of art to Earth's climate and the universe. He also recently implemented a vision he began working on in 1982 that has all Columbia freshman taking a science course as part of Columbia's famed core curriculum. He received the 2001 Presidential Teaching Award and the 2002 Great Teacher Award from the Society of Columbia Graduates. Several years ago, he appeared weekly on the Discovery Channel's program *Science News*, bringing the latest astronomical discoveries to the U.S. television audience. More recently, his television appearances have been limited to more serious matters on Comedy Central's *The Daily Show*. Last fall, he helped launch Quest University in British Columbia, a highly innovative liberal-arts and sciences university for undergraduates. He serves on far too many university, government, and American Astronomical Society committees for his own (or anyone else's) good. He believes he is a better cook than astronomer and, ambiguously, most of his colleagues who have sampled his gastronomical undertakings agree.

Piet Hut, an astrophysicist, was born and raised in Holland, received his Ph.D. at the University of Amsterdam in 1981, and has lived in the United States since then. He taught at the University of California, Berkeley, until taking his present position as one of two astrophysicists at the Institute for Advanced Study in Princeton in 1985. He has been a full professor there since 1985, and in 2002 he was appointed the head of the new Program of Interdisciplinary Studies at IAS. His specialty is computational astrophysics in particular, and large-scale computer simulations in all fields of science in general. Interdisciplinary interests largely revolve around a comparative study of "ways of knowing," different ways of looking at reality, from science and philosophy to art and contemplative perspectives.

Darcy B. Kelley is professor of biological sciences at Columbia University. She received her A.B. from Barnard College and her Ph.D. from the Rockefeller University, where she was assistant professor before joining the faculty of Princeton University. In 1982 she moved to Columbia University, where she cofounded the interdepartmental graduate program in neurobiology and behavior. Kelley has been a scientific advisor to the Sloan and Fairchild Foundations and is currently a trustee of the Wenner Gren and the Grass Foundations and editor of *Developmental Neurobiology*. The work of her research group focuses on three questions: How does the brain produce and perceive vocal communication signals? How does this vocal system become sexually differentiated? How do vocal communication systems evolve? Her research focuses on South African clawed frogs and uses approaches ranging from field studies in Africa to molecular genetics and neurophysiology in the laboratory at Columbia. In 2002, Kelley was named Howard Hughes Medical Institute Professor, an award that acknowledges an effort of Columbia's science faculty to establish Frontiers of Science, a new core-curriculum course for all entering College students. This award was renewed in 2006 and supports an online resource for science educators based on Frontiers (http://www.fos-online.org/). Among her awards are the Jacob Javits Award for Neuroscience Research from the National Institutes of Health (twice) and the Forbes Lectureship at the MBL. Kelley has a longstanding interest in the public perception of science through portrayal in plays, movies, and television. She serves as scientific consultant for the Ensemble Theatre /Alfred P. Sloan Foundation Science & Technology Project, which commissions, develops, and presents new works that delve into how we view and are affected by the scientific world.

David H. Krantz was born in Buffalo, New York, in 1938. He received his B.A in mathematics (summa cum laude) from Yale University (1960) and Ph.D. in psychology from the University of Pennsylvania (1964). He taught at the University of Michigan (1964–79), conducted research at Bell Laboratories (1980–85), and since 1985 has taught at Columbia University, where he is currently professor of psychology and statistics and codirector of the Center for Research on Environmental Decisions. Krantz's initial research interests were foundations of measurement, color perception, and psychophysics. Later he focused primarily on statistical reasoning and on protective and environmental decision making. His teaching has focused on these same topics. He has also been part of the leadership for Frontiers of Science, Columbia's required core-curriculum course in science. Krantz served as head of Experimental Psychology at Michigan (1974–77), acting head of Human Information Processing Research at Bell Laboratories (1982–84), chair of statistics at Columbia (1990–92), and Professor-in-Charge of Education at the Earth Institute at Columbia (2001–3). He has been a Guggenheim Fellow and a Fellow of the Institute for Advanced Study in the Behavioral Sciences.

Alan Mittleman is director of the Louis Finkelstein Institute for Religious and Social Studies (http://www.jtsa.edu/x533.xml) and professor of Jewish Philosophy at the Jewish Theological Seminary. Mittleman is the author of three books: *Between Kant and Kabbalah* (SUNY Press, 1990), *The Politics of Torah* (SUNY Press, 1996), and *The Scepter Shall Not Depart from Judah* (Lexington Books, 2000). He is also coeditor of *Jewish Polity and American Civil Society* (Rowman and Littlefield, 2002), *Jews and the American Public Square* (Rowman and Littlefield, 2002), and *Religion as a Public Good* (Rowman and Littlefield, 2003). Mittleman served as professor of religion at Muhlenberg College from 1988 to 2004. From 2000 to 2004, he served as director of the major research project "Jews and the American Public Square," which was initiated by the Pew Charitable Trusts. He served as visiting professor of religion at Princeton University in 2007.

Jeffrey D. Sachs is the director of the Earth Institute, Quetelet Professor of Sustainable Development, and professor of health policy and management at Columbia University. He is also special advisor to United Nations secretary-general Ban Ki-moon. From 2002 to 2006, he was director of the UN Millennium Project and special advisor to United Nations secretary-general Kofi Annan on the Millennium Development Goals, the internationally agreed goals to reduce extreme poverty, disease, and hunger by the year 2015. Sachs is also president and cofounder of Millennium Promise Alliance, a nonprofit organization aimed at ending extreme global poverty. He is widely considered to be the leading international economic advisor of his generation. For more than twenty years Sachs has been in the forefront of the challenges of economic development, poverty alleviation, and enlightened globalization, promoting policies to help all parts of the world to benefit from expanding economic opportunities and well-being. He is also one of the leading voices for combining economic development with environmental sustainability and, as director of the Earth Institute, leads large-scale efforts to promote the mitigation of human-induced climate change. In 2004 and 2005 he was named among the 100 most influential leaders in the world by *Time* magazine, and in 2007 he was awarded the Padma Bhushan, a high civilian honor bestowed by the Indian government. Sachs lectures constantly around the world and was the 2007 BBC Reith Lecturer. He is author of hundreds of scholarly articles and many books, including *New York Times* bestseller *The End of Poverty* (Penguin, 2005). Sachs is a member of the Institute of Medicine and is a research associate of the National Bureau of Economic Research. He has received many honorary degrees, most recently from Whitman College, the Mount Sinai School of Medicine, Ohio Wesleyan University, Trinity College Dublin, the College of the Atlantic, and Southern Methodist University. Prior to joining Columbia, Sachs spent more than twenty years at Harvard University, most recently as director of the Center for International Development. A native of Detroit, Michigan, Sachs received his B.A., M.A., and Ph.D. at Harvard.

Dr. Charles H. Townes, who received the Nobel Prize for his role in the invention of the maser and laser, is presently a professor in the graduate school at the University of California, Berkeley, and engaged in research in astrophysics. He is known for a variety of researches involving the interaction of electromagnetic waves and matter, and also as a teacher and government advisor. Born July 28, 1915, in Greenville, South Carolina, Townes graduated with highest honors from Furman University in 1935, earning a B.S. in physics and a B.A. in modern languages. He completed a master's degree in physics at Duke University and in 1939 received the Ph.D. at the California Institute of Technology. He was a staff member of Bell Telephone Laboratories (1939–47), associate professor and professor at Columbia University (1948–61), vice president and director of research of the Institute for Defense Analysis (1959–61), provost and professor of physics at the Massachusetts Institute of Technology (1961–65), and became University Professor of Physics at the University of California, Berkeley in 1967. Townes's principal scientific work is in microwave spectroscopy, nuclear and molecular structure, quantum electronics, radio astronomy, and infrared astronomy; he is presently most active in the latter two fields. He has the fundamental patent on masers and, with A. L. Schawlow, the basic patent on lasers. In addition to the Nobel Prize, he has received a number of awards and honors, including membership in the National Academy of Sciences, National Academy of Engineering, and the Royal Society of London. He has been awarded the National Academy of Science's Comstock Prize and the John J. Carty Medal, the Founders Award of the National Academy of Engineering, the Rumford Premium of the American Academy of Arts and Sciences, the Stuart Ballentine Medal of the Franklin Institute (twice), the C. E. K. Mees Medal of the Optical Society of America, the Medal of Honor of Electrical and Electronics Engineers, the Plyler Prize of the American Physical Society, NASA's Distinguished Public Service Medal, the Thomas Young Medal and Prize of the Institute of Physics and the Physical Society (England), the Wilhelm Exner Award (Austria), the 1979 Niels Bohr International Gold Medal, the National Medal of Science, the 2005 Templeton Prize, and the 2006 Vannevar Bush Medal. He has been appointed to the Russell Lectureship of the American Astronomical Society and has been inducted into the National Inventors Hall of Fame and into the Engineering and Science Hall of Fame. Townes is also the recipient of honorary degrees from twenty-five colleges and universities.

B. Alan Wallace began his studies of Tibetan Buddhism, language, and culture in 1970 at the University of Göttingen in Germany and then continued his studies over the next fourteen years in India, Switzerland, and the United States. Ordained as a Buddhist monk by H. H. the Dalai Lama in 1975, he has taught Buddhist meditation and philosophy worldwide since 1976 and has served as interpreter for numerous Tibetan scholars and contemplatives, including the Dalai Lama. After graduating summa cum laude from Amherst College, where he studied physics and the philosophy of science, he returned his monastic vows and went on to earn his Ph.D. in religious studies at Stanford University. He then taught for four years in the department of religious studies at the University of California, Santa Barbara, and is now the founder and president of the Santa Barbara Institute for Consciousness Studies (http://sbinstitute.com). He has edited, translated, authored, and contributed to more than thirty books on Tibetan Buddhism, medicine, language, and culture, and the interface between science and religion. His published works include *Choosing Reality: A Buddhist View of Physics and the Mind* (Snow Lion, 1996), The *Taboo of Subjectivity: Toward a New Science of Consciousness* (Oxford, 2000), *Buddhism and Science: Breaking New Ground* (Columbia University Press 2003), *Balancing the Mind: A Tibetan Buddhist Approach to Refining Attention* (Snow Lion, 2005), *Genuine Happiness: Meditation as the Path to Fulfillment* (Wiley, 2005), *The Attention Revolution: Unlocking the Power of the Focused Mind* (Wisdom, 2006), *Contemplative Science: Where Buddhism and Neuroscience Converge* (Columbia University Press, 2007), *Hidden Dimensions: The Unification of Physics and Consciousness* (Columbia University Press, 2007), and *Embracing Mind: The Common Ground of Science and Spirituality* (Shambhala, 2008). He has participated in numerous scientific studies of meditation, including Cultivating Emotional Balance (UCSF), the Shamatha Project (UC Davis), Mindful Awareness Project (UCLA), Meditation for Epilepsy Project (UCLA and University of Vienna), and the Compassion and Attention Longitudinal Meditation Study (Emory).

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