PERSPECTIVES on Science and Christian Faith

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In This Theme Issue on Addiction …

"The fear of the Lord
is the beginning of Wisdom."
Psalm 111:10

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It's Not Rocket Science; It's Harder

James C. Peterson

When Paul Henrickson retired, he reflected that he had two careers. The first was as an aerospace engineer with NASA; the second, as the chaplain at Roanoke College. Of the two, he was sure from experience that working with people was much more difficult than rocket science. Rocket science is a remarkable accomplishment that requires great precision in directing immense forces of heat and pressure, yet he found people more complex. We human beings are not simple, as will be seen in this issue's articles on addiction.

We all live simultaneously at multiple different levels. Picture a physicist studying a particular interaction at the subatomic particle level, seeking to explain it with "a theory of everything." Yet a chemist could see the same instance and note that it is occurring within a molecule of glucose. The molecular level of complexity is just as real as what is happening between the particles, but not described solely by particle interactions. Then a biochemist notes that this glucose is part of an ATP reaction that is releasing energy. The arriving physiologist notes that the energy is contracting a muscle, which the anatomist notes is attached to a vocal cord. The contraction of the muscle in this case is at the direction of a brain signal, as noted by a neurologist. Specifically, someone is singing, as the musician describes. In fact, she is singing in a chorus for pay. Is it always about money? No, she could earn more in another chorus. "She has chosen this one to be with her friends," says the sociologist. "But, ah," says the theologian, "do you hear that they are singing the 'Hallelujah' chorus from Handel's *Messiah*?" This subatomic particle interaction is embedded in an act of worship.

When trying to understand the perceptions and actions of a human being, whether it be the event above or, more generally, addictions, no one level of approach will give a full account. Describing the human experience at any one level may be insightful about that aspect, but it remains severely incomplete. Human action is too ambiguous and complex to be captured by what Donald MacKay called "nothing-buttery." Human beings are far more than "nothing but" any one particular aspect of their existence. They are more than atoms, or chemicals, or genes, or cells, or environment, or animals, or individuals. The simpler components do not begin to explain all that is happening at higher levels of complexity. Examining only one aspect at a time can be an insightful exercise, but such analysis at any specific level, is quite different from capturing a whole that is more than its parts. Chemistry is not merely particle physics. Physiology is more than biochemistry. Music is not just physiology. Theology is not just sociology. At each level of greater complexity, there is the potential for an emergent phenomenon not described completely by its constituent parts.

To begin to scratch the surface toward understanding the wrenching crisis of addiction, *PSCF* has an unusual capacity to approach what is happening at many of the multiple levels of human life that addiction entangles. Judith Toronchuk leads this issue delineating some of the complex interactions of neurology in addiction. Robin Rylaarsdam guides us through the genetic component. Kent Dunnington finds insight in the effective twelve-step movements as a philosopher considering personality theory. Janet Warren taps theology to find parallels for discernment and treatment, between addiction and sin. And Daniel Mallinson brings to bear political science to advocate public policy.

Thanks to each scholar, we are better informed to understand and deal with this challenging scourge of addiction. Thanks as well to the authors of a wide-ranging set of book reviews, and to letters from Randy Isaac and Walter Bradley. Their letter exchange, concerning the previous issue of *PSCF*, plays out more of how God is revealed in creation.

James C. Peterson
Editor-in-Chief

Judith A. Toronchuk

Article

Addiction: Diseased Brain, Divided Will, or Restless Heart?

Judith A. Toronchuk

Addictive disorders lay a heavy burden on global medical resources while continuing to devastate personal lives at an alarming rate. Complex interrelated risk factors, including biological, psychological, sociological, cultural, and spiritual factors, must be considered as churches and communities address the individual and societal problems. This article will consider multiple causes of substance and behavioral addiction and reflect on the issue of determinism versus free will. I will take the position that addicts, as all persons, are simultaneously constrained by their embodied nature and yet free to respond to God's grace. The disease model and the choice model are not in opposition: rather, the brain changes that occur during addiction give rise to habits and compulsions which, nevertheless, can be broken as new habits are formed through both divine grace and grace offered by supportive others. Multiple approaches are needed to address a multifactorial problem.

Addiction rates around the world continue unabated while church, society, and individuals struggle to respond in an efficacious manner. Since 2014, the US and Canada have had the highest per capita consumption of opioids (combined prescription and illicit) in the world. The addiction and overdose burden primarily afflicts young males; in the US in 2016, opioids were responsible for 20% of deaths among those aged 24 to 35.[1] The US Centers for Disease Control and Prevention (CDC) reports that tobacco use in the US remains the leading preventable cause of disease, disability, and death—contributing to one in every five deaths.[2] Globally, the World Health Organization (WHO) estimated that, in the twentieth century, 180 million people were killed by tobacco.[3] Why do people choose to endanger their health, livelihood, family, and even life itself to consume addictive substances?

Judith A. Toronchuk *holds a PhD in physiological psychology from McGill University and a MA of Theological Studies from Regent College. She taught neuroscience and psychology at Trinity Western University for over twenty years, has published on sensory physiology and affective neural systems, and served on both the ASA and CSCA Executive Councils.*

Addictive behavior illustrates the age-old ontological conundrum of whether human behavior is essentially determined, at various levels and by multiple factors, or freely engaged in by the individual. The disease model, supported by substantial neurophysiological research, states that substance addictions[4] are recurring disorders of the brain, originating in genetic components and neuroplasticity.[5] Evidence is now accumulating that an entire spectrum of behaviors—including compulsive gambling, eating, and viewing of pornography—have underlying genetic and neural similarities with substance abuse.[6] However, because not all users develop addiction, and most addictions remit without treatment, this medical model has been called into doubt by those who stress psychosocial and environmental influence as well as spiritual and moral factors.[7] In this article, we will discuss each of these factors in turn and attempt a holistic response.

Neural Mechanisms of Addiction

For organisms to learn and successfully repeat behaviors that result in survival of

the individual and the species, certain brain mechanisms for motivation, emotion, and executive control must be activated.[8] Substance abuse occurs when these normal mechanisms become overwhelmed due to repeated, supranormal phasic activation by particular external substances. Pleasurable behaviors including eating, drinking, music, video games, and social and sexual interactions are all accompanied by release of the neurotransmitter dopamine in the nucleus accumbens (NAc), a small subcortical area in the ventral striatum which codes for salience of rewards and reward cues. This area, part of the limbic system, is rich in dopamine receptors, and it sends output to forebrain areas responsible for attention, memory, and executive control. The current view of most researchers is that most abused substances promote, by direct or indirect means, rapid phasic bursts of dopamine release three to five or more times greater than that provided by nonaddictive reinforcers which produce more tonic release.[9] The universal dopamine theory of addiction is the most prevalent theory among researchers, although others propose that addiction involves disruptions of multiple transmitters and that different drugs produce different neural adaptations as discussed below.[10]

Dopamine release in NAc flags an event as worth *attending to* and the cues associated with it as worth *learning* so that the rewarding behavior may be repeated. After it was discovered in 1954 that rats will press a lever thousands of times per hour to receive electrical stimulation at this location in the brain, it was proposed that the NAc was a "pleasure center," but this is now seen as too simplistic. The ability to learn and remember the salient cues predicting rewards depends on an extensive neural pathway which extends from the midbrain ventral tegmental area (VTA) where dopaminergic neurons originate, to the NAc where dopamine is released, then to the orbitofrontal cortex which participates in evaluation and executive control, and finally to other structures involved in memory and emotions. Dopamine released by VTA axons into synapses in NAc attaches briefly to receptors on NAc neurons and then is rapidly taken up again into the releasing axons by means of molecular transporter molecules.[11] Cocaine blocks these transporter molecules, whereas amphetamine and its derivatives cause the transporters on the dopaminergic axons to run in reverse. In either event, the dopamine available in the synapse to stimulate the postsynaptic cell is increased. Reward has both "wanting" and "liking" components because, as addicts come to realize, one can "want" something that one does not really "like"; thus the NAc should not be simplistically referred to as the brain's "pleasure center."

Dopamine release in NAc produces "wanting" rather than "liking" by focusing attention on the stimuli already associated with reward.[12] At the same time, the memory of reinforcement causes decreased activity in the frontal cortical executive circuits which normally provide inhibitory control over behavior.[13] The most recent hypothesis is that dopamine release is time-locked to unexpected or novel stimuli and acts as a reward prediction signal.[14] This mechanism underlies learning of the behaviors necessary to provide a mammal with food, drink, and social partners, and results in the long-term structural changes in synapses which normally underlie learning. The mechanism functions as it should if the organism learns, for example, where food is available and repeats whatever behavior procured it. The problem arises when supraphysiological bursts of dopamine produced by addictive substances cause attention, emotion, and motivation to focus exclusively on drug-related cues. Psychostimulants such as cocaine, methamphetamine, MDMA, and "bath salts" directly affect the NAc.[15] The increased bursting activity produced by these drugs is necessary and sufficient on its own to promote reinforcement directly. Evidence indicates that indirect processes, reviewed below, which often involve endogenous opioid or cannabinoid receptors, are needed to indirectly activate the dopamine response to the presence of opiates, ethanol, cannabis, and nicotine.[16] Dopamine is of primary importance in stimulant addiction and cue-triggered craving for opioids, but perhaps the endogenous opiates and GABA[17] systems play the primary role in producing satisfaction ("liking" as opposed to "wanting") in opioid and cannabis addiction.[18]

Nonaddictive behaviors cause the slow, lengthy release of dopamine in NAc, stimulating high affinity D2 receptors which sustain moderate levels of motivation necessary to procure and consume rewards.[19] Large rapid bursts of dopamine stimulate both D2 and lower affinity D1 receptors which signal expectation of reward and cause drug "highs." Activity in the midbrain VTA itself is influenced by reciprocal innervation from widespread limbic and lower-level areas involved in memory, emotion, attention, and

motivation. Most cells in the NAc also receive multiple varied inputs regarding stimulus salience from widespread limbic areas via dopamine, glutamate, endocannabinoids, and other inputs. Conditioning to salient cues can be induced by dopamine bursts large enough to activate the D1 receptors. Stimuli associated with the drug thus become conditioned and eventually trigger phasic release of dopamine from VTA onto the NAc. The VTA neurons are themselves normally under tonic inhibition due to the transmitter GABA.[20] The timing of dopamine bursts is likely controlled by VTA local interneurons and other GABA-releasing axons from those ventral brain regions, subject to neuroplastic changes, which are involved in evaluation of rewards, attention, arousal, and memory. Among the changes in the brain associated with repeated drug use are altered firing patterns in VTA and its input areas due to cellular-level mechanisms which normally accompany learning.

Endogenous opioids (including endorphins) and endogenous cannabinoids (endocannabinoids) interact in complex ways with the dopamine system in natural and drug-produced hedonic responses along with additional transmitters, many involved in eating and satiety.[21] In addition, the release of dopamine is increased by glutamate released in the VTA by dorsal raphe cells.[22] Serotonin (5-HT) from dorsal raphe cells also plays a lesser but more complex role. One type of serotonin receptor[23] ($5\text{-}HT_{2C}$) in the VTA seems to decrease stimulant-induced reinforcement, while another ($5\text{-}HT_{1B}$) indirectly increases dopamine release by disinhibition of $GABA_A$ receptors.[24] Endogenous opioids and endogenous cannabinoids also interact in complex ways with the dopamine system in natural and drug-produced hedonic responses. Other transmitters and modulators involved in natural rewards, including leptin, insulin, galanin, neuropeptide Y, substance P, and melanocortins, also influence the system. Many of these substances are involved in regulation of eating. In summary, the control of dopamine release is complicated and much more research will be necessary to paint a complete picture.

Opiate drugs, including heroin, fentanyl, and oxycodone, stimulate opioid receptors directly. Most opioid abusers start with prescription drugs but soon discover less expensive alternatives on the street.[25] When prescriptions run out or are limited, users often turn to cheaper illicit drugs such as heroin. However, fentanyl is even cheaper than heroin, and users are often unaware that what they buy on the street as heroin or oxycodone may be substantially fentanyl.[26] Fentanyl, in combination with street drugs, was responsible for over 80% of the more than 1,420 overdose deaths in British Columbia in 2017.[27] Synthetic opioids mimic the effects of these neuromodulatory endogenous opioids by binding to μ opioid receptors, which are plentiful in both VTA and NAc.[28] One effect of μ receptor stimulation is to release the "brakes" in the VTA by disinhibiting normal inhibitory modulation GABAergic neurons in the VTA, which in turn disinhibit dopamine release in the NAc. Most of the reinforcing effects of opioid drugs are due to direct stimulation of μ receptors on the NAc cells. Naturally occurring endorphins decrease sensitivity to pain, increase relaxation, and cause drowsiness by blocking the brainstem area (locus coeruleus) that responds to arousing stimuli. Hence, opioids reduce both anxiety and pain, and normally function to promote positive feelings brought on by contact and social interaction. The effect that endorphins have on cortical emotional systems helps explain why relational loss is perceived in humans as similar to pain and panic. Social pain in humans, separation distress in animals, and the affective component of physical pain all involve the anterior cingulate cortex and the insula; furthermore, μ opioid receptors are implicated in each of these types of pain.[29]

Alcohol use disorders are among the most common mental disorders, with 36% of adult males in the US meeting the criteria for the disorder at some time in their lives.[30] Ethanol has widespread complex interactions with GABA, serotonin (5-HT), endorphins, endocannabinoids, glutamate, and nicotinic receptors, although the major contributor to pleasurable sensations is the mesolimbic dopamine system. It also acts on the inhibitory GABA interneurons which normally act as "brakes" controlling VTA cells, thereby indirectly producing increased release of dopamine in NAc.[31] Ethanol's facilitation of the inhibitory transmitter GABA in widespread areas of the brain leads to muscle relaxation, decreased anxiety, decreased behavioral inhibition, and eventually loss of consciousness. Stress-related circuits, including those of corticotropin-releasing hormone (CRH) and neuropeptide Y, are also eventually affected, contributing to the adverse effects of ethanol with-

drawal by producing anxiety and depression. In adolescents, alcohol alters the development of grey and white matter and disrupts pathways involved in attention, verbal learning, visuospatial processing, and memory. In rodents, this causes decreased cognitive flexibility, behavioral inefficiency, increased anxiety, impulsivity, and risk-taking, as well as impaired neurogenesis and epigenetic alterations as further discussed below.[32]

The main psychoactive ingredients in cannabis are Δ-9-tetrahydrocannabinol (Δ-9-THC) and cannabidiol (CBD) which mimic the effects of endocannabinoids at their receptor sites.[33] Cannabiniod receptors are one of the most abundant receptors occurring throughout the brain, and activation produces a variety of effects on hunger, nausea, memory, sensation, and subjective perception of time. Similar to endocannabinoids, Δ-9-THC is believed to indirectly decrease inhibition on dopaminergic neurons by inhibiting GABA release in the VTA. After prolonged use, synaptic plasticity required for encoding of memory can be disrupted, and therefore learning can be impaired, especially during periods of brain development or reorganization.[34] Δ-9-THC also has psychoactive effects and increases anxiety, whereas CBD can facilitate learning and reduce anxiety, and when taken together with Δ-9-THC may ameliorate its harmful effects, especially on memory. Unfortunately, the levels of Δ-9-THC in street cannabis has risen threefold over the last twenty years while that of CBD has declined to negligible levels. Legalization has been suggested as a way to standardize and control the ratio of Δ-9-THC to CBD and therefore reduce possible harms caused by cannabis.[35]

Endocannabinoids affect neurodevelopment by interacting directly with the glutamate pathways which play a major role in two processes prevalent during adolescence—the development of axonal connections and the process of pruning irrelevant synapses. Adolescent exposure to Δ-9-THC thus alters the normal maturational fluctuations of the glutamate receptors which underlie learning mechanisms, leading to decreases in dopamine activity in adulthood and to increased levels in stress-related signaling. In regular cannabis users, the hippocampus (involved in long-term memory) has decreased volume, although CBD in addition to Δ-9-THC may ameliorate this effect.[36] Neuroimaging studies also reveal decreased volume in the orbitofrontal cortex, a major area for executive control.[37] Because the effects of cannabis on cognition seem dependent on the maturational state of the brain, adolescents appear to be the most vulnerable to neural changes.[38] The present consensus is that cannabis has addictive potential, although the risk of dependence after first exposure has been reported at 8.9%, compared with higher rates of 20.9% for cocaine, 22.7% for alcohol, and 67.5% for nicotine.[39] Although statistics on long-term use of cannabis are not clear, lower addictive potential than alcohol or tobacco, and hence less-compulsive use suggests lower mortality.

Nicotine, despite its high-addictive potential in humans, differs from most other drugs in that it produces reinforcement without euphoria and is less strongly reinforcing in animals.[40] It activates the hypothalamic-pituitary-adrenal (HPA) axis which governs the body's stress response and can block pain from the stimulation of nerve cells. Nicotine directly stimulates certain types of acetylcholine receptors and, depending on the site of action and subtype of receptor, alters release of dopamine, norepinephrine, serotonin, glutamate, GABA, and endogenous opioids.[41] Stimulation of α4β2 subunits of the nicotinic receptors on dopaminergic neurons in NAc contributes to the rewarding effect. The endorphin/μ opioid system, glutamate, and endocannabinoid systems are also implicated. Consistent with reports that stress increases cigarette smoking, activation of the dynorphin/κ opioid system associated with stress and negative states may be involved in nicotine dependence and withdrawal.[42] The opioid antagonist naltrexone decreases nicotine use, further supporting the hypothesis that endogenous opioids contribute to nicotine reinforcement.

Behavioral Addictions

The neurophysiological mechanisms for uncontrolled gambling, internet use, gaming, pornography, and sexual acting out have been shown to be remarkably similar to those elicited in psychoactive substance abuse. Obesity, overeating, and compulsive shopping are now being researched along these lines.[43] Many of these behavioral disorders share similarities with substance abuse, including preexisting vulnerabilities due to failed regulation of the mesolimbic dopamine system by frontal regions. Dopamine agonists can trigger in some Parkinson's patients

compulsive gambling, sex, and shopping, further suggesting that dopamine dysregulation may be involved in these behaviors. Even the intense euphoria and attentional focus of romantic relationships share many facets of addiction because the basic circuitry for romantic love and attachment necessary for survival of the species shares the same circuitry co-opted by drugs.[44] Is it possible that there is a continuum which stretches from normal, necessary behaviors of eating, romantic love, attachment, and social behavior, through mildly disordered behaviors, which then finally ends in the disfunctionality of addiction? If so, this might mean that addiction, rather than being a disease afflicting only some, is a risk factor carried by all.

Gambling disorder (GD) is the first nonsubstance disorder classified by the American Psychiatric Association in the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition: DSM-5* in the category of "Substance-Related and Addictive Disorders." Both D2 and μ opioid receptors are implicated in GD, and opioid antagonists such as naloxone are the most promising drugs of treatment. As with drug abuse, deficits exist in executive functions, decision making, and inhibitory control because of diminished activation of the ventromedial prefrontal cortex control mechanisms.[45] Similarly, fixations, tolerance, and withdrawal also occur. The heritability of pathological gambling, estimated from twin studies, is similar to alcohol and drug abuse. GD also shares genetic vulnerability factors with antisocial behaviors, alcohol dependence, and major depressive disorder, as well as having a 96% comorbidity rate with lifetime psychiatric disorder.

Obsessive and compulsive eating share disruptions in transmitter and hormone systems, which again overlap normal systems for food reward and the disordered systems associated with drug reward.[46] Chocolate cravers show greater activation in many reward areas which are also activated in drug craving. Dopamine release in the NAc varies as a function of food palatability, and an inverse relationship has been reported between D2 receptors and BMI.[47] One suggestion is that reduced dopamine levels occur in the obese, promoting overeating of highly palatable foods as compensation for reward deficiency. Endocannabinoid and endorphin systems normally interact with the dopamine system to help regulate food intake. Furthermore, chemical signals involved in normal satiety and hunger (i.e., leptin, insulin, ghrelin) not only influence the sensitivity of the brain dopamine system to the rewarding effects of food, but also modulate sensitivity to the rewarding effects of various drugs.[48] The rewarding effects of foods, particularly those rich in fat and sugar, can trigger neuroadaptations in brain reward, stress circuitry, and prefrontal control systems that are similar to those produced by addictive drugs. As stated above, mechanisms which evolved for survival are difficult for most people to control.

Internet gaming disorder is included in the current diagnostic manual, *DSM-5,* under the heading of "Conditions for Further Study." William Struthers presents the case for the addictive properties of internet pornography,[49] but other internet activities such as cybersex, online relations, shopping, and surfing may also be addictive. The findings for all the internet disorders are consistent with neuroimaging and with neurobiological and psychological models of substance disorder.[50] Game-related pictures elicit fMRI activation patterns in both NAc and in the orbitofrontal cortex of heavy-internet-gaming users that are similar to those found in substance abusers. Grey matter reductions in orbitofrontal regions and alterations in the dopamine system have also been reported in excessive internet gaming users.

Genetic and Epigenetic Influences

Genetic variations in the dopamine system have been correlated with substance abuse, obesity, pathological gambling, and several other disorders.[51] Neuroimaging studies show that individuals with lower density of D2 receptors find stimulant drugs more pleasant than those with high density. Nevertheless, not all of these low-density people become addicted, and fully 33% of all people have the allele associated with addiction. One puzzling question is why some users of drugs, alcohol, and tobacco become dependent, but others do not. Exact incidence varies with the type of substance, but only about 10% of individuals using illegal drugs or alcohol become addicted, even though 30%–70% of that risk may be attributable to genetics.[52] As discussed in this issue by Robin Rylaarsdam, because large numbers and combinations of genes, plus epigenetic factors, are implicated, it is difficult to identify specific addiction-related alleles and any one allele may increase a person's risk factor by only a very small percentage.[53]

Genetic coding influences drug risk via two types of mechanisms: (1) the psychoactive effects are influenced by receptors; and (2) the ability to metabolize external substances is controlled by enzymes. Variants of GABA receptors may be implicated in many sorts of addictions, including alcohol. The risk for nicotine addiction is increased by numerous polymorphisms in the genes that encode the various nicotinic receptor subunits. Genetic variants of the μ opioid receptor have been found which modulate the effectiveness of the opioid antagonist naltrexone and which are also associated with relapse of alcohol abuse.[54] Regarding the second mechanism, a protective factor against alcohol abuse is provided by those variants of the genes for alcohol dehydrogenase and acetaldehyde dehydrogenase, which result in unpleasant side effects, as Rylaarsdam notes. Nicotine addiction is also affected by variants of genes for the enzyme that breaks down nicotine in the liver.

The term "Reward Deficiency Syndrome" (RDS) was coined in 1996 to suggest that genetic differences in the dopamine receptor system might be involved in addiction and impulsive disorders.[55] Carriers of the A1 allele of the D2 receptor gene have 30%–40% fewer D2 receptors available for dopamine signaling. Dysfunction in the dopamine receptor system has been associated with several disorders, including alcohol and substance abuse, obesity, and pathological gambling. Neuroimaging studies show that individuals with lower density of D2 receptors find stimulant drugs more pleasant than those with high density, perhaps due to increased sensitivity caused by fewer receptor sites. Individuals with alcohol-use disorders have reduced levels of D2 receptors in the NAc region, but the causal genetic relationship is not clear. Because D2 receptor levels are also affected by stress (and in monkeys by stress-associated social hierarchies), D2 levels influencing the predisposition to drug use could be epigenetically influenced by environmental factors.[56] However, the recurring theme of reduced dopamine activation may explain why most abusers of alcohol have another substance use disorder: at least one-half use tobacco; and one-third, other drugs.[57] Clearly the vulnerability to substance abuse is polygenic and influenced by the environment; nevertheless, understanding of genetic variations may someday provide useful tools for treatment strategies.

Neuroplasticity in Emotion and Control Circuits: Dividing of the Will?

The concept of divided will introduced by Augustine addresses Paul's dilemma in Romans 7:18. As Augustine states it,

> This partial willing and partial non-willing is thus not so bizarre, but a sickness of the mind, which cannot rise with its whole self on the wings of truth because it is heavily burdened by habit. There are two wills, then, and neither is the whole: what one has the other lacks.[58]

This passage from his *Confessions* echoes the common experience of addicted persons so aptly described as burdened by habit that they often want, but do not want, a drug or behavior. "Wanting" something and "liking" it are not the same, but this is only one example of dual-process thinking. The concept of the divided mind has been popularized by Daniel Kahneman in *Thinking, Fast and Slow* which characterizes two brain systems: one—unconscious, instinctive, and emotional; and the other—conscious, logical, and deliberative.[59] Both systems are necessary for normal adult thought, but, in certain situations, the rapid unconscious system gives rise to thought habits which become difficult to break. This insight from Kahneman suggests a useful way to think about addiction in terms of habit driven by unconscious systems.

Repeated use of addictive substances eventually restructures the synaptic pathways from the NAc and VTA, causing an increase in the number of stimulated dendrites, while other usual reinforcers come to stimulate fewer dendrites.[60] The incentive salience system of the NAc can motivate for short-term, but not long-term goals. As attention becomes more narrowly focused on the drug, long-term changes occur in motivation, emotion, and executive control. Due to physiological adaptation to the high levels of dopamine, chronic use of a drug often leads to a decrease in the subjective feeling of pleasure, and increasingly greater amounts are necessary to produce the same "high." Eventually substance abusers try to avoid the distress, irritability, and restlessness of the decreased dopamine release by compulsive pursuit of the substance. Thus changes in motivation are accompanied by changes in emotional mechanisms. The memory of substance reinforcement also decreases activity in the frontal cortical executive circuits that normally

provide inhibitory control over all adult behavior and allow adults to consciously make wise decisions. Whenever frontal cortex is damaged or its output decreased, the ability to voluntarily regulate behavior becomes impaired. Behavioral control shifts from the prefrontal areas involved in conscious decisions to the dorsal striatum, which is involved in habitual motor patterns.[61]

Allostatic dysregulation of the reward circuits, along with the recruitment of stress responses, gives rise to addiction through a shift from *impulsive* action learned via the mechanisms of positive reinforcement, to *compulsive* action learned through either negative reinforcement or habit formation.[62] The initial bursts of dopamine during intoxication cause positive reinforcement, which eventually leads to learning drug cues. The normal molecular basis of learning is based on the repeated activation of synapses, leading to increased efficacy due to long-term facilitation in synapses and dendrites. These normal mechanisms of learning allow cues associated with the drug or behavior to become conditioned and behavioral habits to form.

Following chronic drug use, epigenetic changes occur in gene expression in the NAc, causing increased activation of the gene that codes for dynorphin.[63] Unlike other endogenous opiates, dynorphin inhibits the VTA and further dopamine release, and it also facilitates anxiety-like states. The VTA then activates the amygdala (associated with fear) leading to negative emotions, activates stress systems, and decreases sensitivity to natural rewards. Hormones, such as cortisol, that enhance stress responses are released; and the heightened feeling of stress facilitates craving and relapse. Chronic use decreases subjective reward and often leads to tolerance due to adaptation to increased dopamine, necessitating greater amounts of the drug to produce the usual "high." This sensitization to stress is referred to as the "dark side" of addiction because individuals become focused on compulsively seeking more of the drug to prevent withdrawal and irritability. "Wanting" now occurs in the absence of "liking." Eventually longer-term epigenetic changes occur in the brain. Dynorphin then comes to be suppressed during abstinence, and sensitivity returns to the reward path. This new sensitization means that less drug is now needed to activate the mechanisms of "wanting." These epigenetic changes can remain for months.[64]

Depressive disorders and compulsive running also involve similar epigenetic changes. The processing of cue salience and the ability to exert self-control both require dopamine release and the presence of receptors in the prefrontal cortex; however, neuroimaging shows reduced dopamine activity in this area in addicts due to reduction in D2 receptors (with the exception of cannabis users).[65] Due to impaired prefrontal control, the ability to inhibit risky behaviors and delay reward is reduced, and flexibility in making further choices is impaired. This sensitization to drug cues can also cause craving in abstinent former users. Cues associated with the drug, such as paraphernalia, places, and people, increase anticipatory activity in the sensitized NAc and related areas and reinstate craving. This mechanism helps explain the increased risk of overdose death when a former addict suddenly uses their previously accustomed dose.

Emotional and motivational systems that evolved to promote survival are difficult to control with conscious effort. Marc Lewis has provided a developmental-learning model of addiction which attempts to bridge the gap between the false dichotomy of disease and choice models.[66] Habits form as activity in the NAc restructures and over time strengthens activity in the dorsal striatum (motor program area) and amygdala (emotion center). Axons normally grow from the ventral striatal area of NAc to the dorsal striatum as habits form.[67] Automatization of habits frees up cognitive processes for other things, allowing us to drive and talk at the same time. This shift in activation also occurs when an addiction forms. The repetitive strengthening of this pathway over time can lead to habits of drug use and eventually to compulsion similar to obsessive-compulsive disorder (OCD)—which primarily involves the dorsal striatum—as attention becomes modified by drug use and focused on drug cues.[68] At the same time, the executive control pathways from the prefrontal cortex become disengaged. These well-researched brain changes lead many researchers to classify addiction as a disease, but Lewis, a developmental neuropsychologist, sees it as an extreme form of processes normally used in learning.

These normal modifications of the brain are reversible, leaving open the possibility of unlearning if new habits are formed. Furthermore, as in OCD, these changes occur in pathways below consciousness,

causing them to seem irrational even to the addict. Augustine wrote of his struggle, "Any sort of habit is bondage."[69] Lewis contends that brain changes are normal rather than genetically preprogrammed and depend on feedback from the environment. The mutually reinforcing repetitions of certain behaviors, especially during childhood, also play a role in the development of anxiety and depression. And the brain self-organizes as learning occurs and as habits emerge.

Animals, children, addicts, and those with damaged prefrontal connectivity find delaying rewards difficult because they have less executive control over the dorsal striatum from the prefrontal cortex than do normal human adults. Adolescence is a time of brain reorganization during which the prefrontal areas are last to develop all their connections. The NAc, amygdala, and dorsal striatum develop earlier than prefrontal areas; this leads to imbalances in activation during adolescent development.[70] Dopaminergic axons continue to grow from the striatum to the prefrontal cortex during adolescence, and target choice appears to be malleable.[71] Top-down regulation of these striatal areas increases as the frontal cortex develops. The result of this temporary imbalance is that adolescents have even less top-down control of the lower areas associated with emotion, reward, and habit than younger children, leaving them especially vulnerable to the effects of addictive drugs.

Psychological Factors

The neurophysiological and genetic data help explain why addiction is so difficult to treat; however, we are not fully determined mechanisms, and so other factors must be considered. A study of over 12,000 individuals reported probability estimates of life-time remission from dependence at 84% for nicotine, 91% for alcohol, 97% for cannabis, and 99% for cocaine.[72] Median time to remittance was 26 years for nicotine, 14 for alcohol, 6 for cannabis, and 5 for cocaine. Although we can describe many risk factors, including age, gender, ethnicity, education, and presence of personality disorders that affect risk, nevertheless, addiction is not usually life-long. Most Viet Nam vets who used drugs (about 90%) stopped after their return. The dopamine receptors influencing predisposition to drug use are likely controlled not only by genetic factors, but also by environmental factors, including social stress.[73]

It has long been known that early environment plays a role even in the development of morphine self-administration in animals.[74] Childhood trauma and neglect have been shown to affect the course of neurological development of the brain as the circuits involved in reward anticipation and emotional regulation are changed.[75] The final configuration of the mammalian brain is due to sculpting by experience during development and is particularly malleable during periods of neural development. Childhood patterns of personality development become entrenched due to neuronal plasticity and can underlie depression and anxiety disorders.[76]

In a review of the effects of maltreatment and maternal deprivation on the brain, developmental neuropsychiatrist Martin Teicher asserts, "Maltreatment-related childhood adversity is the leading preventable risk factor for mental illness and substance abuse."[77] Maltreatment alters brain development and affects the structure of prefrontal and orbitofrontal cortical areas, amygdala, and hippocampus which are involved in, among other things, emotional regulation and anticipation of rewards—things that are crucial for avoiding addiction. It is also associated with reduced response to anticipated rewards in parts of the striatum, perhaps leading to enhanced risk for addiction.

The well-known research by John Bowlby and Mary Ainsworth, dating from the 1950s, showed that in order to thrive infants must not only be fed, but must also be in an emotionally satisfying, nurturing relationship with a stable caregiver in order to develop emotional regulation.[78] Addiction could thus be seen as an attachment disorder with attempts at self-repair in traumatized individuals.[79] Self-medication may thus represent an adaption to uncontrollable environmental factors that leads to loss of stability, loss of relationships, and loss of self. The basic circuitry for romantic love and attachment, which is evolutionarily prepared for survival of the species, includes and overlaps the circuitry co-opted by drugs, particularly opiates; and dopamine is also a major contributor to pair bonding in animals. Augustine, too, according to his own account in *Confessions,* suffered childhood abuse.

In order to fully understand the addiction crisis, individual stress and trauma must also be located in a wider social context. Peer use is one of the strongest

predictors for adolescent use of alcohol. According to addiction specialist Gabor Maté, adolescents whose primary relationships are with peers do not easily learn emotional attunement with others because their peers are equally emotionally immature and cannot model appropriate emotional control. A child's lack of emotional attunement with her caregiver is exacerbated by the lack of support given to the mother by the extended family, tribe, or community. Sociologist Peter Berger claims society, created by humans, acts back on human creators who then become the objectified products of society, often losing individual identity in the process.[80] This entails a form of self-objectification that forces individuals to construct their own identity. As the framework of tradition and the support of known community are diminished in modern society, individuals become isolated from their traditional base and social roles.[81] The mechanisms of social dislocation foster addiction as families are uprooted, and people turn inward because they no longer feel connected.[82] Socioeconomic status in humans and animals has been correlated with D2/D3 receptor availability in the striatum; and, as seen above, density of these receptors is lower in addicted humans, although the causal relationship here is unclear.[83]

When given a choice between cocaine and food, or cocaine and sweetened water or milk, most primates and rats choose the tasty substance, even when it is nonnutritive.[84] Self-administration by animals in bare cages pressing levers for intravenous drugs might, in fact, be partly a function of boredom and lack of choice. While boredom and loneliness are common in dislocated individuals, the greater problem in modern culture is loss of meaning. Psychiatrist Viktor Frankl asserted in 1946 that addiction along with depression and aggression are due to a feeling of emptiness and meaninglessness he called the "existential vacuum."[85] External substances provide focus and identity for individuals who lack self-identity and a sense of control over their otherwise uncontrollable lives. While social conditions are not responsible for addiction in any one individual, they lower the playing field for all, and the vulnerable succumb as they seek to temporarily fill the excruciating void.

Social and Cultural Factors

Although much of the medical model has been largely confirmed, it does not always take social context into account. The concept of addiction as disease is reified, according to sociologist Robert Granfield, by insisting that individuals are sovereign entities able to make choices apart from cultural context.[86] As he wryly notes, addiction is not an equal opportunity disease; some individuals are more vulnerable than others. Those constrained at the bottom of the social order have less choice to "just say no."

In a historical analysis of addictions, Bruce Alexander argues that prevalence tends to wax and wane, with periods of social chaos, such as the decline of the Greek and Roman empires, characterized by addictive behaviors.[87] Plato argued that the main cause of alcohol abuse in Greece was the structure of society itself. In what Plato called "just societies," addiction is rarely problematic, but in tyrannical societies almost everyone succumbs. Alcoholism, Alexander claims, was also a serious problem in the declining Roman Empire as evidenced by Augustine's description in *Confessions* of his mother's early behavior.

The present period is also a time of social chaos and inequality. The economically depressed regions of the US South and Appalachia are among the most drug-afflicted areas. While not dealing specifically with addiction, J.D. Vance's *Hillbilly Elegy* sheds light on the problems caused by community disruption and dislocation of families.[88] A study on mortality rates in the US shows that rates among white working-class males without tertiary education are unexpectedly rising, while they continue to decrease among better educated males, white females, and nonwhite individuals.[89] The authors of this study assert that the increase is due to alcohol- and drug-related deaths plus suicide—diseases of despair. Indeed, addiction has become a worldwide problem as the UN estimates that 5% of adults worldwide used illicit drugs in 2014, and 29 million suffer from drug use disorders. Alcohol, tobacco, and illicit drug use account for 12% of worldwide mortality.[90]

Technology and consumerism tend to interact in a complexity of ways to produce, sustain, and in turn be supported by substance use. Opiates were advertised and mass marketed in patent medicines in the late nineteenth and early twentieth centuries, allowing them to become acceptable to the public at that time. For example, the evangelical reformer William Wilberforce used the tincture of opium known as laudanum daily for 45 years, ostensibly for stomach pain. The fentanyl crisis is partly iatrogenic

due to physician overprescription of opioid pain medication. Oxycontin makers indulged for profit in fraudulent claims about the nonaddictiveness of their products.[91] Modern advertising is complex, potentially ambiguous, and affects all of us. It is well known that the tobacco industry continued to relentlessly promote cigarettes even after evidence showed them to be addictive. A 1979 report for Reynolds Tobacco discussed industry plans to enlist the venerable sociologist Peter Berger in their campaign against antismoking publicity.[92] In 1991 Berger produced a report, paid for by Philip Morris, in which he appealed to personal liberty to smoke, arguing that antismoking publicity would discourage liberty to smoke, in spite of the known health and social costs of smoking.[93] Arguing in favor of freedom of choice, some politicians continue to speak out against big government regulation of the tobacco industry, but they, in contrast, reject legalization of less-addicting cannabis. The point here is that social, economic, and political factors beyond the control, and sometimes even awareness, of the individual play definite roles in the choice of addictive substance.

Harm reduction policies of providing safe injection sites, needles, Narcan kits, and methadone have been controversial among those who see them as exchanging one opioid for another or as encouraging addicts to continue their habits without consequence. The continued use and development of overdose reversal methods such as naloxone; use and development of methadone and other treatment drugs; and development of alternative medications, including cannabinoids, to relieve pain are supported by Francis Collins and his colleagues at the National Institutes of Health (NIH).[94] Daniel Mallinson, in this issue, presents policy options for both governments and the church in light of both evidence-based science and social ethics.[95] Catholic scholar Irene Pettus points out the harms that overzealous Christian attitudes have inflicted on drug abusers, as well as on those in chronic and terminal pain who cannot access controlled medicines.[96] In her view, churches that hold attitudes of rejecting not only drug users but also harm reduction, have damaged individuals and groups when they ought instead to play a prophetic role, ministering to the marginalized and criminalized. She reminds us that pain-reducing opiates are largely unavailable to non-Western people, even for terminal illness, partly because of policies based on fear of addiction.

Meaning vs. Despair: Restless Hearts

At one time addiction was seen as a moral or spiritual problem, rather than as a physical problem. Addicts were counselled to find moral and spiritual strength to just abstain. Turning aside from the view of universal sinfulness, AA tends to classify the alcoholic as the victim of a disease yet within a framework that has moral and spiritual implications.[97] Not all agree that AA is the most effective form of treatment, but it does work for many, partly because members develop new habits through the support of a strong social network which provides unconditional love and grace no matter how many times they relapse. Of course, support, community, love, and grace are what we should also expect to find within the body of Christ. Social support itself produces natural levels of dopamine, and treatments that provide individuals the slow release of dopamine associated with social support rather than supraphysiologic bursting, do seem to show the greatest promise. In particular, the various 12-step programs that utilize continued social support can be combined with medical treatments and cognitive therapy.[98] Kent Dunnington, in this issue, sees AA as the best recovery regimen because it aims for a humble reconstitution of the self in the face of the challenges of accepting one's own guilt, shame, and failure while building a new identity.[99] Addicts often lack the self-identity needed to trust or invest in their future self. Its development, however, is undercut by guilt, shame, and failure. The admission of powerlessness over alcohol and the need to cast one's self on a higher power reflect how difficult it is for prideful creatures to ask for grace. Dunnington avers that 12-step programs allow addicts to see self-hood as grace received, by learning to the rest in the unconditional love of others.

Nevertheless, AA leads to a theological challenge—one can either recognize the Creator as revealed in Jesus Christ, or define AA's "higher power" as one likes, thereby turning one's life over to an essentially self-created divinity.[100] Acknowledging the present emphasis on widespread behavioral addictions, Linda Mercadante asks if AA's insistence on total abstinence is a new form of effortful Pelagianism. Previously we were all sinners; now we are all diseased. She points out that addiction and sin are fellow travelers, but not to be equated. This conclusion is echoed in this issue by Janet Warren reminding us

that we all do need development of our self-narrative, because we all face difficulty in acceptance of our guilt, shame, and failures.[101]

In *Confessions* Book X, Augustine describes his sexuality, need for love, and need for adulation in terms reminiscent of behavioral addictions. On becoming bishop, he even refused to allow women to enter his residence.[102] He also describes his post-conversion attempts to not enjoy the taste of food or the music of hymns, seemingly replacing his earlier addictions with what psychologist Bruce Alexander considers moralistic obsession. The tendency to merely replace one addiction with another is common, and as stated above, comorbidity is high. Although AA's cofounder Bill Wilson gave up alcoholism, he struggled as a chain smoker until his death from smoking-related emphysema. Alexander opines that Augustine cured his addiction by adopting a different, more preferable and healthier, form of addiction that provided him with both social support and ecstatic experience. A valid question here might be if addiction to religion is possible. Religion can become, like addiction, just another way to gain control of one's life. Dunnington notes that addiction to God is indeed possible if religion is grounded in a desire to control God.[103] True submission recognizes that even our relationship with God is possible only through grace—in thankfully accepting who we are and accepting God's grace.

Paul's dilemma in Romans 7:15–19 illustrates the moral problem of willing to do one thing, but doing the opposite. Morality has to do with actions, right and wrong, whereas spirituality has to do with the intent of the heart and openness to God's action in one's life (Rom. 8:1–8). Rather than a form of controlling life by means of religion, spirituality involves relationship with God. True relationship occurs in freedom rather than self-abnegation, honestly accepting that we are less than what we wish we were. We cannot control our lives or God's opinion of us, but we must accept grace and unconditional love.

Habitual substance abuse changes circuits in the brain and decreases frontal cortical activity because epigenetic changes are fostered by habitual substance abuse. Habit formation provides one of many examples of how the mind and the brain in mutual relationship grow together and shape each other. An addict becomes more and more trapped in a vicious spiral because repetition of a behavior creates pathways in the brain like ruts in an unpaved road. On the other hand, cortical thickness can be physically increased through meditation, and studies have shown that prayer also affects the brain.[104] Thus spiritual disciplines can form habits that enable us to become progressively more of what God intends. As new habits are formed, step by small step, old pathways in the brain become progressively less activated and newer pathways are gradually strengthened. Functional imaging has shown that rational cognitive strategies that lead to reduction of craving for both food and nicotine can produce activation in the prefrontal-striatal pathway, as well as reduced activation in the ventral striatum.[105] Imaging studies also show that, even though addiction results in loss of grey matter in the frontal cortex, the volume of grey matter in the frontal pathways increases again after months or years of abstinence.[106] The brain is always changing in response to the stimulation it receives. New synaptic growth can allow us to renew our minds. Spiritual disciplines can form new habits. Over time, perhaps, relationship with God may even reverse the neural damage done by abusive relationships with a parent or spouse.

Recovery, however, can be slow because it requires repeated instantaneous decisions to resist craving in spite of competition between the striatal habit system and the frontal control system. The competition for activation will replay again and again, requiring a long series of moment by moment choices. Drugs such as buprenorphine or methadone can make each decision point a little easier by satisfying the ventral striatum's craving mechanism. Each decisive moment of temptation, however, will contain a measure, sometimes very small, of free will with which one can grasp the proffered grace. We must avoid both Pelagian perfectionism of moral responsibility, and Manichean determinism of external factors, while recognizing that we are surrounded at each moment by God's prevenient grace reaching out to enable choices as we reach out in return. Paul's injunction in Romans 12:2 to be transformed by the renewal of the mind is intended for all of us, not just addicts, and it extends by the Spirit's gracious work over our entire lifetime.

Notes

[1]T. Gomes, et al., "The Burden of Opioid-Related Mortality in the United States," *JAMA Network Open* 1, no. 2 (2018): e180217, doi:10.1001/jamanetworkopen.2018.0217.

[2]National Institute on Drug Abuse Blog Team, "Tobacco, Nicotine, & E-Cigarettes," accessed April 20, 2017, https://teens.drugabuse.gov/drug-facts/tobacco-nicotine-e-cigarettes.

[3]World Health Organization, *WHO Report on the Global Tobacco Epidemic: The MPOWER Package* (Geneva: WHO, 2008).

[4]The National Institute on Drug Abuse (NIDA) defines addiction as "characterized by compulsive drug seeking and use, despite harmful consequences." The American Psychiatric Association in *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition: DSM-5* (Arlington, VA: American Psychiatric Association, 2013) refers to "substance use disorders" rather than addiction. See NIDA, "Drug Misuse and Addiction," in *Drugs, Brains, and Behavior: The Science of Addiction*, July 20, 2018, accessed August 22, 2018, https://www.drugabuse.gov/publications/drugs-brains-behavior-science-addiction/drug-abuse-addiction.

[5]The medical model is supported by researchers at NIDA, e.g., Nora D. Volkow, George F. Koob, and A. Thomas McLellan, "Neurobiologic Advances from the Brain Disease Model of Addiction," *New England Journal of Medicine* 374, no. 4 (2016): 363–71; and Nora D. Volkow and George Koob, "Brain Disease Model of Addiction: Why Is It So Controversial?," *Lancet Psychiatry* 2, no. 8 (2015): 677–79. The model is disputed by, e.g., Wayne Hall, Adrian Carter, and Cynthia Forlini, "The Brain Disease Model of Addiction: Is It Supported by the Evidence and Has It Delivered on Its Promises?," *Lancet Psychiatry* 2, no. 1 (2015): 105–10.

[6]For example, Volkow, Koob, and McLellan, "Neurobiologic Advances"; Joseph Frascella et al., "Shared Brain Vulnerabilities Open the Way for Nonsubstance Addictions: Carving Addiction at a New Joint?," *Annals of the N.Y. Academy of Sciences* 1187 (2010): 294–315; and William M. Struthers, *Wired for Intimacy: How Pornography Hijacks the Male Brain* (Downers Grove, IL: InterVarsity Press, 2009).

[7]Kent Dunnington, *Addiction and Virtue: Beyond the Models of Disease and Choice* (Downers Grove, IL: InterVarsity Press, 2011); Bruce K. Alexander, *The Globalization of Addiction: A Study in Poverty of the Spirit* (Oxford, UK: Oxford University Press, 2008); and Gabor Maté, *In the Realm of Hungry Ghosts: Close Encounters with Addictions* (Berkeley, CA: North Atlantic Books, 2010).

[8]Discussed in Judith Toronchuk and George F. R. Ellis, "Affective Neuronal Selection: The Nature of the Primordial Emotion Systems," *Frontiers in Psychology* 3 (2012): article 589.

[9]Nora D. Volkow and Marisela Morales, "The Brain on Drugs: From Reward to Addiction," *Cell* 162, no. 4 (August 13, 2015): 712–25, http://dx.doi.org/10.1016/j.cell.2015.07.046.

[10]David J. Nutt et al., "The Dopamine Theory of Addiction: 40 Years of Highs and Lows," *Nature Reviews Neuroscience* 16, no. 5 (2015): 304–12; and Aldo Badiani et al., "Addiction Research and Theory: A Commentary on the Surgeon General's Report on Alcohol, Drugs, and Health," *Addiction Biology* 23 (January 23, 2018): 3–5.

[11]Neurotransmitter receptors are proteins embedded in neural membranes to which transmitters briefly bind. Transporters are embedded proteins which actively move transmitters across membranes.

[12]Kent C. Berridge and Terry E. Robinson, "Parsing Reward," *TRENDS in Neurosciences* 26, no. 9 (2003): 507–13.

[13]Nora D. Volkow, Joanna S. Fowler, and Gene-Jack Wang, "The Addicted Human Brain: Insights from Imaging Studies," *The Journal of Clinical Investigation* 111, no. 10 (2003): 1444–51.

[14]Volkow and Morales, "Brain on Drugs."

[15]MDMA ("Ecstasy" or "Molly") has properties similar to both methamphetamines and hallucinogens. "Bath salts" are synthetic cathinones (found in the khat plant) with stimulant properties.

[16]R. Christopher Pierce and Vidhya Kumaresan, "The Mesolimbic Dopamine System: The Final Common Pathway for the Reinforcing Effect of Drugs of Abuse?," *Neuroscience and Biobehavioral Reviews* 30, no. 2 (2006): 215–38.

[17]GABA stands for γ-amino butyric acid, the most common inhibitory transmitter in the brain. It binds with two basic types of receptors, $GABA_A$ and $GABA_B$.

[18]Nutt et al., "The Dopamine Theory"; and Badiani et al., "Addiction Research and Theory."

[19]Dopamine has at least five types of receptors (D1 to D5) with somewhat different properties.

[20]Volkow and Morales, "Brain on Drugs."

[21]The actual effect of opioids on the dopamine system is still somewhat disputed according to Badiani et al., "Addiction Research and Theory."

[22]The dorsal raphe is involved in emotion, perhaps linking addiction and mood. Glutamate is the most common excitatory transmitter in the brain.

[23]Serotonin (5-HT) has at least sixteen subtypes of receptor.

[24]This material is reviewed in Pierce and Kumaresan, "The Mesolimbic Dopamine System."

[25]NIDA, "Prescription Opioids and Heroin," National Institute on Drug Abuse website, posted January 17, 2018, accessed April 9, 2018, https://www.drugabuse.gov/publications/research-reports/relationship-between-prescription-drug-heroin-abuse/prescription-opioid-use-risk-factor-heroin-use; and Francis S. Collins, Walter J. Koroshetz, and Nora D. Volkow, "Helping to End Addiction Over the Long-Term: The Research Plan for the NIH HEAL Initiative," *Journal of the American Medical Association* 320, no. 2 (2018): 129–30, doi:10.1001/jama.2018.8826.

[26]U.S. Department of Justice, Drug Enforcement Administration, "2016 National Drug Threat Assessment Summary," November 2016, 65–70, https://www.dea.gov/sites/default/files/2018-07/DIR-001-17_2016_NDTA_Summary.pdf.

[27]CBC News, "More Than 1,420 People Died of Illicit-Drug Overdoses in B.C. in 2017, The 'Most Tragic Year Ever': Coroner," posted January 31, 2018, accessed March 25, 2018, http://www.cbc.ca/news/canada/british-columbia/overdose-deaths-bc-2017-1.4511918.

[28]There are three basic types of opioid receptors: μ, κ, and δ. κ receptors in NAc bind with endogenous dynorphin and play a role in withdrawal as discussed below. Opioid antagonists such as naltrexone are somewhat effective in reducing both alcohol and nicotine use, confirming the involvement of opioid receptors in the rewarding effect of these drugs.

[29]Naomi Eisenberger, "The Pain of Social Disconnection: Examining the Shared Neural Underpinnings of Physical and Social Pain," *Nature Reviews Neuroscience* 13, no. 6 (2013): 421–34; and Naomi Eisenberger, "The Neural Bases of Social Pain: Evidence for Shared Representations with Physical Pain," *Psychosomatic Medicine* 74, no. 2 (2012): 126–35.

[30]Jason P. Connor, Paul S. Haber, and Wayne D. Hall, "Alcohol Use Disorders," *Lancet* 387, no. 10022 (2016): 988–98.
[31]Pierce and Kumaresan, "The Mesolimbic Dopamine System."
[32]Linda Spear, "Effects of Adolescent Alcohol Consumption on the Brain and Behavior," *Nature Reviews Neuroscience* 19, no. 4 (2018): 197–214.
[33]See H. Valerie Curran et al., "Keep Off the Grass? Cannabis, Cognition and Addiction," *Nature Reviews Neuroscience* 17, no. 5 (2016): 293–306 for review of the research literature.
[34]M. Colizzia et al., "Effect of Cannabis on Glutamate Signalling in the Brain: A Systematic Review of Human and Animal Evidence," *Neuroscience and Biobehavioral Reviews* 64 (2017): 359–81.
[35]Curran et al., "Keep Off the Grass?"; and Valentina Lorenzetti, Nadia Solowij, and Murat Yücel, "The Role of Cannabinoids in Neuroanatomic Alterations in Cannabis Users," *Biological Psychiatry* 79, no. 7 (2016): e17–e31.
[36]Reviewed in Lorenzetti, Solowij, and Yücel, "The Role of Cannabinoids."
[37]Francesca M. Filbey et al., "Long-Term Effects of Marijuana Use on the Brain," *Proceedings of the National Academy of Sciences* 111, no. 47 (2014): 16913–18.
[38]Curran et al., "Keep Off the Grass?"; and Lorenzetti, Solowij, and Yücel, "The Role of Cannabinoids."
[39]Catalina Lopez-Quintero et al., "Probability and Predictors of Transition from First Use to Dependence on Nicotine, Alcohol, Cannabis, and Cocaine: Results of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC)," *Drug and Alcohol Dependence* 115, no. 1–2 (2011): 120–30.
[40]Eric J. Nestler et al., eds., *Molecular Neuropharmacology: A Foundation for Clinical Neuroscience*, 3rd ed. (New York: McGraw-Hill Medical, 2015), 378, 385.
[41]Fernando Berrendero et al., "Neurobiological Mechanisms Involved in Nicotine Dependence and Reward: Participation of the Endogenous Opioid System," *Neuroscience and Biobehavioral Reviews* 35, no. 2 (2010): 220–31; Shiroh Kishioka et al., "Nicotine Effects and the Endogenous Opioid System," *Journal of Pharmacological Science* 125 (2014): 117–24; and Nestler et al., eds., *Molecular Neuropharmacology*, 385–86.
[42]Dynorphin is an endogenous opiate that binds to κ opiate receptors and is hypothesized to mediate negative emotional states.
[43]See Frascella et al., "Shared Brain Vulnerablities."
[44]Toronchuk and Ellis, "Affective Neuronal Selection."
[45]Reviewed in Daniela S. S. Lobo and James L. Kennedy, "Genetic Aspects of Pathological Gambling: A Complex Disorder with Shared Genetic Vulnerabilities," *Addiction* 104, no. 9 (2009): 1454–65.
[46]Dardo Tomasi and Nora D. Volkow, "Striatocortical Pathway Dysfunction in Addiction and Obesity: Differences and Similarities," *Critical Reviews in Biochemical and Molecular Biology* 48, no. 1 (2013): 1–19.
[47]Gene-Jack Wang et al., "Similarity between Obesity and Drug Addiction as Assessed by Neurofunctional Imaging: A Concept Review," *Journal of Addiction Disorders* 23, no. 3 (2004): 39–53.
[48]Volkow et al., "Neurobiologic Advances."
[49]Struthers, *Wired for Intimacy*.
[50]Matthias Brand, Kimberly S. Young, and Christian Laier, "Prefrontal Control and Internet Addiction: A Theoretical Model and Review of Neuropsychological and Neuroimaging Findings," *Frontiers in Human Neuroscience* 8 (2014): article 375; and Todd Love et al., "Neuroscience of Internet Pornography Addiction: A Review and Update," *Behavioral Sciences* 5 (2015): 388–433.
[51]Kenneth Blum et al., "The Addictive Brain: All Roads Lead to Dopamine," *Journal of Psychoactive Drugs* 44, no. 2 (2012): 134–43.
[52]Eric Nestler, "Cellular Basis of Memory for Addiction," *Dialogues in Clinical Neuroscience* 15, no. 4 (2013): 431–43.
[53]Robin Rylaarsdam, "The Genetics of Addiction," *Perspectives on Science and Christian Faith* 70, no. 4 (2018): 232–41.
[54]Catherine H. Demers, Ryan Bogdan, and Arpana Agrawal, "The Genetics, Neurogenetics and Pharmacogenetics of Addiction," *Current Behavioral Neuroscience Reports* 1, no. 1 (2014): 33–44.
[55]K. K. Blum et al., "The D2 Dopamine Receptor Gene as a Determinant of Reward Deficiency Syndrome," *Journal of the Royal Society of Medicine* 89, no. 7 (1996): 396–400; also Blum, "The Addictive Brain."
[56]Volkow and Morales, "Brain on Drugs."
[57]Connor, Habor, and Hall, "Alcohol Use Disorders."
[58]Augustine, *The Confessions*, Part 1, Vol. 1, ed. John E. Rotelle, O.S.A. (New York: New City Press, 1997), Book VIII.9.21, 201.
[59]Daniel Kahneman, *Thinking, Fast and Slow* (New York: Farrar, Straus and Giroux, 2011), 20–30.
[60]However, some researchers no longer consider tolerance and withdrawal to be necessary components of addiction. See Nestler et al., *Molecular Neuropharmacology*, 380, 381.
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Article

The Genetics of Addiction

Robin Pals Rylaarsdam

Abuse of alcohol and other substances has been with humanity for millennia, and the devastating effects of addiction to any substance are painful and costly to society, families, and individuals. Addiction disorders are complex behaviors driven by a combination of environmental factors, neurological changes stemming from long-term exposure to the addictive substances, and genetic predisposition to addiction. Recent advances in genomic analysis and gene expression profiling are beginning to advance our knowledge about the contributions of genetics to addiction. The data thus far indicate that the genetic contribution involves a multifaceted interaction among many different genes, with a significant epigenetic component to the final outcome.

It was the time of year for the regional middle school music festival in my corner of the Midwest. In the era long before helicopter parents were invented, I caught a ride with my best friend and her mom to the host town, about 30 minutes from home. As we rode down the dark two-lane blacktop, the topic of drinking came up. My friend's mom matter-of-factly stated that the chance of a daughter of two alcoholics herself becoming an addict was very high, so my friend should never risk taking even one drink. Both of my friend's parents were sober, but the path to sobriety had not been easy for anyone in the family—which was no secret in our town. Were my friend and her brother doomed because of the home life during their childhood? Was the family's sin being punished through subsequent generations? Were they destined to fight the same demons as their parents because of a genetic roll of the dice? Would one drink destine them to scheduling their lives around Alcoholics Anonymous meetings?

Her mom did not have the answers that night, and as with most things in life that involve the brain and human behavior, the answer is tremendously complicated and still incompletely understood. This article will describe the current state of knowledge regarding the contribution of genetics to addictive disorders. Unlike the classic examples of genetic disease, substance dependence is caused by a strong environmental component paired with inherited risk factors and acquired genetic changes. The mechanisms behind these genetic changes, examples of genes that have been identified as candidates for genetic change in addictive disorders, and potential targets for new addiction treatments will be discussed. Finally, this article will make suggestions for church communities in support for addicts and their families.

Addiction, or substance dependence, is defined in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition: DSM-5*, the standard for mental health classifications in the United States, as compulsive drug-seeking and use, despite harmful consequences.[1] By far the most common addictive substances used in our society are nicotine and alcohol. Along with the other commonly abused substances of marijuana, opium derivatives, and cocaine, there is a long history of human use and abuse of these drugs. As far back as the ancient Greeks, people noticed that alcoholism tended to run in families.[2] Twin and sibling studies over

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the years have consistently confirmed this informal observation, and several studies showed that the addiction was specific to alcohol versus other addictive substances or mental illnesses in general.[3] However, commonly described patterns of inheritance associated with single-gene phenotypes are not observed for addictive disorders. In fact, only a few alleles of specific Mendelian-inherited genes are associated with changes in risk of developing an addiction.

Classic Mendelian Genetics and Addictions

The best examples of single-gene variants that influence addiction are the inheritance of genes encoding inactive enzymes for alcohol and aldehyde metabolism. These inactive alleles make consuming ethanol physiologically unpleasant, and thus are clearly protective against alcohol abuse.[4] Figure 1 shows that alcohol dehydrogenase (ADH) and aldehyde dehydrogenase (ALDH) act in series to metabolize ethanol in humans. The first enzyme oxidizes ethanol to acetaldehyde, which is then further oxidized by ALDH to acetic acid. Acetic acid can be converted to acetyl coenzyme A (Acetyl-CoA) which either enters the Krebs cycle to release stored chemical energy for ATP production, or alternatively uses fatty acid production pathways to synthesize fats for later use.[5] A variant in ADH1B that changes a single amino acid in the protein reduces risk for alcoholism in Asians, Native Americans, European Americans, and African Americans.[6] Acetaldehyde buildup accounts for many of the unpleasant side effects associated with hangovers, and thus individuals with low ALDH levels generally find consuming ethanol unpleasant. The drug Antabuse (disulfiram) has been used since the 1940s to inhibit ALDH activity and thus to disincentivize drinking and alcohol abuse by exacerbating the unpleasant after effects of alcohol consumption.[7]

The clear association between ALDH and ADH genetic variants and protection against addiction to ethanol is the exception, and those genes are specific to alcohol. Almost all of the remaining literature regarding genetics and addiction falls into one of two types of investigations: (1) studies of differences in the relative risk of suffering from addiction disorders due to genetic differences between individuals, or (2) epigenetic changes in the genome that, during development or the individual's lifespan, result in daughter cells expressing the same changes in gene expression that were found in the progenitor cell. A small number of studies show germline transmission

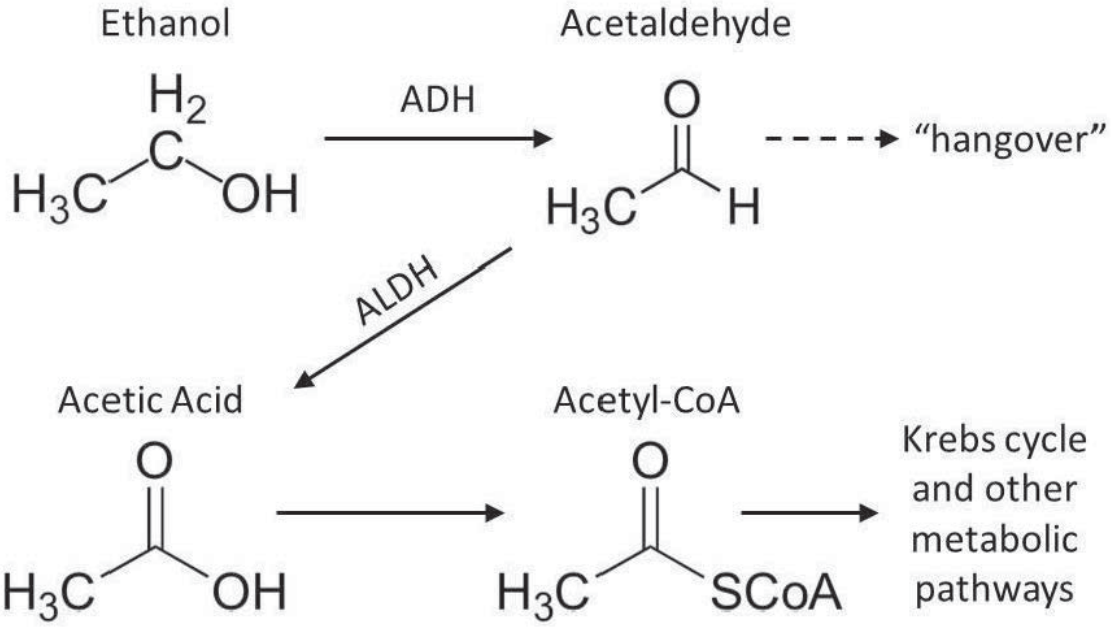

Figure 1. Biochemical Pathway for Ethanol Metabolism. Ethanol is oxidized by alcohol dehydrogenase (ADH) to acetaldehyde, which produces the unpleasant symptoms associated with "hangover." Acetaldehyde is further oxidized to acetic acid by the enzyme aldehyde dehydrogenase (ALDH), and acetic acid can be joined to coenzyme A (CoA) whereby it enters the Krebs cycle, fatty acid metabolism, or other pathways. Chemical structures from Wikipedia commons.

of those changes through sperm or egg DNA modifications. It is important to note that neither of these categories of studies will identify anything resembling popular conceptions of an "addiction gene," relative to any abusable substance or behavior.

Beyond the Punnett Square

A primer on genetics that goes beyond the Punnett square is useful at this point. Punnett square exercises in high school lead people to believe that genetic risk determination can be made very precisely for a given trait, and for the example traits used, this is true. Even more complicated calculations for polygenic trait inheritance in university-level genetics classes suggest that a firm probability of having a trait can be calculated. While this is a very useful foundation to start from, many human traits, including susceptibilities to most common diseases, must take more factors into account. Two key concepts, heritability and relative risks, are important to understand in complicated traits such as addiction.

Phenotypes are determined by both environmental and DNA-based factors. "Heritability" is defined as the proportion of the variation of a trait in a population that is due to genetic factors. Note that this is a measure for a group of people, in contrast to calculating odds for a particular person or couple in the classic genetics problems. In practice, heritability is very difficult to quantify because families share both genetic and social/environmental factors.[8] My son received both his genetics and his childhood environment and social setting from my husband and me. Furthermore, heritability is not fixed for a given trait. In different environments, the heritability of a trait will differ. For example, in a society in which all children have plenty to eat, enriching experiences, and strong loving families, the differences in their intelligence/IQ will be largely due to genetics. In the reality of life in the city of Chicago, the differences in IQ between children have far less to do with genetics and are largely determined by factors in each child's environment.[9]

The heritability, or "genetic component," of addiction disorders ranges broadly in different studies, from 0.3 to 0.7, in part because of the differences in environmental variation.[10] Taking an intermediate value of a heritability of 0.5 means that genes would be responsible for half of the variability in risk for addiction in the whole group of people. To further complicate things, many different genes are likely to cooperate in contributing to that heritability. One given allele, or variant, of a gene may be responsible for only a small portion of the final outcome.

Practically, genetic studies do not attempt to parse out the fraction of responsibility, but are more frequently reported as changes to the relative risk of developing an addiction by observing an appropriately chosen sample of the population. Relative risk is the ratio of the risk of having the trait under two different conditions. For example, in relation to addictions, it would be the risk of becoming addicted for individuals who have a specific allele of a gene divided by the risk of becoming addicted if you do not have that allele.[11]

Relative risk is not trivial to calculate, as all other factors leading into addiction (or whatever trait is under investigation) should be as equal as possible between the two comparison groups.[12] Thus, a fivefold increased risk of addiction for individuals with a specific allele of a specific gene could still mean a very low risk of addiction, or it could mean a quite high risk for each person carrying that allele. It all depends on the starting risk point. Generally, the relative risks for addiction in carriers of one specific allele that are reported in the literature are not impressive—for example, there is a relative risk of only 1.11–1.15 for alcohol dependence in individuals carrying a variation in a gene for the α2 subunit of the $GABA_A$ neurotransmitter receptor, *GABRA2*.[13]

Finding Candidates for Genes That Contribute to Addictions

Our understanding of the biology of response to addictive chemicals and the neurobiology of pleasure and reward has identified several important molecular components as good genetic candidates for influencing addiction. For example, alleles of genes coding for monoamine oxidases (MAOs) play a central role in balancing neurotransmitter levels in the brain and, as such, set a level of sensitivity to the environment that may make an individual more or less susceptible to those influences on addiction and other psychiatric conditions such as depression or anxiety.[14] A great deal of attention has focused on the dopaminergic system because of its role in mediating pleasure and reward. Several studies showed a link between drug abuse (of various substances) and a genetic variation in a noncoding region of a gene adjacent to one of the dopamine receptors, *DRD2*.[15]

While this "Taq1A" polymorphism was initially promising and associated with decreased dopamine-receptor levels and responsiveness, subsequent work did not show correlation with drug abuse.[16] Later studies zeroed in on the *DRD2* gene itself, and have shown more reliable linkage to addictions for a specific variant of the gene.[17] It is important to note that these are correlational studies, and a specific mechanism for driving the increase in drug abuse should be demonstrated experimentally before claiming a cause-effect relationship between an allele of a gene and addiction.

Genetic investigations that seek to associate particular alleles of genes with increased or decreased risk for addictions need a way to identify the candidate genes. With the advent of genomics, the most common tool used to find candidate genes is Genome-Wide Association Studies (GWAS). Single-nucleotide differences (polymorphisms) at millions of different sites throughout the human genome are recorded for groups of affected and unaffected people. On occasion, a DNA variant at one site will be much more prevalent in the genomes of one group or the other, making it a candidate region for a gene controlling that trait. Theoretically, this approach will be powerful in its "blind" identification of undiscovered genes involved in these addiction syndromes, as the experiments are inherently unbiased toward one genetic region versus another.[18]

The results from GWAS studies, however, have been inconsistent, and thus quite disappointing in finding variants associated with alcohol dependence,[19] other than the previously identified ADH and ALDH genes.[20] The inconsistent results suggest that for the very complex trait of addiction, there are many genes that make small contributions to the phenotype, and thus much larger samples of affected and unaffected people are needed to detect the small effects of risk loci.[21] While some authors predict that larger meta-analyses of GWAS studies may be fruitful, others propose that whole-genome sequencing is the most likely approach to moving forward with identifying genes that make small contributions to alcohol use disorder and other addictions.[22] Indeed, some whole-genome studies are already entering the literature.[23] As the cost of whole-genome sequencing continues to drop, and as more whole human genomes (and the associated medical records) can be entered into publicly available databases, this area of study has high potential for extending our knowledge of the many genetic loci that contribute to addictions.

Epigenetics: Changing Inheritance without Changing the DNA Sequence

The second category of genetic studies investigates epigenetics, or inheritance of phenotypic changes that are not caused by changes in the DNA sequence. Almost all examples of epigenetic inheritance involve passing on a pattern of gene expression from an altered parent cell to the daughter cells during cell division—within a single organism, not from parent to child. Notably, the sequence of nucleotides on the DNA strands does not change during epigenetic inheritance, but the phenotype of the offspring cells reflects the altered phenotype of the parent. These changes can be thought of as the genetics underlying the *development* of addictions, rather than the *inheritance* of increased risk for addictions.

There are several different mechanisms for changing gene expression that can be passed to offspring cells during mitosis, or cell division. DNA methylation (fig. 2) was discovered in the 1970s as a process used by bacteria to regulate gene expression, and subsequent studies showed that eukaryotes, including mammals, use differential methylation of cytosine to control levels of transcription for a range of genes.[24] Cytosine is "C" in the "ACGT" abbreviations for nucleotides. DNA sequences are conventionally written by the order of nucleotides on a directional DNA strand, starting with the end with a phosphate group, notated as the "5' end." The opposite end terminates with a hydroxyl group on the deoxyribose, and is termed the "3' end." The two strands of a DNA double helix are antiparallel to each other, such that the 5' end of one strand is attached to the 3' end of its complementary strand. In vertebrates, methylated cytosines are almost always found before, or 5' to, a guanosine residue, and are sometimes referred to as "CpGs." A CG sequence is base paired with a

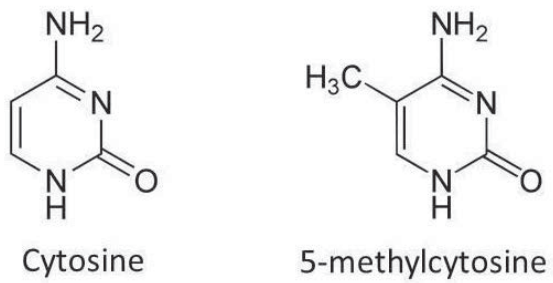

Figure 2. Structures of 5-methylcytosine. The unmethylated pyrimidine base cytosine is shown on the left, next to 5-methylcytosine on the right. Chemical structures from Wikipedia commons.

CG sequence (in the opposite orientation) on the complementary DNA strand, and the enzymes that methylate cytosines recognize CpG sequences that are base paired with methylated CpGs on the partner strand. Thus, after DNA is copied during replication, the newly formed double helix will have one original, methylated strand that helps the methylating enzymes find the nucleotides on the newly synthesized strand for modification, propagating this pattern of methylation through cell divisions.[25]

Methylation influences interaction with many DNA-binding proteins that are important for turning on or turning off transcription in that region. The most important family of these DNA-binding proteins are the histones. Histones are the oft-forgotten foundation of eukaryotic chromosomes. While the classic diagrams of DNA structure evoke a helical staircase model (fig. 3, panel 1), DNA inside cells is found associated with many different proteins. Histones are proteins that are the foundation for the structure of chromosomes (fig. 3, panel 2 gray balls), and organize the DNA in progressively more compact arrangements within the nucleus (fig. 3, panels 3–5).[26] The way that the DNA interacts with histones has great influence on expression of genes in localized regions of the genome. In brief, winding DNA more tightly around histone proteins prevents transcription-related proteins from binding DNA and producing RNA at a given site.[27] Thus, changes that promote histone-DNA association decrease gene expression, and changes that inhibit histone-DNA association increase gene expression.

Histone proteins undergo many different types of chemical modifications, including phosphorylation, acetylation, ubiquitination, and methylation. Each of these changes is catalyzed by an enzyme, and those enzymes bind preferentially to methylated regions of DNA.[28] The overall pattern of histone modifications in a region has been termed the "histone code," and the resulting chromatin remodeling will influence how much transcription occurs from promoters in that area.

Finally, expression of small noncoding RNA molecules named "microRNAs" can alter expression of genes by acting within the cytoplasm to alter the stability or translation efficiency of specific messenger RNAs (mRNAs).[29] Transcription of these regulatory RNAs is often regulated by the DNA methylation and histone modifications described previously, thus allowing those two mechanisms to both directly control expression of genes and to indirectly control gene expression through transcription of the microRNA regulators.

Epigenetic Changes in Alcohol Abuse: Human and Animal Studies

All three of the following epigenetic mechanisms have been observed to be involved in gene expression changes during abuse of different substances.

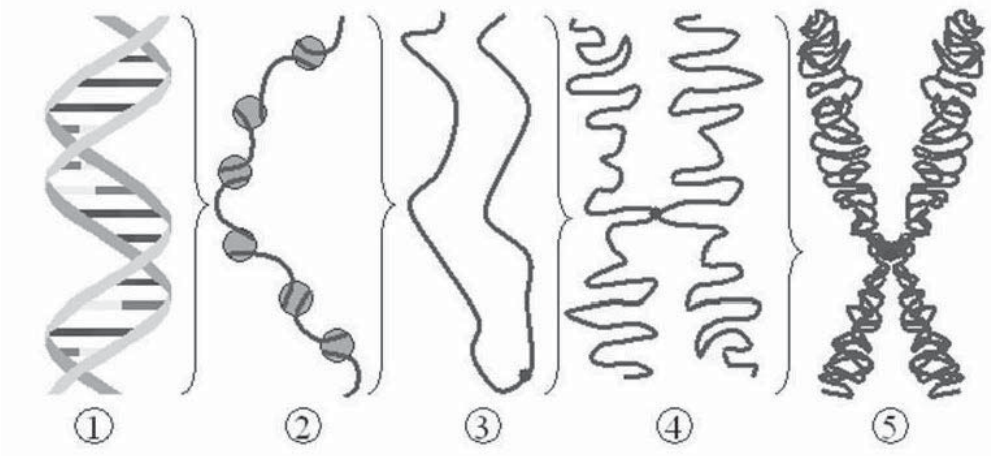

Figure 3. Overview of Eukaryotic Chromosome Structure. Panel 1: Schematic of the DNA double helix. Panel 2: DNA in eukaryotic cells is wound around core particles made of histone proteins (gray balls). Each DNA-histone unit is called a "nucleosome." Panel 3: Nucleosomes self-associate to further condense DNA during times when a cell is not directly dividing. Histone modifications control this condensation in localized regions of the chromosome. Greater condensation is associated with less transcription activity. Panel 4: DNA is replicated during S phase of the cell cycle. Panel 5: During mitosis, the duplicated chromosomes condense further to the X-shaped structures visible during this stage in the cell cycle. Diagram from https://commons.wikimedia.org/wiki/File:Chromatin_chromosome.png.

Alcohol consumption in humans is associated with changes in gene expression in many parts of the brain. The interplay between methylation and histone modifications in controlling transcription is exemplified by a 2012 study in which Igor Ponomarev and colleagues used a microarray experiment to identify many genes with altered expression. Notably, the GC-rich regions of the genome were transcribed more in alcohol abusers than in nonabusing control individuals, while GC-poor regions showed less transcription activity. This observation clearly points to a role for DNA methylation in gene expression.[30] This study also observed decreased expression of *DNMT1*, which encodes DNA methyltransferase; reduction of methylation in GC-rich regions would correspond to increased transcriptional activity.

Changes in histone modifications have also been indirectly observed in both rats and humans after alcohol consumption, with measurement of reduced histone deacetylase (HDAC) expression, an enzyme that removes acetyl groups from histones.[31] Interestingly, using drugs to directly inhibit HDAC activity reversed or blocked the formation of behaviors associated with ethanol abuse in rodents,[32] an observation earlier observed in a clinical study of human alcoholics; here, the HDAC inhibitor valproate reduced withdrawal symptoms and relapse.[33]

Finally, changes in microRNA (miRNA) expression are observed in brain samples from human alcoholics. Changes appear in several miRNA species that coordinate many other biological processes, including expression of genes involved in neuronal excitability and neurodegeneration disorders.[34]

There is no clear smoking gun here. Many genes are subject to epigenetic control during chronic alcohol consumption, and it is likely that some of the genetic risk for alcoholism stems from differences in responses to this epigenetic regulation, and from differences in the extent of epigenetic regulation in individuals, including expression levels of enzymes involved in DNA methylation and histone modifications.[35]

Epigenetic Changes in Other Addictions

Cocaine exposure studies also demonstrate many epigenetic changes in the brain of both animals and humans. In a manner similar to the mechanism of changes observed in alcohol studies, methylation patterns generally change in rodent brains, and the activity of enzymes responsible for DNA methylation is increased.[36] Acetylation and methylation of histones has been demonstrated in rats and mice,[37] and mice deficient in enzymes responsible for histone acetylation have been shown to be less sensitive to cocaine.[38] MiRNA populations also change in response to chronic cocaine exposure, with hundreds of downstream-regulated transcripts changing in abundance as a result, in a coordinated response that changes behavior in the test animals.[39]

While nicotine addiction may not have the negative behavioral issues associated with abuse of alcohol or illegal drugs, the public health costs of nicotine addiction are immense, amounting to as much as $170 billion in healthcare costs in the US alone.[40] A recent study using cultured neuronal cells demonstrated that nicotine causes repositioning of histones throughout the genome, with predicted expression changes in genes associated with histone modifications, neurotransmitter production, and neuronal signaling.[41] Studies in mice recently identified a specific miRNA, *mmu-miR-15b*, that is methylated in response to nicotine, resulting in its reduced expression in both the nicotine-exposed mouse and its first generation of offspring. Interestingly, behavior hyperactivity changes seen as a result were reversible by delivering either the miRNA or a protein that is regulated by the miRNA directly into the mouse brain—a key experiment that demonstrates a cause-effect relationship rather than just a correlation.[42]

Passing on Epigenetic Changes to Future Generations in Animal Studies of Addiction

This last example of changes in nicotine-driven miRNA expression is the first thus far in this article to mention epigenetic effects appearing in offspring. The mechanisms for transmitting epigenetic modifications to future generations of offspring are a rich area of current research. In short, any change to DNA methylation, histone modifications/chromatin remodeling, or miRNA expression, must occur in egg or sperm production, and be maintained after fertilization through development of the offspring. Extensive demethylation of nearly all of the genome occurs immediately following fertilization of vertebrate embryos,[43] although a small number of genes are protected from this resetting event.

New methylation patterns are established during development and are then carried through the many rounds of mitosis that occur as the organism grows to adulthood. One of the earliest examples of a gene maintaining a methylation state from sperm or egg was observed in the mouse gene for insulin-like growth factor (*Igf2*), a gene that contributes to body size in this species. Mice that do not express normal *Igf2* are about half the size of normal mice. Oddly enough, scientists observed that inheriting a mutant copy of *Igf2* from the egg did not produce a tiny mouse, while inheriting the same mutation from sperm did.[44] This observation was termed "imprinting," and the mechanism was later explained by differential methylation of the gene. In mice, the gene for insulin-like growth factor-2 (*Igf2*) is methylated in sperm, and unmethylated in eggs. Because the different methylation states are maintained from sperm and egg through development, only the maternal copy of *Igf2* is transcribed.[45]

Similar differential methylation patterns that are maintained through early development can contribute to expression of miRNAs or to association of DNA methylases or histone-modifying proteins, regulating expression of other genes. Again, only a small subset of genes maintain this differential methylation after fertilization, so this means of sharing changes in expression patterns through generations of offspring is the exception, not the rule. To date, studies relating to addiction use animal models to measure addictive behaviors. One of the most mature sets of experiments investigates multigenerational behaviors in the offspring of cocaine-exposed male rats. Cocaine administration in rats produces a desire for more cocaine; however, after a delay of time, rats avoid further administration of the drug and exhibit anxious behaviors.[46] In a 2014 report, male but not female offspring of cocaine-exposed sires showed decreased cocaine consumption as adults.[47]

Wimmer's group at the University of Pennsylvania later reported that male offspring of cocaine-exposed male rats have increased anxiety-like behaviors, while female offspring of these sires did not show behavioral differences.[48] Earlier studies had indicated that rats with higher baseline anxiety self-administered cocaine at lower levels,[49] which might suggest a protective effect against addiction in the offspring of exposed male rats. Exposing the offspring males themselves to cocaine delayed their feeding behavior in a new environment, a measure of anxiety, when compared to offspring of unexposed sires.[50] Thus, it appears that in rats, paternal exposure to cocaine passes on at least some increase in anxious behavior in the offspring, which may predispose them to less cocaine-seeking behavior.

In a follow-up study, this group measured very specific changes in memory functions, neuronal activity in the hippocampus, levels of the N-methyl-D-aspartate (NMDA) co-agonists D-serine and glutamate, and increased brain expression of D-amino acid oxidase (DAO1), an enzyme that degrades D-serine—all specific to male offspring.[51] Memory deficits are a common occurrence in individuals exposed to cocaine, and in the offspring of rats, memory performances for short-term and long-term tasks were also deficient. Changes in histone modifications, particularly acetylation, were observed near the *Dao1* gene; this explains the observation of reduced D-serine levels and potentially poorer memory formation in that NMDA receptors are key players in this process. Whether this epigenetic change in brain gene expression and memory formation is maintained across a third generation—with or without exposure of the second generation to cocaine—is an interesting question to address in the future.

Animal studies have also shown a pattern of epigenetic inheritance passed from male rats to their male offspring following ethanol exposure. Interestingly, there were clear reductions in ethanol consumption among these male offspring, although ethanol reduced anxiety significantly more in these offspring than in control rats, indicating an increased responsiveness to the drug.[52] Reduction in overall CpG methylation was observed in the sperm of ethanol-exposed rats, and in the DNA of both their male and female offspring. The studies investigated methylation of specific promoters within the genome, and as in the cocaine studies, saw reduced expression of *Bdnf* in specific brain regions.[53] However, clear cause-effect relationships between reduced *Bdnf* expression and either cocaine or alcohol consumption in male offspring of drug-exposed sires are not yet evident.

Other examples of intergenerational transmission of changes in gene expression in brain tissues have been reported following exposure of parent animals to stress[54] and nicotine.[55] It seems likely that in upcoming years more animal studies will use developing genomic technologies to more closely identify a set of genes with differential methylation patterns in the offspring of exposed animals, leading to a richer set

of testable hypotheses for gene expression changes that cooperate to predispose future generations to addictive behaviors. Eventually, these studies may help in developing more effective drug therapies for addiction recovery programs. Most of the current slate of pharmaceuticals either alleviate withdrawal symptoms by activating the same biochemical pathways without producing the same "high" as the addictive drug (for example, methadone treatment for heroin addiction), alleviate withdrawal symptoms by other pathways (for example, gabapentin's use as an anti-convulsant and anti-anxiety drug for alcohol addiction), or cause aversive responses to the addictive substance (for example, Antabuse for alcoholic recovery). Development of more-specific molecules that could target specific changes in gene expression associated with addiction, whether generally or to a specific substance, could be very useful in aiding the recovery of addicts, hopefully increasing the safety and long-term efficacy of the recovery process.

How Does the Church Show Grace and Love to Addicted Individuals and Their Families?

To return to the 1982 car ride with my friend, do these studies provide hope or hopelessness? The choice to take the first cigarette, the first drink, the first hit was still the choice for my friend to make. While her environment and her genetics, as well as her propensity to choose one way or another, exerted pressure on her responses to chemicals, a Christian perspective on this topic cannot fail to note the individual's responsibility to act faithfully to the God who created her. It is interesting that the Temperance movement that was so active in Protestant circles a century ago is almost absent from our churches today. To be sure, some churches and denominations still hold abstinence in high regard, but it is no longer a hallmark of Protestant Christianity. The question of abstaining from legal intoxicants will only expand as more US states and Canada move to legalizing recreational marijuana. In light of the strong evidence of genetic changes, and changes in brain function presented in other papers in this issue, revisiting church support for complete abstinence may be a good idea in many congregations.

However, the implication of the science is clear: regardless of the moral agency involved in developing an addiction, addicts who want to change to sobriety face a tremendously difficult journey. The epigenetic changes that are being more fully described each day by research scientists provide a biological explanation for both short-term and long-term consequences of choices, as well as why recovering from an addiction is so incredibly difficult for most people, more difficult than never starting at all. The Alcoholics Anonymous claim "once an alcoholic, always an alcoholic"[56] is consistent with these biological findings—the epigenetic changes in a person's brain are long term. The ability to change back to the unaddicted state has not been investigated, but there is a clear implication from the psychological and behavioral data that taking another drink/hit/puff, at least for many years, is a dangerous step for an addict who wishes to stay clean. Avoiding the addictive substance altogether for a lifetime is the surest way to maintain sobriety.

Acknowledging that recovery from addiction is more than a decision that involves sheer willpower or moral strength is important—it is physically difficult to overcome the state of gene expression and downstream effects in their brain. Graciousness from the church, encouragement without judgment, and love when the stumbles occur along the journey are essential. Teaching in Christian circles must acknowledge the real biological changes in the brains of addicts. Too often the church writes off individuals who could benefit from the love and support of believers because they are seen as too morally weak to be part of the community. Every church must stand alongside a recovering addict in acknowledgment of the physical challenges he or she faces in getting and staying sober.

Addiction Prevention Work within the Church Community

The work of the Christian community to support moral choices through loving care and healthy relationships for people at greater risk of addiction is an important consideration for every congregation. The idea of the actions of an addict causing epigenetic changes to their children is likely new to many readers, but important to consider. The children from these families have more than just environmental challenges to overcome, but the great hope is that by overcoming them, the chain of epigenetic inheritance may be broken for the next generation. Unfortunately, church families may withdraw from the hurting families that may be broken as a result of

the addiction, rather than enfolding the children in healthy community relationships. It is imperative for leaders in the church, both formal leaders and influential church members, to set the lead in accepting and enfolding families in these situations. Are these families, and particularly their children, included in invitations to after-church lunches, weekend barbeques, playdates at the park, sleepovers? If not, a great opportunity is being ignored. Pastoral leadership should deliberately challenge families to do this work of love and gracious acceptance in ways that honor and respect the families who are struggling with an active or recovering addict.

In many ways, youth pastors are at the forefront of preventative medicine for teenage children of parents who have abused drugs or alcohol. We now know that adolescent brains are particularly susceptible to epigenetic changes induced by alcohol and nicotine.[57] Fostering healthy relationships and developing useful ways to help students avoid substance abuse altogether is the best way to address substance abuse. There is no literature that describes human brain epigenetic changes in response to occasional intake of these substances, but the absence of data does not indicate an absence of an effect. Church-based programs that offer supportive social environments to children and that are deliberately welcoming to all children, not just those of upstanding families, can play a huge role in keeping children healthy. Proactively addressing substance abuse with vigor and in a multidisciplinary approach at the very first sign of a young person's abuse is important. Understanding the underlying motivations that led the youth to abuse in the first place will be essential to preventing further abuse, and understanding the child's motivations in a way that is humble and welcoming rather than fault finding and condemning is critical. The National Institute on Drug Abuse, one of the United States National Institutes of Health, has an excellent online resource for characteristics of effective drug prevention programs for those interested in exploring this topic further.[58]

In conclusion, it is evident that the genetic basis for addictions is complex. Much remains to be learned about how individual genetic code changes, as well as changes in gene expression acquired throughout the lifespan, contribute to the overall development of these very difficult outcomes. The gap between model animal studies and human measurements is significant, and will be important to address as genetic and genomic studies become more powerful and affordable in coming years. Thirty years on, the questions that surfaced in the car ride to the music festival are only beginning to be answered, and children of parents who struggle with addiction face challenges, both biological and environmental. While we await the development of drugs that can assist with weaning individuals off their addictions, it is essential to provide all the supports possible to address the nongenetic aspects of the disease, both for the addict and for their family.

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Kent Dunnington

Article

Recovery and the Humble Reconstitution of the Self

Kent Dunnington

There is evidence supporting the claim that twelve-step programs offer the best hope of recovery for addicted persons. This article offers an explanation for the success of twelve-step programs. It argues that twelve-step programs are the best recovery regimen because they aim at a humble reconstitution of the self, and a humble reconstitution of the self directly addresses two of the most besetting challenges of the addict: (1) the challenge of identifying with the self over time, and (2) the challenge of incorporating personal pain, guilt, shame, failure, and trauma into one's self-understanding. After explaining these two challenges, the article examines the role of pride in typical instances of self-constitution before showing how twelve-step programs self-consciously pursue a different, humility-based, path of self-constitution. The article concludes by considering the scientific and theological merits of its central hypothesis.

Alcoholics Anonymous (AA) and other twelve-step programs (TSPs) appear to "work." They appear to help people recover from addictions, and to do so better than alternative treatment programs. Although contested, these claims are backed by anecdotal evidence and, more importantly, by several clinical studies.[1] Let's suppose that it is true that TSPs such as AA work best for addicts. We need not suppose they work for all addicts (they do not), but suppose on the whole TSPs are the most effective available treatment regimen for addicts. Why should that be?

It is perplexing that TSPs work. First, TSPs are nonmedicalized programs of recovery, whereas the prevailing paradigm of addiction presents it as a neurobiological disease. Second, TSPs place spirituality and moral growth front and center, whereas it is a commonplace of the contemporary outlook on addiction that it is "not a sin, but a sickness." And third, much of what TSPs claim about addiction is patently false or woefully superficial.[2] For instance, the evidence that addicts are incentive-sensitive, and therefore are not powerless over their addictions, is overwhelming,[3] but the first step of TSPs states that addicts are powerless over their addictive substance or process. How is a nonmedicalized recovery program that privileges moral/spiritual growth and presents a false and superficial understanding of addiction, nevertheless the best available recovery program?

One way of responding to this puzzle is to question the prevailing understanding of addiction; perhaps the success of TSPs is a mystery only as long as we are committed to a disease model of addiction. I have tried to make that argument elsewhere, by challenging the disease model of addiction and attempting to replace it with a habit model.[4] In this article, however, I want to set aside the question of whether addiction is or is not a disease. I am no longer confident that such a debate should be at the center of our efforts to understand addiction and recovery.

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My thesis is that TSPs are the best recovery regimen because they aim at a humble reconstitution of the self, and a humble reconstitution of the self directly addresses two of the most besetting challenges of the addict: (1) the challenge of identifying with the self over time, and (2) the challenge of incorporating personal pain, guilt, shame, failure, and trauma into one's self-understanding. I will first lay out the reasons for thinking these two are among the most besetting challenges of the addict before briefly sketching how TSPs address them. At the close of the article, I will propose that understanding the work of TSPs in the way that I have suggested is scientifically plausible (since it is consistent with the neurological findings about addiction), scientifically testable (given the right measurement tool), and theologically illuminating (since it avoids the pitfalls of a purely sociological or a purely mystical interpretation of the power of TSPs).

Addiction as an Intrapersonal Prisoner's Dilemma

One way of getting a grip on what goes wrong in addiction is by trying to understand the perspective from which addictive behavior "makes sense." This might seem like a dead end given the commonplace assumption that addictive behavior is irrational, insane, and unaccountable, but the evidence that addicts, like non-addicts, are incentive-sensitive suggests otherwise.[5] Natalie Gold offers a powerful heuristic for thinking about the rationality of addictive behavior.[6] Gold argues that addictive behavior over time can be understood as an intrapersonal prisoner's dilemma. Let me explain by first reviewing the set-up of a prisoner's dilemma.

Suppose you and a fellow gang-member, Hascal, are arrested and detained in separate rooms. You cannot communicate with each other. The officer describes your options: "If you rat out Hascal, and he doesn't rat you out, you're off scot free. If you don't rat him out, and he rats *you* out, you get three years in the can and *he* gets out scot free. If you both rat each other out, you both get two years. And if neither of you rats the other out, you both get a year."

What should you do? What would be *rational* to do? You know Hascal is presented with the same options, but you cannot talk with him to establish a plan of cooperation. You do not know whether he'll snitch on you or not. The fascinating thing about a prisoner's dilemma is that from the perspective of your individual well-being, it is always rational to snitch. Here is why. You know Hascal will either snitch or keep quiet; those are his only two options. Consider what would be best for you to do in either case. Suppose he snitches: then it is better for you to snitch (that way you get two years instead of three in the can). Suppose he keeps quiet: it is still better for you to snitch (that way you get off scot free instead of spending a year locked up with Hascal). So from the perspective of your individual well-being, it is rational for you to snitch no matter what Hascal decides.

What does this have to do with addiction? Well, suppose you are an alcoholic who wants to recover, but you are facing a powerful temptation to drink. You might think as follows. *Resisting this temptation and bearing the misery of sobriety here and now is only worthwhile if my future self holds up his end of the bargain. If I resist these cravings today only for future-me to give in to them tomorrow, all this misery will be for naught. So I need to be confident that my future self is going to hold up his end of the bargain. But I don't know what my future self will do! All I know is that he'll either hold out, or he'll give in. But wait a minute. If he's going to give in, no way am I going to suffer here and now—it would be a wasted effort. So if my future self is going to drink, I should just drink now. But suppose my future self is going to hold out. Well, even then why shouldn't I enjoy one last drink since he'll get the ball rolling later? Either way, I should drink!*

Although this may be a case of "thinking drinking," as AAs call it, it is not obviously irrational, any more than it is irrational for you to snitch after you think through what is best for you given Hascal's two possible actions. And if that is right, then we have discovered a perspective from which addictive behavior—recurrently giving in to temptation to use—makes rational sense. Put differently, from this perspective, weakness of will is *rational* whereas self-control would be *irrational*, thus reversing the standard Aristotelian view, according to which incontinence is irrational and continence rational.

What is distinctive about the perspective from which recurrently giving in to temptation is rational? Here is the key insight. The distinctive thing about this perspective is that it is a perspective within which an agent does not have a cooperative and trusting

relationship with her future self. Such an agent lacks tools, which apparently others have, of "communicating" with her future self. She feels cut off from her future self, in something like the sense in which you would feel cut off from Hascal while being detained in separate rooms. At best, you can hope for or gamble on Hascal's cooperation, but you cannot rely on it or trust it. In sum, it is possible to interpret addictive temptation as the occasion of an intrapersonal prisoner's dilemma, and to interpret addictive behavior as evidence of an inability to "team up" with one's future self in order to cooperate in the pursuit of shared goals.

The analysis suggests that one of the besetting problems of the addict is an inability to fully identify with a future self. This conclusion is supported by contemporary psychological and neurological research. For example, it explains the strong link between impulsivity and borderline personality disorder (BPD).[7] Lack of self-control (impulsivity) is a defining symptom of BPD, but we can best understand *why* there should be a correlation between BPD and impulsivity by recognizing that persons with BPD have a special difficulty making strong identifications with future versions of themselves. Daniel Bartels and Lance Rips also found a strong correlation between an agent's ability to delay gratification and an agent's sense of connectedness with past and future psychological states, such as memories, intentions, beliefs, and desires.[8] Subjects who rated themselves as more psychologically connected to past and future versions of themselves displayed greater self-control and a lower "discount rate" when evaluating future goods. In sum, the kind of loss of control that is typical of addiction is highly correlated with a disconnected or fragmented "sense of self."

If the analysis is correct, then a program of recovery will need to address the fragmented self that besets addicted persons.[9] The success of AA and other TSPs, I will argue, is largely due to their ability to provide addicted persons with narratives that can overcome the fragmented self and help addicted persons more strongly identify with both their past and future selves. But how, exactly, do we "build" a self? What is involved in moving from a fragmentary toward a more unified self? What exactly would it mean to have a more "solid" or "robust" sense of self that one can count on, and that would cooperate with one's future self?

Two Ways of Constructing a Self

"Self" is not a clear term. It is used in at least the following five ways.[10] Self can mean

(1) *person*—one has a self insofar as one is a human person;

(2) *personality*—one has a self insofar as one has distinctive personal characteristics;

(3) *phenomenological subject*—one has a self insofar as one experiences consciousness;

(4) *identity*—one has a self insofar as one has a sense of "who I am"; and

(5) *executive agent*—one has a self insofar as one can make choices.

It is easy to see how these different meanings can come apart; this shows how easily we can equivocate on the notion of the self. But the sense of self that I have been discussing, and that is emerging as an important theme in discussions of addiction and recovery, is the sense of self picked out by meaning (4). When we say addicted persons are beset with a fragmentary self, we mean that addicted persons lack a sufficiently robust identity.

This remains vague, though, so let's try to sharpen it. The notion of identity is itself polysemous, since there are various ways in which I might be concerned about "who I am." We use "identity" variously to pick out the notion of

(4a) *self-understanding*—a relatively clear idea of what others would need to know about my story in order to really "know me";

(4b) *vocation*—a relatively clear idea of the kind of agent I am called to be;

(4c) *ego ideal*—a relatively clear set of beliefs about myself, reflection upon which is an occasion of pride; and

(4d) *sense of self-worth*—a relatively clear sense that I am deserving of unconditional love and care.

Again, we can see how these are different by reflecting on how they can come apart. For instance, we can imagine a severely downtrodden addict who possesses only (4a). If she were honest, she could say the things about herself that someone else would need to know in order to understand "her story," but she might not have a clear sense of practical agency, or of personal pride, or even of her self-worth. And we could imagine scenarios in which each of (4a)–(4d) come apart from the others.[11]

My view is that a stable and secure "sense of self" is typically achieved through the progressive alignment of (4a)–(4d). That is, by integrating my personal story, my vocation, my ego ideal, and my sense of self-worth, I achieve a reliable experience of some underlying substrate of "who I am" that can withstand the slings and arrows of fortune. Whether there really *is* such a substrate is an important philosophical question, but one that is irrelevant to the phenomenology. What the research shows is not that persons must *have* a substantial self in order to successfully exercise self-control, but only that they must *sense* that they do. In other words, they must have a first-person experience of strongly identifying with an extensive collection of future first-person experiences.

If it is true that addicts have a fragmented self, that they struggle to identify strongly with their future selves because in some meaningful sense they do not fully know who they are, then the problem is likely to be a failure of alignment between the various senses of self that I have outlined. But why should addicts have a special problem aligning (4a)–(4d)? Let me state succinctly what I take the problem to be, and then unpack the claim in the following paragraphs. The problem, most of the time, is that human persons achieve a unified experience of the self by gradually aligning their (4a) self-understanding, (4b) vocation, and (4d) sense of self-worth with a clear and relatively attainable (4c) ego ideal. But, in the case of serious addiction, personal failure and shame undercut this standard mechanism whereby human beings achieve a unified experience of the self. Put differently, most of the time a strong sense of self is built by leveraging pride (which is what the ego ideal is all about), but, in the case of serious addiction, personal pain, guilt, shame, failure, and trauma consistently undercut pride and thereby short-circuit the conventional "selving" project. To understand why TSPs are powerful recovery regimes, we must see why pride is the conventional mechanism for selving, and why addictions cause breakdowns in that mechanism.

Pride is the conventional mechanism for selving because the consolidation of a strong ego ideal typically conditions the other aspects of selfhood: self-understanding, vocation, and self-worth. For example, the ego ideal typically conditions our quest for self-understanding because any tension between some component of our self-understanding and some component of our ego ideal is an occasion of shame. If it is part of my self-understanding that I am a drunk who has often put the well-being of my family in jeopardy, and if it is part of my ego ideal that I be a good father, reflection on my self-understanding will be an occasion of disappointment and shame. The ego-ideal-induced experience of shame will then motivate a quest for revision of either my self-understanding or my ego ideal. How do I revise it? There are at least three ways.

First, I might "flip the script" and attempt to valorize being a degenerate and reckless drunk, incorporating it into my ego ideal, and thereby achieving alignment between my self-understanding and my ego ideal. Occasionally people or people-groups who have long been shamed for some characteristic or behavior will manage to flip the script and take pride in that characteristic or behavior, by incorporating it into a revised ego ideal. This is what happened, for instance, in the "black power" movement. There are addiction subcultures that flip the script as well. One heroin addict wrote to me from prison that she and her boyfriend (who died by overdose) were

> disgusted with the plastic, air-brushed perfection that is the American ideal. So our pale, anemic, track-marked flesh became a mark of distinction that separated us from all that. We were not ashamed of being addicted to heroin because we took a certain amount of pride in our deliberate choice to live in opposition to that ideal.

So addicts *may* leverage pride to consolidate a strong sense of self, but they thereby cut themselves off from recovery.

Alternatively, when confronted with this gap between my ego ideal and my self-understanding, pride might push me to simply repress and deny the aspect of my self-understanding that is in conflict with my ego ideal. Rather than flip the script and valorize the drinking life (as some drunks do, especially in the early throes of addiction), I simply disavow that I am a drunk who has endangered his family. Here again, pride is leveraged in order to overcome a fragmented sense of self, but here again, recovery becomes impossible since the addict is in denial.

A final possibility suggests itself. When confronted with the gap between my ego ideal and my self-understanding, I might try to bring my

self-understanding in line with my ego ideal by becoming a more devoted father. If I succeed, and I grow into a responsible father, I gain a new self-understanding, a new story to tell about myself: I used to be a drunk, but that is not who I am today. Here again, the ego ideal is the engine that leverages the alignment between self-understanding and ego ideal, which is constitutive of a strong sense of self. But here again, we see how major addiction can easily short-circuit the normal process whereby our ego ideals drive the consolidation of the self. Most of the men and women[12] in TSPs have tried, and failed, to leverage their ego ideals to overcome their destructive behavior. Pride is a strong enough force to overcome many a temptation, but quite often it seems to be insufficient for overcoming the constant onslaught of addictive temptation.

We are beginning to see how the ego ideal is typically in the driver's seat in the effort to achieve a unified self. The ego ideal can motivate flipping the script, denial, or moral effort. We can demonstrate a similar set of relationships between one's ego ideal and one's vocation, and between one's ego ideal and one's sense of self-worth. We see that the ego ideal—that particular perspective on ourselves that can occasion a sense of pride and positive self-regard—typically conditions the formation of our vocation as well as our sense of self-worth. For instance, the formation of our vocation is constrained by our ego ideal whenever we have the conviction that we should be a certain kind of agent but recognize that being such an agent cannot occasion an experience of pride. This is, I suspect, what keeps many serious addicts away from a TSP. It is no part of their ego ideal that they become a "Stepper." And how could it be? Involvement in a TSP requires the explicit admission of helplessness, failure, and powerlessness. So long as the ego ideal is in the driver's seat, certain vocational possibilities remain problematic.

Let's consider one more example of how pride is the typical engine for unifying the self. Most of us develop a sense of self-worth—a sense that we are worthy of the love and respect of others—by attaining to an ego ideal such that we believe we *deserve* the love and respect of others because of something intrinsically good or delightful about us. We do not want to be the undeserving recipients of gracious love, we want to be the deserving recipients of love that is responsive to our good qualities. That we are creatures who resist grace is but one way of saying that our sense of self-worth is typically conditioned by our ego ideals.

To sum up, most addicted persons have a fragmented experience of themselves. They are not able to enter into cooperative partnerships with their future selves, and thus addictive behavior becomes rational from the perspective of the isolated here-and-now self. And addicted persons are especially prone to a fragmented self because of the way that their shame and guilt undercut the consolidating role of pride in the formation of a unified sense of self. Pride can lead an addict to flip the script, but then a self-satisfied drunk can never recover. Pride can lead an addict to deny her addiction, but then an addict in denial can never recover. Pride often motivates moral effort, but addictive temptation seems to be uniquely resilient and intense, to the degree that the normal pride-driven efforts at self-control generally fail.[13]

There is, however, another way of consolidating a unified sense of self. It is not the typical way, even if it is the path to selfhood recommended by Jesus and other sages. There is a kind of selving that is grounded in humility, rather than pride. One way of understanding the success of TSPs as recovery programs is by seeing that they offer a nonpride-driven way of consolidating a unified sense of self. If addicted persons need a unified sense of self to exert self-control, but the normal pride-driven "selving" project is not available to addicts, then we should not be surprised by the success of TSPs, which focus on the humble reconstitution of the self.

Why TSPs Work

According to *Twelve Steps and Twelve Traditions*, "the attainment of greater humility is the foundation principle of each of A.A.'s Twelve Steps."[14] "All of A.A.'s Twelve Steps ask us to go contrary to our natural desires," the book explains; "they all deflate our egos."[15] And even a cursory reading of the literature of AA bears out the central role that humility plays in the program. It is also not luminously clear from this literature exactly *what* humility is or exactly *why* humility should be the "foundation principle" of the twelve steps. Similarly, the "Big Book" as well as *Twelve Steps and Twelve Traditions* highlights pride as the alcoholic's biggest problem, but it is not

luminously clear what pride is or how pride hamstrings alcoholics.

But I think that we are now in a position to see how humility and pride might matter to the practice of recovery. The *emotion* of pride—as in, "I just *feel* so proud"—is an experience of pleasure evoked by a positive self-survey. That is, we experience the emotion of pride when we consider ourselves and discover that there is something about us that distinguishes us as better than, more important than, or more significant than some relevant class of others. It is a powerful emotion, the pursuit of which can energize a wide range of personal initiatives. The *character trait* of pride is the disposition to be overconcerned to experience the emotion of pride. Put differently, the proud person is the one who is overconcerned about all of those ways in which his personal significance over against others can be experienced through a positive self-survey. And so, to be a proud person is to be someone who is ego driven in a straightforward sense: most of what the proud person does is conditioned by her desire to experience herself as "better than" some relevant class of others. The character trait of humility is simply the absence of the character trait of pride: it is a general lack of concern about one's own personal significance over against others.[16]

We still tend to think of pride as a vice and, therefore, of an ego-driven life as a kind of moral failing, but I hope my discussion in the previous section indicates that, for most of us, most of the time, pride is precisely what enables us to make sense of who we are. Even though I ultimately reject Hume's neo-Aristotelian reinstatement of pride into the column of the virtues, I think he is exactly right—that almost all ambition, success, and aspiration is pride driven. Hume rightly noted that if we got rid of pride, it is not at all clear what motive most of us would have for self-improvement or service to our fellow citizens.

TSPs recognize that this ego-driven way of life is a disaster for addicts, but we can only really grasp why that should be, once we see that the ego-driven life is the norm. In the previous section, I tried to suggest why the normal way in which pride is leveraged to achieve a unified self typically fails for persons who are beset with serious addictions. The central insight of TSPs is that there must be another way to build a cohesive self, a way that does not rely on what Iris Murdoch calls "the fat, relentless ego."[17]

How, then, can humility be the bedrock of a reconstitution of the self? Return again to the various senses, (4a)–(4d), of identity. I showed how, typically, the constitution of the self is pride driven, in the sense that it is one's ego ideal that conditions and constrains one's self-understanding, one's vocation, and one's self-worth. There is, however, another way. One might put one's self-worth in the driver's seat and allow it to condition the others. But how can I *begin* with a sense of self-worth if that sense of self-worth is not already ego-based, built on the back of my achievement, my importance, my status—in other words, my intrinsic or achieved goodness that grounds and justifies my sense of self-worth?

Here the fundamentally Christian orientation of TSPs emerges, because the whole program hinges on the conviction that I can discover that I am accepted, loved, valued, and treasured regardless of my failures. It hinges on the conviction that I am worthy of acceptance, inclusion, and care—no matter what. Put theologically, it hinges on the conviction that there is grace, a love beyond merit. TSPs assert such a love by setting forward the reality of a Power in whose care I can rest and therefore in whom I can unconditionally trust.

> The effectiveness of the whole A.A. program will rest upon how well and earnestly we have tried to come to "a decision to turn our will and our lives over to the care of God *as we understand him*."[18]

The theological significance of "as we understand him" has been amply examined,[19] but at least part of the reason that TSPs include this caveat is that they want nothing to stand in the way of a certain kind of experiment of trust. TSPs do not assert the reality of a trustworthy God on the basis of revelation or authority, but on the basis of experience. "We who have tried it … can testify that anyone, anyone at all, can begin to do it."[20]

TSPs link the willingness to submit to and rest in the care of God to the virtue of humility. Faith is required to *believe* in God, but it is *dependence* upon God that grounds humility and thereby frees one from the dominating impulses of the ego. Dependence is the heart of the matter for TSPs, and they go to some lengths to rescue the notion of dependence from its associations with servility. It is pride that insists on unqualified independence, and humility which recognizes that, as creatures, we are fundamentally

dependent and needy. "It is startling to discover how dependent we really are, and how unconscious of that dependence."[21]

TSPs do not simply assert the existence of a love that can sustain us, though we be without merit. They embody it. They embody it in a variety of ways, but primarily by inviting people to tell the story of their failures in a context of complete acceptance. In this way, they sever the constraining and controlling function of the ego ideal. If, week after week, I can ritually relay the stories of my past (and often continuing) confusion, illusion, failure, and devastated hopes, then I can begin to gain a sense of who I am and who I could be that does not require to be buttressed by my ego ideal. That is, I can begin to piece together a self-narrative in which I play no noteworthy or heroic role whatsoever. New TSPers worry: "If I keep on turning my life and my will over to the care of Something or Somebody else, what will become of *me*?"[22] Veteran TSPers discover that they find a truer and more cohesive self, precisely by relinquishing the old pride-driven self-constitution project.

TSPs highlight this shift in self-constitution strategy by repeatedly drawing a contrast between the addict's penchant for independence before the TSP, and what the addict is learning about dependence within the TSP, underlined especially in step two. Like (nearly) everyone else, addicts want to establish their own significance independently of others' love and care, so that others' love and care is deserved, rather than a gift of grace. What addicts discover within TSPs is that their significance may be established in a way that is dependent upon the love and care of their Higher Power and of their fellow Steppers. In other words, TSPs train addicts to see their selfhood as itself a gift of grace, something they receive by learning to rest in the love of others.

AA and other TSPs ingeniously combine the self-constructing power of narrative with a context that eschews ego-ideal-driven narratives. Put differently, telling your story in a way that emphasizes your own personal excellence avails nothing in a TSP meeting. So, you must find a different way of telling the story of who you were, who you are, and who you are becoming. And thus, you may discover an identity that is rooted in the sense of self-worth, the recognition that you are unconditionally loved, rather than in the ego ideal, the belief that you are distinctively important or impressive. TSPs are powerful recovery regimes because they train addicted persons, whose resources for a prideful reconstruction of the self are typically decimated, to find a new self-understanding and vocation without recourse to pride. They do this by turning the ego ideal into an enemy, an unwelcome and destructive presence that must be starved and systematically sidelined through the practice of the twelve steps. TSPs thus center the selving project on humility, rather than pride.

TSPs, Science, and God

I have argued that TSPs are successful largely because they recognize the need for a nonpride-driven reconstitution of the self. My hypothesis is that TSPs excel other recovery regimes because they prioritize, more than other recovery regimes, a narrative-driven reconstitution of the self from a posture of avowed humility. One might object that this moralizes and spiritualizes a phenomenon that should be understood and interpreted in strictly neurobiological terms, but this objection, I think, would be a failure of true empiricism. For one thing, my hypothesis is consistent with contemporary neurobiological data, and furthermore, my hypothesis is testable. Let me say a quick word about each.

First, the claim that TSPs excel other recovery regimes because they prioritize the humble reconstitution of the self is consistent with contemporary neurobiology. Neurobiologists—at least those who accept the basic premise of cognitive behavioral therapy—recognize that the relationship between neurology and cognition is a two-way street: that is, the structure of our brain affects what we think and (equally so) what we think affects the structure of our brain. If this is true, then it should not be surprising were we to discover a correlation between certain ways of conceptualizing the self, on the one hand, and certain sobriety-conducive neuronal patterns, on the other hand.

This is just what we have discovered. Neurobiologist Marc Lewis, for example, argues that

> the facility for viewing one's life as a narrative may be what's missing in addiction. And the loss of an accessible self-narrative corresponds with clues that the dorsolateral prefrontal cortex becomes partially disconnected from the motivational core [the amygdala-accumbens-orbitofrontal cortex

> network] both in episodes of now appeal and over the long-term course of addiction.[23]

In other words, Lewis argues that addicts typically display a neurological disconnect between those parts of the brain that are responsible for linking the past to the future in the form of a personal narrative.

It is not clear to me what, exactly, this correlational data proves, but it should lend empirical support to those techniques that enable addicted persons to recover an ability to tell a cohesive story that links their past, present, and future. At the very least, it demonstrates that my hypothesis is consistent with the neurobiological evidence, and therefore it is consistent with a disease model of addiction (supposing that model is *itself* consistent with the evidence). There is no reason a defender of the disease model should flinch at TSPs appeal to humility as the foundation of recovery. It may well be that the brain disease of addiction is constituted in part by a partial disconnect between the dorsolateral prefrontal cortex and the amygdala-accumbens-orbitofrontal cortex network, and that the rehabilitation of that connection may be accomplished through the kinds of practices that TSPs feature.

Second, the hypothesis is testable. Suppose we had a measure of the robustness of one's sense of self as well as a measure of humility as I have defined it here. Given these two measurement tools, we could design experiments that test whether TSPs more successfully increase these two measures in participants than do other recovery regimes. We could examine whether successful recoveries in TSPs correlate with higher levels of these measures than failed recoveries. And so on. But do we have such measures?

Some of the studies mentioned earlier, for example, those by Bartels and Rips, use measurement tools that do track the psychological connectedness of agents to their past and future selves. As far as I can tell, these measurement tools track, at least partially, the robustness of an agent's sense of self.

I am less confident that we have proper measures of humility. For one, the social science of humility has long been hampered by a measurement problem because humility, more than any other virtue, is opaque to the one who possesses it. Humble people rarely say or even think that they are humble, whereas proud people often do! Thus there is a serious methodological challenge in the social science of humility.[24]

But, in my view, there is an even greater conceptual (as opposed to methodological) challenge in the social science of humility. Humility is the most contested character trait that has been featured in any table of the virtues. Humility is celebrated in the Hebrew scriptures; magnified as a defining characteristic of Jesus in the Christian scriptures; cited by Augustine, Aquinas, and many other medievals (especially the monastics) as the cornerstone virtue of the Christian religion; dismissed by Aristotle as characteristic of the lowly underclass of society who could never aspire to genuine virtue; denigrated by Hume and Nietzsche and many other moderns as a "monkish," slave virtue that could only impede genuine civilization and flourishing; and the story continues. Any concept with such a tumultuous and storied tradition is bound to have undergone revision through its many denunciations and recuperations, and this is certainly true of humility. All of which is to say that there is minimal agreement among social scientists as to how humility should be defined.

June Tangney has written the seminal article in the field of social science humility research in which she identifies six aspects of humility: having an accurate view of self, acknowledging limitations, being open to new ideas, keeping one's abilities and accomplishments in perspective, having a low self-focus, and valuing all things.[25] Social scientists have generally followed Tangney's advice in developing measurement tools that track these various dimensions of humility. Low self-focus is closest to what, I have suggested, TSPs have in mind when they counsel humility, and there are indeed measures of humility that isolate self-focus. This suggests a place to begin measuring the role of humility in TSPs.

But even here, things are tricky, because for TSPs a crucial determinant of success is the way that low self-concern is grounded by a glad dependence on God and on the TSP group for one's sense of self-worth. We can see how this matters, by thinking about other ways in which low concern or a low self-focus might be grounded. Suppose I have low self-focus because I am simply obsessed with some other matter of interest. That is not the kind of humility that TSPs have in mind, because it is not a perspective from which a reconstitution of self can occur. What is needed, I think, are measures of

humility that are more sensitive to the motivational core of the virtue. In the Christian tradition and in the TSP tradition, glad dependence on God is the motivational core of the virtue of humility.[26] A measurement that could track such a motivational profile would be especially helpful in testing some version of the hypothesis I have set forth here.[27]

I have to say "some version" because, of course, there is no way to test whether dependence on God explains the success of TSPs. We can test only whether those who assume a posture of dependence upon a supposed Higher Power are better positioned for recovery. Nevertheless, my hypothesis takes TSPs seriously as a repository of genuine spiritual and moral wisdom, in a way that other attempts to explain the success of TSPs often do not. Most attempts to explain the success of AA and other TSPs tend in the direction of one or another reductionism. Avowed naturalists feel a need to reduce the success of AA to mere sociology, focusing, for instance, on the importance of social support for recovery (here, the theological-spiritual content of TSPs has no explanatory force). Avowed supernaturalists, on the other hand, often feel a need to reduce the success of AA to mere mysticism, as though God miraculously heals those who finally submit to a "Higher Power" (here, TSPs are treated as magic, rather than as a repository of spiritual practice and wisdom).

In my view, TSPs work because the spiritual practices they set forth enable addicted persons to discover that there is a way of connecting their past and their future into a cohesive narrative, despite the fact that their lives have been marred by shame, guilt, trauma, and failure. There is nothing magic about it. It works, in part, by reconfiguring the brains of addicted persons. But if my thesis is correct, we must conclude that the best practices of recovery from addiction invite addicted persons to live as though there is some Higher Power whose unconditional love frees the addicted person from the spiral of pride-driven ego quests. TSPs work because the spiritual practices they recommend enable a genuinely novel kind of self-constitution.

Conclusion

In this article, I have tried to clarify why an agent's solidarity with her past self, and especially with her future self, is so crucial to self-control, and I have tried to show how TSPs provide the opportunity for addicts to forge a new sense of self when the typical ego-ideal-driven means for selving have been undercut by addiction. Considering the advances made in the neuroscience of addiction, it is surprising that TSPs are still relevant recovery regimes, let alone arguably still the most successful. I have offered an explanation for why they might be especially successful, one that coheres with neurobiology and is testable through social scientific research methods. It is also an explanation that keeps the relevance of theology and spiritual practice very much front and center, and which advances, I think, a more honest empiricism than what is often found in addiction studies today.

Notes

[1]The social-scientific data on whether AA "works" is controverted, to say the least. The best attempt to interpret the breadth of the data is by Lee Ann Kaskutas, "Alcoholics Anonymous Effectiveness: Faith Meets Science," *Journal of Addictive Diseases* 28, no. 2 (2009): 145–57. Kaskutas thinks that there is incontrovertible evidence that AA attendance is highly correlated with (and therefore predictive of) abstinence and sobriety; however, she claims that the studies that have attempted to isolate causation (as opposed to mere correlation) are not in sufficient agreement to support any scientific claims about whether AA "works" better than any other alternative. Many other scholars think that the evidence is strong that AA is better, even if only marginally so, than other treatment regimens for alcoholism, including John McKellar, Eric Stewart, and Keith Humphreys, "Alcoholics Anonymous Involvement and Positive Alcohol-Related Outcomes: Cause, Consequence, or Just a Correlate? A Prospective 2-Year Study of 2,319 Alcohol-Dependent Men," *Journal of Consulting and Clinical Psychology* 71, no. 2 (2003): 301–8; George Vaillant, "Alcoholics Anonymous: Cult or Cure?," *Australian and New Zealand Journal of Psychology* 39 (2005): 431–36; Gene Heyman, *Addiction: A Disorder of Choice* (London: Harvard University Press, 2009); and Owen Flanagan, "Phenomenal Authority: The Epistemic Authority of Alcoholics Anonymous," in *Addiction and Self-Control: Perspectives from Philosophy, Psychology, and Neuroscience*, ed. Neil Levy (Oxford, UK: Oxford University Press, 2013), 67–93. I set aside here the question of whether other TSPs are as effective as AA because there is not enough empirical data on that question.

[2]See Flanagan, "Phenomenal Authority."

[3]Heyman, *Addiction*, 105–7.

[4]Kent Dunnington, *Addiction and Virtue: Beyond the Models of Disease and Choice* (Downers Grove, IL: InterVarsity Academic, 2011). A similar argument from a different disciplinary matrix is offered by Marc Lewis, *The Biology of Desire: Why Addiction Is Not a Disease* (New York: Public Affairs, 2014).

[5]Heyman, *Addiction*, 105–7.

[6]Natalie Gold, "Team Reasoning, Framing, and Self-Control: An Aristotelian Account," in *Addiction and Self-Control*, ed. Levy, 48–66.

[7]See Gold, "Team Reasoning, Framing, and Self-Control," 61–62, for several studies on this link.
[8]Daniel Bartels and Lance Rips, "Psychological Connectedness and Intertemporal Choice," *Journal of Experimental Psychology: General* 139, no. 1 (2010): 49–69.
[9]There is no one reason why addicted persons suffer fragmentation. Many people resort to addiction to cope with such fragmentation, which is very often due to childhood trauma. However, fragmentation can also be a result of addiction, since denial (a type of fragmentation) is a typical response when one's behavior consistently departs from one's values. In other words, addiction is typically a response to fragmentation *and* a catalyst for further fragmentation.
[10]I have distilled this typology from June Price Tangney and Mark Leary, *Handbook of Self and Identity*, 2nd ed. (New York: Guilford Press, 2012), 6–7.
[11]For development of such scenarios, and a much more detailed philosophical account of the "self," see Kent Dunnington, *Humility, Pride, and Christian Virtue Theory* (Oxford, UK: Oxford University Press, forthcoming).
[12]Several feminist theologians have argued that although pride may be the primordial *male* sin, it is not the main failing of women; therefore, projects that accuse women of pride or call for their humility are likely ideological ruses of male power. For a classic statement of this position, see Daphne Hampson, "On Power and Gender," *Modern Theology* 4, no. 3 (1988): 234–50. For a full response to this line of critique, see Dunnington, *Humility, Pride, and Christian Virtue Theory*, chap. 6, as well as Matt Jenson, *The Gravity of Sin: Augustine, Luther, and Barth on* 'Homo incurvatus in se' (London: T&T Clark, 2007), chap. 3. For my purposes here, no full response is needed. I am neither claiming that pride is a problem for women, nor am I recommending humility. Indeed, I acknowledge that pride is the most typical and powerful mode of self-constitution. I am merely arguing that, since pride is short-circuited by the kinds of shame cycles in which addicted persons find themselves trapped, TSPs are successful because they provide a concrete alternative mode of self-constitution. I am not (in this article) denigrating pride or valorizing humility.
[13]This is, I think, the main insight of disease-models and compulsion-models of addiction: there really *is* something distinctive about the force of addictive desire, and there really is a "loss of control" to the extent that our normal mechanism for self-control—pride—remains too weak to do the job.
[14]Alcoholics Anonymous, *Twelve Steps and Twelve Traditions* (New York: Grapevine, 1953), 70.
[15]Ibid., 55.
[16]This kind of account of humility—called a "low concern" account—is offered by Robert Roberts and Jay Wood, *Intellectual Virtues: An Essay in Regulative Epistemology* (Oxford, UK: Oxford University Press, 2010), 236–56. In *Humility, Pride, and Christian Virtue Theory*, I show how this generic account, although preferable to the alternative ("proper estimation" and "limitations-owning") accounts, has to be further specified to capture what is distinctive about the Christian vision of humility.
[17]Iris Murdoch, *Sovereignty of Good* (London: Routledge, 1971), 51.
[18]Alcoholics Anonymous, *Twelve Steps and Twelve Traditions*, 34–35.
[19]See, for example, Kent Dunnington, *Addiction and Virtue*; Linda Mercadante, *Victims and Sinners: Spiritual Roots of Addiction and Recovery* (Louisville, KY: Westminster John Knox Press, 1996); and the collection of essays in Jerome Miller and Nicholas Plants, eds., *Sobering Wisdom: Philosophical Explorations of Twelve Step Spirituality* (Charlottesville, VA: University of Virginia Press, 2014): Part Two.
[20]Alcoholics Anonymous, *Twelve Steps and Twelve Traditions*, 35.
[21]Ibid., 36.
[22]Ibid.
[23]Lewis, *Biology of Desire*, 206.
[24]For a summary of several measurement problems in the social science of humility, see Don Davis et al., "Relational Humility: Conceptualizing and Measuring Humility as a Personality Judgment," *Journal of Personality Assessment* 93, no. 3 (2011): 225–34.
[25]June Tangney, "Humility: Theoretical Perspectives, Empirical Findings and Directions for Future Research," *Journal of Social and Clinical Psychology* 19, no. 1 (2000): 70–82.
[26]See Kent Dunnington, "Humility: An Augustinian Perspective," *Pro Ecclesia* 25, no. 1 (2016): 18–43.
[27]My colleague Liz Hall and I are developing such a measure.

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E. Janet Warren

Article

"I Do Not Do What I Want": Commonalities in Addiction and Sin

E. Janet Warren

Addiction is a prevalent and complex problem. Likewise, sin is universal but cannot be considered in a simplistic manner. I suggest that psychological conceptions of addiction and theological conceptions of sin can inform one another. Although they are not identical, both addiction and sin are characterized by ambivalence, denial, self-absorption, and self-deceit. Both often develop as a means to avoid emotional/psychological distress but easily spiral out of control. They involve volition, but choices may be constrained by experience. Considering the nuances of sin and addiction can guide a compassionate Christian response.

"I'm addicted to my cell phone." I had been working with this woman in regard to her anxiety, family relationships, and need to be in control. She did not expect me to take her proclamation seriously, but in fact, the phone causes her stress, she has "withdrawal" symptoms if she loses it (panic), feels soothed if it is nearby, and has increased her use of it.

"Christians should not get angry; I must forgive my parents." This patient, horrifically abused as a child, had difficulty expressing her emotions related to this experience. She was involved in multiple church activities, was confident that "God has a plan for my life," and felt anxious if she had to miss church.

"I need you to fill out my disability form," said a man in his mid-thirties, who makes appointments with me between drinking binges and jail terms. He steals to buy alcohol and, when intoxicated, often gets into altercations.

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These vignettes raise multiple questions regarding the definitions and nature of addiction, sin, volition, avoidant behaviors, anxiety, and moral culpability. These topics are large, but an examination of aspects of them, especially the characteristics and roots that are common to both sin and addiction, can prove fruitful. First, I review addiction, arguing that it is a biopsychosocial phenomenon, with components of both "disease" and "choice." It often starts as a way to avoid distress but can run rampant. I next examine psychological discomfort, or angst, suggesting it is inherent to humanity and can lead to sin and addiction. Avoiding angst relates to the complex topic of sin, which, like addiction, includes ambivalence, self-deceit, and choices constrained by experience. Finally, I discuss the interrelationship of angst, avoidance, sin, volition, and addiction, and I suggest antidotes based on this research.

This article is *conceptual*, not clinical. It is not a comprehensive study of either addiction or sin, but it raises issues that contribute to each topic. I suggest that considering some psychological facets of addiction can inform our theological understanding of sin and vice versa and can guide Christian ministry.

Addictions

"I can't help it. My mom and dad were addicted to alcohol—I've inherited the disease." This was said by a patient in an urban clinic in response to my questioning whether he was interested in quitting alcohol.

"Who cares if people die from tainted fentanyl? They choose to use it." I overheard this statement at a social gathering. Aside from callousness, it illustrates a common misunderstanding of addiction as simple choice, as well as the "us-them" perception of addicts as the *only* ones with problems.

Some experts state that addiction, if viewed broadly, is a universal experience.[1] It is certainly widespread. Addiction spans all ages, cultures, and social classes. A library catalogue search yields books not only on drugs and alcohol, but also on gambling, videogaming, coffee, sugar, love, and work. Physician Gabor Maté, who works with severe drug abusers, admits to being addicted to shopping for classical music.[2] Surveys reveal that approximately half of Christian men admit to some form of sexual addiction.[3] Addiction is not an isolated phenomenon; it has psychological, relational, spiritual, and societal influences and consequences.

Because addiction is a multifaceted condition, experts debate whether it a disease or a moral lapse, an illness or a symptom of an illness, a chemical problem or a psychological one, and whether addicts are victims or sinners.[4] Interestingly, the term addiction is relatively new and was associated with substance use only in the last two centuries. The phenomenon has likely been around as long as humans (e.g., there are multiple biblical prohibitions against excess drinking). Historically, substance abuse has been considered a social and/or moral problem as well as a disease (based on the assumption that only sick people make irrational choices). The trend in the last few decades has been to view it primarily as a neurochemical disease,[5] but many experts acknowledge the interplay between biology and psychology and suggest viewing addiction broadly.[6] For example, although the American Society of Addiction Medicine defines it as "a primary, chronic disease of brain reward, motivation, memory and related circuitry," they add that there are characteristic "psychological, social and spiritual manifestations" that result in individuals "pathologically pursuing reward and/or relief by substance use and other behaviors."[7] Maté's simple definition of addiction is helpful:

> Repeated behavior, substance-related or not, in which a person feels compelled to persist, regardless of its negative impact on his life and the lives of others.[8]

At a public level, Alcoholics Anonymous (AA) speaks of "sickness not sin," but it recognizes the importance of cognitive-behavioral-spiritual measures in recovery.[9] Physical, mental, and social intertwine in addiction. Of course, too broad an approach is not always helpful when dealing with a variety of substances that have differing addictive potentials, but recall that I am taking here a conceptual, not a clinical, approach.

Physiological components of substance addiction include *tolerance* (needing increasing amounts to get the same effect) and *withdrawal* (developing unpleasant symptoms that are relieved by taking more of the substance).[10] Thus a vicious cycle develops. Changes in neural circuitry and neurochemistry (e.g., increases in dopamine) occur with most addictions and can exacerbate them through a negative feedback loop.[11]

Psychological components are myriad. The addiction can be all-consuming, involving obsession (alcoholics describe "thinking drinking") and self-preoccupation, continual ambivalence (conflict between desire and aversion), and helplessness. Those with serious addictions are often impulsive and impatient, with a tendency toward negative and concrete thinking. They have low self-esteem; attachment, relationship, and employment problems; and poor social supports and skills. Other mental health conditions commonly coexist,[12] and a history of childhood trauma is present in up to 65 percent of those with drug and alcohol addictions.[13] Post-traumatic stress disorder is related to both childhood trauma and substance abuse.[14] These commonalities suggest that addiction often starts as a way to alleviate emotional pain.

Perhaps because of the cognitive dissonance associated with self-destructive behavior, denial, repression, rationalization, secrecy, and dishonesty are common.[15] Self-deception is complex and may involve conscious lying, subconscious avoidance of shame, glibness, and reticence to discuss the issue. Or plain hostility. Excuses, such as "I have nothing in common with …," "I can stop any time," "No one

else thinks I have a problem," and "It's not harming anyone," are common.

The etiology of addiction is multifactorial and incompletely understood. It is crucial to recognize that our assumptions about cause determine our response. Here is a simplified/exaggerated example. If substance abuse is considered a disease, then the treatment is medical; if it is viewed only as a willful, moral choice, then the response should be punishment or remediation for the "bad behavior."[16] Multiple experts have criticized a strict disease model of addiction. Although there are definite neurobiological and hereditary factors in addiction, correlation does not necessarily mean causation, and neurochemical theories (e.g., dopamine as the prime factor) do not distinguish between addictive substances and rewarding but nonaddictive substances (e.g., chocolate) or activities (e.g., reading cartoons).[17] And genetic science is inexact. Research in epigenetics suggests that early life experience and environmental factors interact and affect gene expression patterns in those with addiction.[18] Advances in understanding neuroplasticity also support the mantra that "biology is not destiny."[19] Furthermore, not all people who use addictive substances (e.g., analgesics) become addicted, tolerance and withdrawal symptoms can develop in nonaddicts, and many addicts experience neither tolerance nor withdrawal.

Addictive behavior, like all other human behavior, is subject to social, developmental, and cognitive influences. The conception of opiate addiction, for example, is historically and culturally determined, and attitudes and beliefs also have hereditary components.[20] Addiction is the only "disease" that can be treated by group support meetings and, unlike other chronic conditions, epidemiological studies show that most addicts recover by their late twenties.[21] There are also inherent paradoxes in addiction discourse: someone can "decide" not to "compulsively" use a drug, and AA members admit they are "powerless," yet gain control over their drinking through the program.[22] These inconsistencies underscore the need for a nuanced approach to addiction.

Since neurobiological explanations for addiction are inadequate, we need to briefly consider human volition, which is similarly complex. As mentioned, it is counterintuitive for people to persist in harmful choices. Psychologist Gene Heyman suggests that if voluntary is defined in ways that do not preclude self-destructive behavior, then addiction is not automatically a disease that people "passively" acquire. For example, self-harmful ritualized compulsions are rewarding in that they can relieve anxiety. Voluntary behavior has a biological basis but is governed by feasibility, consequences, costs, and benefits.

Using behavioral and economic theory, Heyman explains the seeming irrationality of self-destructive choices by considering local (short-term, immediate) versus global (long-term, delayed, broad) alternatives.[23] He notes that, since our environment always offers options for activities, most behavior is choice behavior, and voluntary acts are resistible. Choices, however, are inherently labile and dependent on a frame of reference, and goals can be ambiguous. Most substances of abuse offer immediate benefits and hidden costs, whereas rewards from choices based on a global perspective accrue slowly; this helps explain the irrationality of addiction. Even the worst "drug days" are valued higher than an extended period of abstinence. Generally, people stop using drugs when the cost of continuing is too great. Heyman emphasizes that voluntary behavior does not mean that someone chooses to become an addict. Maté similarly points out that choice, will, and responsibility are not "absolute and unambiguous concepts"; choice occurs within a context, and context is affected by brain functioning.[24]

Psychiatrist Gerald May, who incorporates Christian concepts, defines addiction as "a state of compulsion, obsession, or preoccupation that enslaves a person's will and desire."[25] The term "enslaves" implies more than simple choice. Addiction, desire, and freedom interact. We have attachments or desires, of which we are often unaware, and addiction develops if we act on those impulses. All addictions "impede human freedom and diminish the human spirit."[26] Christian philosopher Kent Dunnington, using the philosophical category of habit, points to human responsibility in noting that addictions are "more like things that we become … rather than being things that we have."[27] In the cycle of addiction, choices limit future choices.

Admittedly, some proponents of both the "disease" and the "antidisease" camps go too far in their criticisms. Furthermore, perspectives will vary with experience and goals: consider a neurobiologist in a lab, a clinician working with hard-core drug addicts, a psychotherapist dealing with trauma survivors, or

a panel of experts deciding policies. Most agree that there are biological, social, and psychological components to addiction. Neither a strict disease nor a strict moral-failure model is adequate. Addictions occur on a spectrum of severity, and perhaps those at the extremes should be considered differently; for example, a "cell-phone addiction" is quite different from a cocaine addiction. Viewing addiction too broadly may decrease its explanatory power and trivialize serious addiction problems. However, the discussion serves to underscore the complexity of the condition, its multifactorial etiology, and the nuance of choice. Furthermore, recognizing characteristic patterns may avoid stigmatization and disabuse us of any "us-them" dichotomy. As May notes, those with severe addictions are only an extreme example of what is common to all human experience.[28]

To review, addiction often starts small but expands into a vicious cycle of pain and pain relief. It is mysterious, pervasive, and takes on a life of its own; as one of my patients remarked, "My food consumes me." Etiological factors include biological predispositions, childhood trauma, and choices based on immediate benefits but constrained by the consequences of those choices. Addiction involves ambivalence (persistence despite negative consequences), denial, self-absorption (an obsessive focus on one's own problems and solutions), and avoidance behavior, all of which have social and functional repercussions.

From a Christian perspective, some of these issues interrelate with the concept of sin. But before discussing this, it is worth considering commonalities that may underlie both addiction and sin. I believe that the concept of angst is helpful in this regard.

Angst

My patient arrived with a picked-at, angry, and anxious face. She loudly threatened to buy benzodiazepines on the street, since I would not prescribe them. (In fact, she had successfully and cooperatively weaned off this addictive drug a few months ago.) Not all distress is this extreme and obvious, but it is part of the human condition.

I use the term angst to describe feelings of discomfort, tension, emptiness, and fear that are usually unfocused and have an existential nature.[29] This term is vague, but I use it deliberately because the feeling is vague, and the term avoids clinical connotations of anxiety disorders. Angst is considered normal and is experienced by everyone at some point in their lives, although in varying degrees. It is part of the larger, complex category of emotions, which have biological and psychological facets, and include elements of interpretation and behavior.[30] Although boundaries can be fuzzy, angst should be distinguished from anxiety caused by some chemical substances, and the healthy fear that fuels the flight or fight response. It is also different from extreme emotions associated with mood disorders (although it may precede them), and the negativity that some people use manipulatively. I focus on existential angst, but applications may extend to general psychological distress.

Angst may have negative associations but, in fact, some degree of discomfort is beneficial. It can increase success and resilience. Research shows that humans function optimally at a midpoint between boredom and anxiety. For example, the 1908 Yerkes-Dodson law shows that selective attention increases with increasing stress, but anxiety, at a certain point, can erode performance.[31]

In Christian spirituality, the idea of discomfort leading to spiritual growth is common, often framed in terms such as "wilderness experience" or "dark night of the soul."[32] Augustine's classic line, "our hearts are restless 'til they rest in you," summarizes the view that only God can resolve angst.[33] Denis Haack suggests that disequilibrium (a term borrowed from learning theorists) is necessary for spiritual growth.[34] Both repentance and conversion are often accompanied by cognitive, emotional, and spiritual discomfort. David, Job, and Habakkuk all experienced angst that aided their trust in God. Kirk Bingaman similarly argues that it is at anxious and uncertain moments of human history that God is most present.[35] Writing on alcoholism, Mercadante suggests that our restlessness is given by God in order to prevent shallow contentment.[36]

It has been suggested that angst, or existential anxiety, was present in the first humans and was a factor in their rebellion. This idea was initially discussed by philosopher Søren Kierkegaard who describes anxiety as a psychological (even ontological) state of simultaneous attraction and repulsion to future possibilities.[37] He presents an example of a man standing at the top of a cliff, simultaneously afraid of falling and strangely tempted to jump—the "dizziness of freedom." This tension relates to choice: choosing

either self-destructive or self-actualizing behaviors, to obey or disobey God. Kierkegaard insists that angst is not a sin but a precondition for sin. Its resolution can be good or bad. Anxiety can stimulate realization of one's true identity and freedoms, but, through attempts to alleviate anxiety, many individuals freely and inexplicably choose badly.

Theologian Reinhold Niebuhr has developed this "existential anxiety thesis."[38] He believes that anxiety develops as a result of the tension between the limitations of our creatureliness and our spiritual ability to transcend and reflect on it. We are free but finite beings and are born into conditions that incite discomfort. Anxiety relates to temptation, is the inevitable result of the paradox of freedom and finitude, and reflects the frailty of human life. Psychologist/theologian J. Harold Ellens agrees that angst, both systemic and situational, is a universal experience.[39] This relates both to our separation from the paradisiacal womb when we are born, and to our alienation from God when we sin, which too is a universal experience in our fallen world. He describes Eden as "anxiety laden."

Although elaboration on these proposals is beyond the scope of this article, I agree that angst is inherent to the human condition. It can be summarized by the cliché: "There is a God. It is not me." This existential anxiety is evident in the first humans who doubted their Creator, in the people of Israel whose wilderness wanderings were characterized by murmuring and suspicion, in many prophets and psalmists, in Mary who birthed the son of God, in Jesus who cried on the cross, and in all his followers who choose to take up that often burdensome cross. Of these, only Mary and Jesus chose obedience in the face of discomfort. To reiterate, it is not sinful to feel distress, but the way we respond to it may be. However, given the previous discussion on the psychological complexities of volition, our choices may not be as free and simple as Kierkegaard, for example, suggests. Sin, discussed below, is constrained by context and experience.

Most people dislike discomfort and therefore choose to avoid it. This can take many forms, including chronic unhappiness, relationship difficulties, withdrawal, bullying, anger, and addiction. Note that alleviating angst is not the only factor in these conditions, and there may be a fine line between "normal" and "abnormal" angst. People experience emotions differently; "severe" for one person may be "mild" for another. Furthermore, avoiding or alleviating extreme emotional pain may be appropriate in some situations. However, recall that I am using the term angst conceptually, not clinically. With this is mind, let us consider common strategies in the avoidance of angst.

Avoidance

As mentioned, some degree of angst can encourage dependence on our Creator, but many people turn away from God. This relates to the theological concept of sin—part of the human condition. Like addiction, sin can include avoidance, ambivalence, helplessness, selfishness, low self-esteem, and self-deception. There is an element of choice, but it is multifaceted.

Many have argued that sin is not a helpful word, even offensive, in a counseling context and/or that it is not applicable to addictions.[40] As mentioned, AA no longer uses "sin" language, but the concepts of repentance, restitution, and forgiveness are implicit in many of their treatment approaches.[41] It could be argued that the language of addiction (the basic human predicament) has replaced the language of sin. However, I believe that an addiction model is inadequate compared with the rich doctrine of sin.[42]

Sin is a ubiquitous phenomenon but not a unidimensional concept; biblical terms are myriad and polysemic, including deceitfulness, lawlessness, crookedness, rebellion, missing the mark, failure, ignorance, and perversion. Theological conceptualizations have typically considered pride as the primary sin, viewing it as a crime, a deliberate violation of God's law, involving willful rebellion or self-exaltation.[43] However, this neglects biblical concepts such as inadequacy, failure, and ignorance. Feminist theologians have noted that pride is more common in men, whereas sloth, self-abnegation, or lack of self-acceptance is the primary sin in women.[44] Contemplative author Henri Nouwen suggests that the biggest temptation common to humanity is not money, sex, or power, but self-rejection, a fear of never being good enough.[45] Recall that addiction and low self-esteem commonly coexist.

It is likely that mistrust and/or rejection of God underlie both pride and sloth.[46] In fact, pride and self-contempt can be seen as two sides of the same coin:

people may be unconsciously proud of being humble, long suffering, or having low self-worth.[47] Sinful responses to angst include moving against, or acting superior to, others (pride, arrogance, narcissism), moving toward others in self-effacement (idleness, dependency), and avoiding others or moving toward objects (self-absorption, isolation, addiction). The ability to sin is neither biological nor sociological, but a consequence of human freedom—we can place our faith in God, ourselves, or some other person or object. Pride always involves a lack of trust in God, which manifests as attempts to gain control of our lives, to relieve the discomfort of uncertainty, to be either more or less than what we are meant to be.[48] As theologian Terry Cooper states, "The temptation, when we experience anxiety, is to deny our creatureliness and dependence on God."[49] This concept of sin accords with the concept of addictions, as these are almost always self-destructive, making us less than God intends. Interestingly, some addictive substances may temporarily, and falsely, elevate self-esteem—a cover-up for feelings of low self-worth.

Along with the multiplicity of terms, Christian writings suggest that sin can take on a life of its own, controlling the one who chose it initially. Paul and Peter denounce people as "slaves to sin," or "whatever masters them" (Rom. 6:16–22; 7:5, 23; 2 Pet. 2:19); sin leads to more sin: the wicked are "snared in the work of their own hands" (Ps. 9:16) and "caught in the toils of their sin" (Prov. 5:22).[50] Sin is not always logical or conscious. Paul admits to the paradox of doing the evil he does not want to do (Rom. 7:19); this state no doubt produced angst. Biblical scholar Mark Biddle similarly objectifies sin, describing it as an "organic continuum" that can "twist and pervert" reality, and noting that "sin's afterlife vibrates throughout the system [of reality]."[51] Theologian Serene Jones believes that sin is both something we do and something that happens to us, something we consciously enact and also a part of a social reality that we do not desire.[52] C. S. Lewis claims that people become the choices they make; with each decision they either turn away or toward God and eventually their choices, in a sense, choose them.[53] This is the ironic cycle of sin and addiction: we lose control through thwarted attempts to gain control; our angst increases the more we try to avoid it.

In contemporary theology, sin and our responsibility for it are conceptualized in nuanced manners. Most agree that we have a sinful nature or, in mathematical terms, a 100% pretest probability of sinning. However, scholars question the classic Augustinian notions of the enormity of the "Fall," the impossibility of knowing goodness, inherited sin, and the universal transmission of Adam's guilt.[54] Rather than viewing humanity as totally depraved, we can acknowledge our preference for quick fixes, easy answers, comfort over discomfort, and action over inaction. As with addiction, there is a fine line between "disease" and "choice," between passive reception and active responsibility. Like addiction, "biology is not destiny," but sin can be preconditioned by life experiences and context, and can grow to the point at which our ability to choose is limited.

To further elucidate the complexities of sin and choice, we can consider the concept of self-deception. This is an important aspect of both sin and addiction, and includes denial and minimization. The first humans, when confronted with their disobedience, almost instinctively made excuses, even implicating God ("The woman you put here with me …," Gen. 3:12). Recall that addicts frequently delude themselves, "I can stop anytime." As Christian psychologist David Myers states, "One of the brute facts of human nature is our capacity for illusion and self-deception."[55]

Self-deception has been studied from philosophical, anthropological, psychological, and theological perspectives. It likely predated language development, and occurs at all levels of society.[56] It involves an illusion of control and an element of rationalization. Its most common form is overconfidence. Self-serving biases are well known in psychological research; for example, people routinely rate themselves as above average on multiple measures.[57] However, biases and self-justification are largely unconscious and not necessarily deliberate; they are attempts to reduce cognitive dissonance, deceive others to protect ourselves, and reduce anxiety related to unsatisfied desires. From a Christian perspective, self-deception, because it involves mistrust of God, can be considered sin. It invites pride and can run rampant.[58] Dunnington suggests that self-deception is a sign of moral earnestness, a cover-up for the discrepancy between what is desired and what is achieved.[59] Overall, self-deception, with its costly misapprehension of reality, results in suboptimal societal functioning.

The concept of self-deception supports the notion of sin as complex and not always willful. We sin because we are sinned against, because we fear unconscious pain, or because our sin has entrapped us. Moral responsibility is difficult to judge. Sin intertwines with angst and avoidance. We next examine its relationship with addiction.

Angst, Avoidance, Sin, Choice, and Addiction

To summarize, angst is inherent to the human condition, and attempts to avoid it, often involving self-deception, are common. Addiction can be viewed as a way to avoid emotional pain. However, although it may start this way, it easily spirals out of control and restricts subsequent choices. Addiction, because it attaches to an object instead of God, can be considered a sin. Recall that both sin and addiction can be characterized by ambivalence, avoidance, self-deception, dishonesty, helplessness, and self-preoccupation. Both exist in gradations of severity. Both are counterfeit means to ease psychological distress. Both are influenced by the sin of others. Both can become larger-than-life and feed back negatively on prior behavior. Indeed, the language of sin is similar to the language of addiction: both are sinister, systemic, and sometimes objectified. The Latin *addicere,* from which the English word addiction derives, can mean "bound to" or "enslaved by."[60] The concept of enslavement applies to both sin and addiction. Cumulative effects of sinful choices eventually entrap and limit future choices. To reiterate, addiction and sin are not identical but have many common aspects that bear further discussion.

Theologian Linda A. Mercadante points out similarities between sin and addiction: both are progressive, luring, and easily habituated. She advocates avoiding "the pitfalls of both the typical moralistic understanding of sin and an unnuanced disease model of addiction,"[61] by considering the subtleties of freedom, will, responsibility, and bondage. Mercadante notes that sins vary and do not entail equal responsibility or guilt. In this, she follows the language suggested by Andrew Sung Park of *han*: suffering from being sinned against.[62] Victimization is not necessarily sin, but "inordinate self-loss." She notes that Christianity differs from addiction models like AA ("once an addict, always an addict") because it affirms the inherent goodness of humanity as made in the image of God. Although we have all sinned and tainted the divine image, we have redemption through Christ and the possibility of recovering the *imago Dei*.[63] I agree and would add that, given the relationships between childhood trauma, low self-esteem, and addiction, most addicts can benefit from receiving reinforcement of their status as children of God, and from the love, acceptance, and affirmation offered by Christian faith.

Addictions, especially chemical ones, have multiple paradoxes that illustrate the nuances of moral culpability. Addicts often deny their problem, but addiction also develops as a way to deny other problems. Withdrawal from addictive substances can lead to anxiety, but many substances provide a means to relieve anxiety. Self-medication quickly turns toxic. The prevalence of childhood trauma in those with addictions suggests an element of victimization (being sinned against) in addiction. Christian Gostecnik and colleagues point out that those who have suffered severe abuse tend to repeat their trauma, following known patterns of behavior and thought, despite their desire for resolution and salvation. They long for genuine emotional and spiritual intimacy but, because of their psychic injuries, are afraid of loving relationships and lack the ability to form them. Addictions develop when people seek resolution from this inner conflict through objects. "Addictions of all kinds are so-called substitutes for unrealized relationships."[64]

Maté similarly views addictions as a "flight from distress" and believes that they develop "when we constantly seek something outside ourselves to curb an insatiable yearning for relief or fulfillment."[65] He notes that people are often more afraid of living than dying, and they use drugs to provide emotional anesthetic and an antidote to emptiness, boredom, and alienation. Addictions always originate in pain; therefore we should not ask about the specific addiction but about the pain underlying it. His observations connect the concepts of angst, addiction, and avoidance.

From a Christian perspective, Dunnington suggests that addictions are a product of modernity with its arbitrariness, boredom, and loneliness. (I suggest that they are perhaps magnified because of the excess of options in contemporary society.) Paradoxically, rather than causing loss of control, addictions give people a sense of being in control, offering focus to

a chaotic life. They provide a solution to restlessness, and commonly take on more respectable forms, such as shopping, hobbies, or entertainment.[66] Meditation, central to AA, is challenging because it threatens to reveal insufficiencies. We all yearn for the "ecstatic intoxication" that comes from union with God.[67] Addictions are then merely empty, inadequate substitutes that we use to alleviate this anxiety and that lead to false worship. They are a potent form of idolatry.

Gerald May also relates addictions to our longing for fulfillment, our hunger for love; he specifically believes that we have an "inborn desire for God."[68] We seek any means possible to satiate our hunger—unsatisfactorily. Our desires bond to things and behaviors, and we become obsessed with these objects of attachment, idolizing them. Yet, ultimately, "it is in the very nature of addiction to feed on our attempts to master it."[69] May also discusses addiction in relation to original sin. Freedom, willfulness, desire, temptation, and attachment interrelate in Eden: the serpent tempts the first humans by instilling doubt and then a desire to become godlike, thus turning temptation into attachment, and the humans then become attached to their desires outside of God's will. May believes Adam and Eve are genuinely confused and gullible because of the enslaving nature of attachment: responsible, but not necessarily willfully rebellious.[70] In general, addiction uses up desire and thus counteracts our freedom to love God. Although May is admittedly not a theologian, he echoes Kierkegaard and Niebuhr in viewing angst as a precondition for sin. Elsewhere he quotes a friend:

> When I feel very, very good I start to marvel at the wonder of being alive. And then I become frightened … the more I feel the beauty of being here on this earth the more I realize how fragile life is … when I've got problems or distractions or something to struggle with I feel much better, because then at least I know who I am and what I need to do.[71]

This illustrates the existential tension common to humanity, and accords with Dunnington's suggestion that addictions offer a centering focus in life.

Sin and addiction are not black-and-white concepts. They include elements of vulnerability *and* responsibility, compulsion *and* volition, disease *and* choice. Although addiction and sin have similar characteristics and roots (avoidance/alleviation of angst through any manner other than trust in the triune God), they have important differences. Primarily, from a Christian perspective, "all have sinned and fall short of the glory of God" (Rom. 3:23), whereas not everyone has an addiction. There is also no guarantee that faithful obedience will eliminate addictions. Addiction, because it mostly involves observable behavior, is also more amenable to scientific study than is sin. Furthermore, there are occasions when sin is simple choice or willful rebellion rather than avoidance of angst, and occasions when addiction is best understood through a medical model. As mentioned, the term angst may not always be helpful. This study has provided only very brief treatments of complex psychological and philosophical topics that relate to addiction. Nevertheless, understanding some aspects of addiction may illuminate some aspects of sin. And understanding sin, and its concomitant grace, may help heal addictions.

Antidotes to Addiction and Sin

A nuanced conceptualization of sin and addiction can be applied to the introductory examples (p. 263, although space precludes a full discussion of psychotherapeutic approaches). The first case can be informed by a model of addiction that includes avoidance of angst as a causative factor. The second case may require gently challenging concrete thinking and emphasizing divine love. In both of these, some elements of sin and addiction can be seen, but the labels are unlikely to be helpful. In the third case, sin and addiction are obvious, as is the need for compassion. None is simple.

This discussion encourages a compassionate understanding of addiction and sin. By virtue of being free and human—but capable of awareness of the divine—we all experience some degree of angst. We dislike this tension and continually try to resist, escape from, or find substitutes for it. And, in our desire to avoid discomfort, we mistrust God. In short, we are all prone to sin and addiction. They are a tangled mess of predisposition and willful choice. We do not need to solve the paradoxes, but being aware of them will aid our ministry. By looking underneath behavior, asking about pain, we can access its roots. In my psychotherapy practice, I have observed that people's symptoms and behavior invariably amount to efforts to escape and/or protect

themselves from emotional pain. The mind is very creative—patients describe elaborate metaphorical fortresses or concrete-reinforced pits in which they buried their emotions. Christians often quote the Bible (with a literal/legalistic interpretation) to justify their protections: "don't get angry"; "honor your parents." Not all "sin" involves willfulness; in fact, childhood trauma can predispose one to harmful choices. Pastoral counselors can expose avoidance strategies, uncover emotional pain, and direct sufferers to the Great Physician.

In addition, we can foster awareness of short-term versus long-term perspectives and the consequences of repeated bad choices. We can seek to understand seemingly irrational decisions. We can recognize the varying degrees of culpability, the influence of the sins of others, and the naturalness of avoiding angst. We can distinguish between unconscious choice and willful rebellion. In doing so, we may not only alleviate addiction but help prevent it. A broad perspective disabuses us of any "us-them" mentality. It helps explain why people may condemn "addicts"—they force us to face our own inadequacies. Recognizing that those with obvious addictions are an extreme example of tendencies common to all can be humbling. Considering addiction as a means to avoid emotional pain can shed light on our own sinful behaviors. Interestingly, people with substance addictions often admit their powerlessness more readily than Christians admit their sinfulness. We may not all be addicts but we all need a Savior.

The above study also highlights the universality and necessity of angst. Rather than avoiding it, perhaps we should embrace it at times. Maybe we need to accept ambiguity, dwell with discomfort, and marvel at mystery. Haack encourages churches to restore disequilibrium, by allowing scripture to unbalance convictions, and by cultivating ambiguity. They should teach that discomfort is normal, and offer a safe space for experiencing it.[72] May suggests that the best way to respond to God's call is to "be present to the mystery in a gentle, open-handed, and cooperative way."[73] In an earlier volume to his work on addiction, he presents two options whenever we engage life: (1) willingness, or surrender, and (2) willfulness. The first embraces the mystery of life; the second seeks to manipulate or escape it: "Willfulness must give way to willingness and surrender. Mastery must yield to mystery."[74]

This echoes Christ's command to "take up [your] cross daily and follow me" (Luke 9:23). God gifts us with angst so that our need to depend on him alone is continual. He gifts us with freedom to accept or reject his love. But freedom can be scary; a relationship with the living, transcendent and mysterious God can be uncertain and challenging.

We can be assured of and surrender to God's love and mercy. Christ invites those who are weary and heavy laden to "come to me … and I will give you rest" (Matt. 11:28), and Paul teaches, "where sin increased, grace abounded all the more" (Rom. 5:20). May defines grace as "the dynamic outpouring of God's loving nature that flows into and through creation in an endless self-offering of healing, love, illumination, and reconciliation."[75] This grace is the only thing more powerful than addiction, although addiction impedes our ability to receive grace. To overcome addiction, human and divine wills need to be aligned. God calls us to live lives prayerfully, aiming for honesty, dignity, community, responsibility, and simplicity.[76] In ministering to people, I suggest that we emphasize love over judgment (James 2:13). God's mercy is so wide and his Spirit so ubiquitous that nonbelievers also may experience the grace common to all.

A final antidote to addiction and sin is a loving Christian community. As noted, addiction is an isolating phenomenon.[77] Like sin, it separates us from God and one another. Spiritual surrender allows reconnection. This explains the success of AA, which has friendships at its core; the groups fulfill the human need to belong. Dunnington points out that whereas AA emphasizes self-identification as recovering addicts, the church seldom characterizes itself as a community of repentant sinners. Indeed, the addict is an unwitting prophet:

> The prevalence and power of addiction indicates the extent to which a society fails to provide nonaddictive modes of acquiring certain kinds of goods necessary to human welfare.[78]

The Christian community should encourage vulnerability, hospitality, and accountability; provide convincing alternatives to addictive substances and activities; and embody the all-consuming love of God to heal, liberate, and transform.

Antidotes are usually simpler in principle than in practice. Sin is always "lurking at the door"

(Gen. 4:7), escape is always easier, change is always challenging. As Nouwen writes,

> Compassion … requires the inner disposition to go with others to a place where they are weak, vulnerable, lonely, and broken. But this is not our spontaneous response to suffering. What we desire most is to do away with suffering by fleeing from it or finding a quick cure for it.[79]

Conclusion

Like Paul, we often do the things we do not wish to do and do not do the things we wish. This ambivalence may be a consequence of existential angst and may lead to addictive behaviors. We have noted many similarities between sin and addiction: both are affected by context and experience, involve self-deception, easily spiral out of control, and diminish human flourishing. Furthermore, studies of addiction and sin can be mutually informative. The psychological literature on addiction can inform our theological conceptualization of sin, as follows. First, the diversity of addiction and range of severity can help us to view sin in a broader manner—more than simple "bad behavior," and differing with respect to moral culpability. Second, knowing that most addictions are rooted in childhood trauma and are an attempt to escape emotional pain can improve our understanding of possible underlying factors in sin, guide our ministry, and increase our compassion toward sinners. Sin, like addiction, arises not necessarily from a stance of defiance but from one of perceived helplessness. Third, understanding the negative feedback cycle that is common in addiction and that limits choice can help us recognize a similar pattern with respect to sin, and again guide our ministry. Fourth, knowing the larger relational and societal effects on and effects of addiction can open our eyes to the similar tangled web that is common with sin. It is usually insufficient and ineffective to simply point out sin without considering its roots and shoots, and its broader context.

Christian views of sin can enhance our understanding and treatment of addiction, as follows. First, the concept of universal existential anxiety may help elucidate some of the origins of addictive behavior and guide therapy. Second, some basic conceptions of sin as disobedience, dishonesty, and self-deception suggest that there is moral responsibility in addiction. This elevates the notion of choice and increases agency to the addict, which may, in turn, enhance recovery. Third, the Christian concept that, although created in God's image, we have all fallen short of God's glory, helps us to empathize with addicts. Finally, commitment to Christ can offer deliverance, redemption, healing, and salvation to those who are enslaved by addiction.

As I write, acutely conscious of humanity's vulnerability to addiction, I observe myself being distracted—computer games, e-mails, snacks—I observe my embarrassment and hear my thoughts: "it's not that bad," "I can control it." If we are honest with ourselves, we are all dishonest. We deny our creatureliness, deny our sin, and deny God. In fact, we often seek means to alleviate pain and tension apart from God—actions which may lead to addiction. Like the addict, we feel ambivalent, ashamed, annoyed. Like the addict, we experience loss of control, relapse: such is the cycle of the Christian journey. Our hope and trust can only be in the Savior, who invites us to relinquish our counterfeit comforts and chains, and instead find truth, beauty, and hope at the foot of the cross.

Notes

[1]D. Rastegar and M. Fingerhood, *Addiction Medicine: An Evidence-Based Handbook* (Philadelphia, PA: Lippincott Williams & Wilkins, 2005), 1; and Gerald G. May, *Addiction and Grace: Love and Spirituality in the Healing of Addictions* (New York: HarperCollins, 1988), 2.

[2]Gabor Maté, *In the Realm of Hungry Ghosts: Close Encounters with Addiction* (Toronto, ON: Vintage Canada, 2008).

[3]See, for example, https://www.josh.org/key-findings-in-landmark-pornography-study-released/.

[4]A book title: Linda Mercadante, *Victims and Sinners: Spiritual Roots of Addiction and Recovery* (Louisville, KY: Westminster John Knox, 1996).

[5]The American Psychiatric Association (APA) focuses on substance use disorders. APA, *Diagnostic and Statistical Manual of Mental Disorders: DSM-V* (Washington, DC: APA, 2013).

[6]Y. H. C. Yau, S. W. Yip, and M. N. Potenza, "Understanding 'Behavioral' Addictions: Insights from Research," in *The ASAM Principles of Addiction Medicine*, 5th edition, ed. R. K. Ries et al. (Philadelphia, PA: Lippincott Williams & Wilkins, 2014), 55–81.

[7]There is "impairment in behavioral control, craving, diminished recognition of significant problems with one's behaviors and interpersonal relationships, and a dysfunctional emotional response," https://www.asam.org/resources/definition-of-addiction.

[8]Maté, *In the Realm of Hungry Ghosts*, 128.

[9]Discussed in K. Dunnington, *Addiction and Virtue: Beyond the Models of Disease and Choice* (Downers Grove, IL: InterVarsity Press, 2011), 125–30.

[10]APA, *DSM-V*; summarized in Rastegar and Fingerhood, *Addiction Medicine.*

[11]These changes can be permanent, especially with certain substances. Rastegar and Fingerhood, *Addiction Medicine*, 7–15; N. D. Volkow and K. R. Warren, "Drug Addiction: The Neurobiology of Behavior Gone Awry," in Ries, *ASAM Principles*, 3–18; Maté, *In the Realm of Hungry Ghosts*, 140–75. May discusses the neurological cycles of feedback, habituation, and adaptation. The brain changes its equilibrium to the desired action or substance. With substance withdrawal, the old equilibrium returns but stress increases because of the "new sense of normality"; May, *Addiction and Grace*, 73–77. Also, see Judith A. Toronchuk, "Addiction: Diseased Brain, Divided Will, or Restless Heart?," *Perspectives on Science and Christian Faith* 70, no. 4 (2018): 218–31 for further discussion on the neurobiology of addiction.

[12]Thirty percent of those with substance addictions have anxiety and depression; Rastegar and Fingerhood, *Addiction Medicine;* A. J. Herron, P. J. Rinaldi, and P. Levounis, "Conceptual and Treatment Issues in 'Behavioral Addictions,'" in Ries, *ASAM Principles,* 1024–30; see also Yau, Yip, and Potenza, "Understanding 'Behavioral' Addictions"; G. M. Heyman, *Addiction: A Disorder of Choice* (Cambridge, MA: Harvard University Press, 2010), 142–73; and May, *Addiction and Grace*, 21–63.

[13]S. R. Dube et al., "Adverse Childhood Experiences and Personal Alcohol Abuse as an Adult," *Addiction Behavior* 27, no. 5 (2002): 713–25; R. Hammersley et al., "Trauma in the Childhood Stories of People Who Have Injected Drugs," *Addiction Research & Theory* 24, no. 2 (2016): 135–51; K. Asberg and K. Renk, "Substance Use Coping as a Mediator of the Relationship between Trauma Symptoms and Substance Use," *Substance Use and Misuse* 47 (2012): 799–808; C. Gostecnik et al., "Hidden Mission of the Psyche in Abuse and Addiction," *Journal of Religion and Health* 49 (2010): 361–76, doi.10.1007/s10943-009-9264-8; and Maté, *In the Realm of Hungry Ghosts*, 188–200.

[14]L. Khoury et al., "Substance Use, Childhood Traumatic Experience, and Posttraumatic Stress Disorder in an Urban Civilian Population," *Depression and Anxiety* 27, no. 12 (2010): 1077–86, doi.10.1002/da.20751; and K. T. Brady and S. E. Back, "Childhood Trauma, Posttraumatic Stress Disorder, and Alcohol Dependence," *Alcohol Research: Current Reviews* 34 (2012): 408–13.

[15]Robert Trivers states that deception is a requirement for drug abuse in *The Folly of Fools: The Logic of Deceit and Self-Deception in Human Life* (New York: Basic Books, 2013), 173–5; Rastegar and Fingerhood, *Addiction Medicine,* 20–25.

[16]E.g., Heyman, *Addiction*, vi–20.

[17]Heyman, *Addiction*, 142–43.

[18]D. C. Ajonijebu et al., "Epigenetics: A Link between Addiction and Social Environment," *Cellular and Molecular Life Science* 74, no. 15 (2017): 2735–47, doi.10.1007/s00018-017-2493-1.

[19]M. S. Stanford, *The Biology of Sin: Grace, Hope and Healing for Those Who Feel Trapped* (Downers Grove, IL: InterVarsity Press, 2010); and Heyman, *Addiction*, 90–100.

[20]Stanton Peele, *The Meaning of Addiction: Compulsive Experience and Its Interpretation* (Lexington, MA: D.C. Heath and Company, 1985), 2–26, http://www.peele.net/; Dunnington, *Addiction and Virtue*; Maté, *In the Realm of Hungry Ghosts*, 201–8; and Heyman, *Addiction*, 89–110.

[21]Heyman, *Addiction*, 65–88.

[22]Ibid., 112; and Dunnington, *Addiction and Virtue,* 32–35.

[23]Heyman, *Addiction*, 115–41.

[24]Maté, *In the Realm of Hungry Ghosts*, 174, 198.

[25]May, *Addiction and Grace*, 13.

[26]Ibid., 39.

[27]Dunnington, *Addiction and Virtue,* 72.

[28]May, *Addiction and Grace*, 43.

[29]http://www.dictionary.com/browse/angst.

[30]E.g., R. C. Roberts, *Spiritual Emotions: A Psychology of Christian Virtue* (Grand Rapids, MI: Eerdmans, 2007); and E. T. Rolls, *Emotion and Decision-Making Explained* (Oxford, UK: Oxford University Press, 2014). Negative emotions can be transformed for positive gains: E. E. Whitehead and J. D. Whitehead, *Transforming Our Painful Emotions: Spiritual Resources in Anger, Shame, Grief, Fear, and Loneliness* (Maryknoll, NY: Orbis, 2010).

[31]R. M. Yerkes and J. D. Dodson, "The Relation of Strength of Stimulus to Rapidity of Habit-Formation," *Journal of Comparative Neurology and Psychology* 18 (1908): 459–82, doi.10.1002/cne.920180503; D. Goleman, *Social Intelligence* (New York: Bantam, 2006); and A. Lang, *The Beauty of Discomfort: How What We Avoid Is What We Need* (Toronto, ON: Collins, 2017).

[32]E.g., D. Turner, *The Darkness of God: Negativity in Christian Mysticism* (Cambridge, UK: Cambridge University Press, 1995).

[33]Augustine, *Confessions*, I.1, public domain.

[34]D. D. Haack, "When Spiritual Growth Involves Discomfort: Disequilibrium in Biblical Perspective," *Presbyterion* 41, no. 1–2 (2015): 31–49.

[35]He follows Hans Urs von Balthasar. K. A. Bingaman, "A Pastoral Theological Approach to the New Anxiety," *Pastoral Psychology* 59 (2010): 659–70, doi.10.1007/s11089-009-0269-8.

[36]Mercadante, *Victims and Sinners,* 20–24.

[37]Søren Kierkegaard, *The Concept of Anxiety: A Simple Psychologically Oriented Deliberation in View of the Dogmatic Problem of Hereditary Sin,* trans. Alastair Hannay (New York: Liveright Publishing, 2014); ____, *The Sickness unto Death,* trans. Walter Lowrie (Princeton, NJ: Princeton University Press, 1954), 195–208; see discussions in G. R. Beabout, "Does Anxiety Explain Hereditary Sin?," *Faith and Philosophy* 11, no. 1 (1994): 117–26; and T. D. Cooper, *Sin, Pride and Self-Acceptance: The Problem of Identity in Psychology and Theology* (Downers Grove, IL: InterVarsity Press, 2003), 40–45.

[38]Reinhold Niebuhr, *The Nature and Destiny of Man*, vol. 1 (New York: Charles Scribner's, 1964), 178–240; see also P. Tillich, *The Courage to Be,* 2nd ed. (New Haven, CT: Yale University Press, 2000); Cooper, *Sin, Pride and Self-Acceptance,* 158–62; J. W. White, "The Personality of Sin: Anxiety, Pride, and Self-Contempt," *Mid-America Journal of Theology 27* (2016): 85–97.

[39]J. H. Ellens, "A Psychospiritual View of Sin," in *Counseling and the Human Predicament: A Study of Sin, Guilt and Forgiveness,* ed. L. Aden and D. G. Benner (Grand Rapids, MI: Baker, 1989), 36–48.

[40]For example, Philip G. Monroe notes that the term can be offensive, as found in "Exploring Clients' Personal Sin in the Therapeutic Context: Theological Perspectives on a Case Study of Self-Deceit," in *Care for the Soul,* ed. Mark McMinn and Timothy Phillips (Downers Grove, IL: InterVarsity Press, 2001), 202–17.

[41]For example, Steps 4, 6, and 9 relate to taking a "moral inventory," Step 5 involves admitting wrongs, and Steps 7 and 8 involve making amends; see W. McDonough, "Sin and Addiction: Alcoholics Anonymous and the Soul of

Christian Sin-Talk," *Journal of the Society of Christian Ethics* 32, no. 1 (2012): 39–55.

[42]As Mercadante states, sin "perceived as moralistic, judgmental and counterproductive" has led to medical reasoning as a favored response to addictions, in *Victims and Sinners*, 5. Dunnington agrees that sin and addiction can neither be conflated nor entirely separated: *Addiction and Virtue,* 125–40.

[43]Mark E. Biddle notes that, since Augustine, the juridical/forensic metaphor has been prioritized, especially in western evangelical theology. Mark E. Biddle, *Missing the Mark: Sin and Its Consequences in Biblical Theology* (Nashville, TN: Abingdon, 2005), viii.

[44]V. S. Goldstein, "The Human Situation: A Feminine View," *Journal of Religion* 40 (1960): 100–12; and J. Plaskow, *Sex, Sin and Grace: Women's Experience and the Theologies of Reinhold Niebuhr and Paul Tillich* (Lanham, MD: University Press of America, 1980).

[45]Henri Nouwen, *Discernment: Reading the Signs of Daily Life* (New York: HarperCollins, 2013), 30–37.

[46]Biddle, *Missing the Mark,* 32–76, 136; David Smith similarly concludes that sin transcends selfishness and idolatry, and has at its root the rejection of God as God, and of Christ as his son, in *With Willful Intent: A Theology of Sin* (Wheaton, IL: BridgePoint, 1994), 301–26.

[47]Cooper, *Sin, Pride and Self-Acceptance;* he compares "anxious greed" (common in power-hungry men) with "greedy anxiety" (common in insecure women) as reflections of different types of sin.

[48]J. Wesley White, drawing on Kierkegaard, Niebuhr, and Cooper, similarly notes the interrelationship between anxiety, pride, and self-hatred, suggesting the last two are a "pride system." We experience uncertainty regarding direction. This anxiety is an occasion for sin because it tempts us to inflate our significance. Pride produces further anxiety because it is a false foundation. It also functions as a mask for self-contempt. White, "The Personality of Sin."

[49]Cooper, *Sin, Pride and Self-Acceptance*, 36.

[50]Mark Pestana details the diminished freedom that characterizes sin, in "Part One: How Pride Causes Slavery to Sin," *Journal of Spiritual Formation and Soul Care* 8, no. 1 (2015): 53–74.

[51]For example, Isaiah 59:8–10 describes sinners as unable to walk straight. Biddle, *Missing the Mark,* 118–19, 130; and Smith similarly calls sin a "vicious and destructive power," in *With Willful Intent,* 313.

[52]S. Jones, *Trauma and Grace* (Louisville, KY: Westminster John Knox Press, 2009), 103.

[53]C. S. Lewis, *Mere Christianity* (San Francisco, CA: Harper, 1952), 86; and ____, *The Great Divorce* (New York: HarperCollins, 1946), 75, 123.

[54]The classic historical-causal view of original sin was developed by Augustine (*Confessions*, *City of God*, Book 14) and perpetuated by Calvin and his followers; e.g., M. J. Erickson, *Christian Theology*, 2nd ed. (Grand Rapids, MI: Baker, 1998), 652. It has been criticized primarily on biblical grounds: the concept is not found in the Old Testament, being uniquely Pauline; biblical conceptions of time are not necessarily chronological; the concept of the "Fall" has been extended beyond its original intent; it is difficult to believe that God ordained all death because of the disobedience of two people. E.g., Biddle, *Missing the Mark*, 3–8; and T. E. Fretheim, *God and World in the Old Testament* (Nashville, TN: Abingdon, 2005), 70–77.

[55]D. G. Myers, *The Inflated Self: Human Illusions and the Biblical Call to Hope* (New York: Seabury Press, 1980), xiv.

[56]A. Barnes, *Seeing through Self-deception* (Cambridge, UK: Cambridge University Press, 1997), 34–50; Trivers, *Folly of Fools*; and Rolls, *Emotion and Decision-Making Explained*.

[57]E.g., D. G. Myers, *Intuition: Its Powers and Perils* (New Haven, CT: Yale University Press, 2002); and S. K. Moroney, "Thinking of Ourselves More Highly Than We Ought," in *Care for the Soul,* ed. McMinn and Phillips, 308–30.

[58]E.g., Monroe, "Exploring Clients' Personal Sin"; and May, *Addiction and Grace,* 43–52.

[59]Dunnington, *Addiction and Virtue,* 170–80.

[60]Yau, Yip, and Potenza, "Understanding 'Behavioral' Addictions."

[61]Mercadante, *Victims and Sinners*, 5.

[62]A Korean word meaning "a physical, mental and spiritual response to a terrible wrong done to a person"; Andrew S. Park, *From Hurt to Healing: A Theology of the Wounded* (Nashville, TN: Abingdon, 2004), 11; and Mercadante, *Victims and Sinners,* 27–48.

[63]Ibid., 160–69.

[64]Gostecnik et al., "Hidden Mission."

[65]Maté, *In the Realm of Hungry Ghosts*, 2, 25–45.

[66]Dunnington, *Addiction and Virtue,* 110–20, 148–52, 176, 192.

[67]Ibid., 158, quoting Augustine.

[68]May, *Addiction and Grace*, 1.

[69]Ibid., 4. Common ways we deceive ourselves include denial, repression, rationalization, cynicism, hiding, and delaying, see pages 42–54.

[70]Ibid., 109–14. The desert temptation is similar: attachments that lead to addiction (power, doubt, idolatry) are presented by Satan to Jesus, 138–39. Given the nature of sin and addiction as almost independent realities, the biblical teaching on evil spirits and their influence on sin and consequently on addiction is relevant. Interestingly, the language used to describe demons is similar to the language used to describe sin. E.g., E. J. Warren, *Cleansing the Cosmos: A Biblical Model for Conceptualizing and Counteracting Evil* (Eugene, OR: Wipf and Stock, 2012). The term "demon rum" is apropos.

[71]Gerald G. May, *Will and Spirit: A Contemplative Psychology* (San Francisco, CA: HarperCollins, 1982), 31.

[72]Haack, "When Spiritual Growth Involves Discomfort."

[73]May, *Addiction and Grace*, 107.

[74]May, *Will and Spirit*, 8, 28–32.

[75]May, *Addiction and Grace*, 17.

[76]Ibid., 18, 141, 164–79; see also Mercadante, *Victims and Sinners*, 170–85.

[77]May, *Will and Spirit*, 3.

[78]Dunnington, *Addiction and Virtue*, 10, 184–94.

[79]Henri Nouwen, *The Way of the Heart* (New York: Seabury Press, 1981), 20.

Daniel J. Mallinson

Article

Tackling Addiction: A Case for Drug Policy Reform Based on Science and Christian Ethics

Daniel J. Mallinson

Debates over the efficacy and morality of drug prohibition in the United States are presently driven by changes in politics, economics, and science. Groups mobilize against mass incarceration and for marijuana. States face tight budgets and pressure for funding expanded prison systems. An important question for this issue on addiction science is how to translate the science, as well as Christian ethics, into evidence-based drug policy that can have an impact in this political environment. The science presented in this theme issue highlights the physiological complexity of addiction. This article presents a four-dimensional view of addiction: moral, biological, social, and spiritual. The intent is to offer policy options for both government and the church that build upon a Christian ethical view and addiction science. Churches are already on the front lines of fighting addiction. When examining the intertwining of faith and science, we must be cognizant of the way in which the two can inform public policy.

According to the Centers for Disease Control and Prevention, approximately 91 Americans die per day from opioids.[1] The four-fold increase in opioid deaths from 1999 to 2015 resulted in over one-half million deaths in total. At the same time, commentators increasingly admit that the War on Drugs is largely failing in its overarching goal of reducing drug abuse.[2]

Churches find themselves at the front lines of offering addiction treatment through variations on Alcoholics Anonymous.[3] Prominent pastors and Christian publications, such as *Christianity Today*, increasingly promote a reframing of addiction as a disease that has a moral dimension, as opposed to simply a moral failing. In fact, a 2016 article by Matthew Loftus presented four dimensions of addiction: moral, biological, social, and spiritual.[4] Within this model, redemption through the Gospel and community through the church represent important elements of addressing drug addiction, alongside the biological and psychological realities of addiction.

In this article, I argue for moving toward the four-dimensional model through drug policy reform and a mindset among Christians regarding addiction that moves beyond a focus on the moral dimension. I begin by briefly discussing what the Bible says about the spiritual dimension of wanting, and contrasting the existentialist and evangelical/Pentecostal views and approaches to addressing addiction. These two views have influenced Christian approaches to addiction intervention over the last two hundred years.[5] I will then address the scientific ideas of wanting that emerge from Judith Toronchuk's article.[6] Next, I will address how the dominant framing of drug addicts as deviants during the war on drugs era, does not lend itself to addressing Loftus's four dimensions of addiction. This is followed by a discussion of what an evidence-based

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approach to treating drug addiction might look like. Such an approach will necessarily involve both public and private efforts to reach those struggling with addiction. Moreover, this approach will require a rethinking of the past thirty years of drug policy in the United States. In fact, this rethinking is already occurring in state and local governments.

The Fall, Our Wanting, and Addiction

As humans, we were created with a deep longing, or wanting. First and foremost, God created us with a wanting for him; a deep longing for vertical relationship. But that was not all. We were also created with a desire for horizontal relationship. We see it in the second chapter of Genesis:

> The Lord God said, "It is not good for the man to be alone. I will make a helper suitable for him." (Gen. 2:18)[7]

The work of naming the animals did not satisfy. Only when Adam saw bone of his bone and flesh of his flesh was his horizontal relational wanting satisfied. Of course, wanting quickly became twisted:

> When the woman saw that the fruit of the tree was good for food and pleasing to the eye, and also desirable for gaining wisdom, she took some and ate it. She also gave some to her husband, who was with her, and he ate it. (Gen. 3:6)

The fruit of the tree of knowledge was *desirable* because it offered God-like wisdom. Alas, the fruit also yielded death and separation.

Sin thus separates humanity from God, leading to estrangement in this important vertical relationship. Moreover, the story of the Fall illustrates estrangement in our longing for horizontal relationship: "Your desire will be for your husband, and he will rule over you" (Gen. 3:16).

There are several competing views on the meaning of this passage. I will not attempt to reconcile or adjudicate them here, but instead I wish to point out that many of the interpretations represent a desire that is difficult to fulfill, either for headship, worth, or physical/psychological pleasure.[8] Thus, human wanting is present and active from the beginning of creation, but, at the Fall, humans no longer correctly orient the fulfillment of that wanting through relationship to God and fellow humans; instead, they turn inward to selfish desires.

In an existentialist view, addiction arises from this estrangement from God, which can cause anxiety, "and we seek to sooth our anxiety in inappropriate ways."[9] Saint Augustine of Hippo wrote that "You [God] stir man to take pleasure in praising you, because you have made us for yourself, and our heart is restless until it rests in you."[10]

Further, Blaise Pascal argues:

> What is it, then, that this desire and this inability proclaim to us, but that there was once in man a true happiness of which there now remain to him only the mark and empty trace, which he in vain tries to fill from all his surroundings, seeking from things absent the help he does not obtain in things present? But these are all inadequate, because the infinite abyss can only be filled by an infinite and immutable object, that is to say, only by God Himself.[11]

C.S. Lewis presents the longing thusly:

> All the things that have ever deeply possessed your soul have been but hints of it—tantalizing glimpses, promises never quite fulfilled, echoes that died away just as they caught your ear. But if it should really become manifest—if there ever came an echo that did not die away but swelled into the sound itself—you would know it. Beyond all possibility of doubt you would say "Here at last is the thing I was made for." We cannot tell each other about it. It is the secret signature of each soul, *the incommunicable and unappeasable want*, the thing we desired before we met our wives or made our friends or chose our work, and which we shall still desire on our deathbeds, when the mind no longer knows wife or friend or work. While we are, this is. If we lose this, we lose all. … *All that you are, sins apart, is destined, if you will let God have His good way, to utter satisfaction.* … But God will look to every soul like its first love because He is its first love.[12]

These notions of restlessness, craving, and unappeasable want are popularly translated today as humanity's "God-shaped hole." Humankind's efforts to find meaning and to fulfill wanting apart from God result in a wide range of idolatries, of which drug and alcohol abuse is only one.[13]

Of course, there is no shortage of discussion in the remainder of scripture, beyond the Creation account,

regarding the ramifications of a selfish fulfillment of wanting. Micah 6, Hosea 13, and Ezekiel 7 remind us of the deeper lack of satisfaction that comes when we seek to satisfy ourselves only with the pleasures of the world. James writes that "for where you have envy and selfish ambition, there you find disorder and every evil practice" (James 3:16). Paul writes in Ephesians 2:3: "All of us also lived among them at one time, gratifying the cravings of our flesh and following its desires and thoughts. Like the rest, we were by nature deserving of wrath." Furthermore, as Paul writes in 1 Corinthians 10:13: "No temptation has overtaken you except what is common to mankind." Paul goes on to write that "God is faithful; he will not let you be tempted beyond what you can bear. But when you are tempted, he will also provide a way out so that you can endure it." In response to this temptation, Paul exhorts the Corinthians to "flee from idolatry" (1 Cor. 10:14). Again, alcohol and drug use is but one idol that humans use in an attempt to fill their "God-shaped hole."

Pastor and Chancellor of Bethlehem College and Seminary John Piper offers a recent attempt to positively harness the human longing for God that is adapted from hedonism, which Piper calls "Christian Hedonism."[14] He argues that God created us to seek joy, and that true joy is found only in God. Further, this joy offers a certain transcendence from the pain experienced in life, and our satisfaction in him brings God glory. Such Christian hedonistic joy is not simply a product of conversion, but grows as our faith deepens.

The existential view stands in contrast to the Protestant evangelical and Pentecostal views that addiction is a sin, a moral failing, which can be cured through religious conversion.[15] Relationship with God is necessary for fulfilling humanity's need for psychological and spiritual meaning, but this comes not only from conversion (justification), but also through increasing surrender to God during sanctification. Paul and Augustine both wrote about the divides in the self and will of fallen humanity. Paul's personal admonition as a wretched man in Romans 7 displays a self that is torn between the law of the mind (i.e., reason) and the law of sin. In *Confessions*, Augustine writes, from personal experiences, about his divided will. His perverse will manifests in scenes of anger, idleness, lust, and theft for the sake of tasting the forbidden. The book chronicles Augustine's journey as he is first governed by his perverse will, then discovers what would become Catholicism's view regarding the provision of reason by which to overcome the will, and finally finds the necessity of God's grace for submitting his will to him. Mitchell Kalpakgian writes,

> As Augustine's autobiography reveals, the will can receive God's grace, assert will power, change the course of a person's life, conquer evil, cooperate with God's Divine Providence, and love as God loves.[16]

Overcoming the perverse will and submitting to God, however, are not merely a result of conversion, but also the continually working out and maturing of one's faith. As this theme issue highlights, viewing addiction simply as a moral failing, or a sinful act of agency, ignores physiological and psychological dimensions that often require additional support and time to address.

The Science of Wanting

C.S. Lewis claims in *The Problem of Pain* that the Fall transitioned us from being subject to the laws of the spiritual to the laws of nature. Toronchuk's lead article in this collection provides a useful overview of how science has identified the natural pathways for our feelings of "wanting." I will not reproduce all of her points here, but I do wish to highlight a few that establish a foundation for developing an evidence-based policy response to addiction.

Dopamine is an important component of our natural reward, pleasure, and motivation system. As Toronchuk states, "Dopamine release in NAc [nucleus accumbens] produces 'wanting' rather than 'liking' by focusing attention on the stimuli already associated with reward."[17] There are a plethora of natural ways to increase dopamine release or receptor availability, including sex, certain foods, exercise, meditation and prayer, massage, sunshine, and more.[18] Many drugs either directly or indirectly affect the ways in which dopamine operates in the brain. Drug abuse thus results in a dysregulation of the brain's built-in reward system.[19] There is evidence that drug abuse not only floods the system with dopamine, but that it also reduces normal dopamine function, thus increasing feelings of need or wanting.[20] It is important to note, however, that there is growing scientific support for the idea that behavioral addictions also alter the brain's reward system,

though perhaps not as strongly as pharmacology.[21] The battle of wills is still relevant, but we must recognize that drugs and habits weaken a person's agency to make decisions.

This is an important point of discussion, particularly as we move to focusing on the appropriate policy response for addressing drug addiction. As Christians, we understand that many, if not all, of our personal wantings are for physical things that represent mere shadows of the true object of our obsession: God. We all have idols in our lives that we pursue with an obsession that should be reserved for our Creator. But as a civil society, only some of the wantings that we pursue are criminalized. Although from a Christian perspective they are all moral failings, we are learning from a scientific perspective that there are physiological pathways in our bodies that facilitate and reinforce such failings. Granted, there are moral failings that necessarily require criminalization (e.g., child pornography), but is imprisonment the most effective avenue for addressing drug addiction, and to what extent does that policy response inflict injustices that should also be of concern to Christians? It is to these questions that I now turn. After addressing the historical approach of mass incarceration for executing the War on Drugs, I will consider what evidence-based policy would look like for drug abuse, including how some state and local governments are experimenting with related policies.

The War on Drugs and Mass Incarceration

The abuse of drugs was not always socially constructed as a moral failing. In fact, the case of opium use in the 1800s is instructive regarding the modern War on Drugs and emerging efforts to combat opioid addiction. Through much of the nineteenth century, addiction was viewed as a pharmacological property of opium.[22] Thus, resulting public policy efforts centered on regulation of supply and use. As opium addiction became increasingly viewed like alcohol abuse and mental illness, as a "habitual intemperance as a type or result of mental illness," the theory of addiction shifted from pharmacological effect to a "disease of the will."[23] In fact, postmillennialist missionaries to China were active in trying to "purify" the continent from the use of opium.[24] When the definition of a social problem (i.e., its framing) shifts, the required solution inevitably shifts with it.[25] In this case, the social (i.e., policy) response shifts from targeting the drug and its effects to targeting the individual and their moral failings.[26] Drug addicts are thus socially constructed as deviants, resulting in weak political power, an oversubscription of societal burdens, and an undersubscription of societal benefits.[27]

While drug regulation in the United States dates to the early twentieth century, the modern war on drugs commenced under the Nixon administration[28] and via the 1970 Controlled Substances Act, which introduced the current five-tier drug schedule. Granted, this was preceded and legitimized by the Single Convention on Narcotic Drugs of 1961 international treaty, aimed to prevent the production and trafficking of drugs.[29] The US war on drugs increased in fervor, however, under the Reagan, Bush, and Clinton administrations as substantial federal resources were conferred on state and local law enforcement for the purpose of addressing drug crime. Anne Schneider and Helen Ingram argue that the common societal response to deviant groups is to avoid them.[30] In the case of drug addiction, such avoidance occurs through the criminal justice system and the imprisonment of distributors and users.

The incarceration of drug offenders is part of, though not the totality of, the story of the increase in incarceration in the United States. From 1978 to 2014, the US experienced an over 400 percent increase in its incarcerated population, leaving the country with the largest prison population of any country in the world.[31] Within the last five to ten years, state and local governments throughout the US began reconsidering an incarceration-based approach to drug addiction, particularly as imprisonment failed to reduce rates of addiction. Arrests for drugs, however, mask the whole story, as 74 percent of all inmates in one state sample exhibited lifetime substance abuse or dependence disorders, as classified by the DSM-IV.[32] This means that many offenders who are in prison for violent or property crimes also struggle with drug addiction. Thus, the prevalence of drug addiction in the vast criminal justice system is itself staggering.

Prison is a remarkably poor environment for combatting drug addiction. Take Toronchuk's three evidence-based treatment methods:

> Treatments *that provide individuals the slow release of dopamine associated with social support* rather than supraphysiologic bursting, do seem to show the greatest promise. *In particular, the various 12-step programs that utilize continued social support can be combined with medical treatments and cognitive therapy*.[33]

Prisons are notoriously bad environments for all three evidence-based approaches: medical treatment, social support, and therapy. In fact, the early Quaker penitential model, which served as the inspiration for our modern prison system, proscribed isolation for the purpose of reflecting on sins. While the modern prison system remains an isolating experience, there have been efforts to incorporate the three approaches above. For instance, prisons are not known for producing positive health outcomes.[34] Furthermore, there is not enough drug treatment capacity in prisons.[35] However, when available, residential drug treatment programs appear effective.[36] There is also evidence that prosocial support mechanisms, such as education and family reunion programs, increase the likelihood of effective reentry and decreased recidivism. Alas, such programs are not available at all prisons or to the entire prison population within individual institutions.[37] In fact, "less than 20 percent of [federal] inmates with drug abuse or dependence receive treatment."[38] Without such social supports, prisoners instead face a negative social prison culture and a process referred to as prisonization, which does not result in positive long-term outcomes for inmates.[39] Finally, cognitive behavioral therapy shows promise for reducing recidivism, but it is also not always available to inmates, especially in overcrowded prisons.[40] Having established that, as currently structured, prisons in the United States does not utilize the evidence-based methods highlighted above, I now turn to presenting a different model that does.

An Evidence-Based Policy for Addressing Four Dimensions of Drug Addiction

This section will build upon the four dimensions of addiction—moral, social, biological, and spiritual—presented by Loftus in *Christianity Today*.[41] I use this as a framework for presenting alternative methods to mass incarceration for treating drug addiction. When possible, I also highlight the evidence that supports these alternatives and I give examples of governments that are implementing such programs. Importantly, this is not a purely public policy. The church also plays a key role in addressing the four dimensions. Indeed, many churches are already on the front lines of fighting the spreading opioid epidemic in communities across the United States.[42]

The Moral Dimension

While there is growing recognition of the physiological pathways of addiction, controversy remains among Christians as to whether addiction is a moral failing or a disease. The moral failure framing relies on God's commands regarding drunkenness, which surface across both the Old and New Testaments.[43] Christians cannot thus ignore the moral dimension of addiction. But, to view it solely as a moral failing misses the other important dimensions, and any policy response emergent from that single frame is unlikely to bring true healing. Clearly, science and the Christian ethic need to be merged. Christians should emphasize the need for us to protect our minds (Prov. 23:29–35), guard our bodies as temples (1 Cor. 6:19–20), and avoid the self-imprisonment of overindulgence (2 Pet. 2:17–22). But as this theme issue highlights, shaming and warning are not enough. The physiological pathways of addiction remove some of the agency required to "Just Say No."[44] How then can public policy maintain a moral dimension by warning citizens about the dangers of addiction?

For over three decades, the United States has educated young people about the pitfalls of drug addiction in primary and secondary schools. The Drug Abuse Resistance Education (DARE) program is perhaps the most publicly recognizable effort. While DARE's effectiveness came into question by the late 1990s, recent research highlights some of the more effective elements of drug abuse prevention education programs.[45] It is important to recognize that effectiveness of different techniques varies depending on students' developmental level.[46] In terms of generally effective elements, one systematic review offers the following seven evidence-based quality criteria:

1. Effects of program must be proven
2. Interactive delivery
3. Social influence model is superior
4. "Focus on norms, commitment not to use, and intentions not to use"

5. Include community interventions
6. Use of peer leaders
7. Inclusion of broader life and social skills[47]

One of the challenges in widely implementing such evidence-based approaches, however, is the decentralized nature of school curriculum decisions. States make such decisions, and they vary greatly in terms of the fidelity of their standards to recommended content and pedagogical practice.[48] Further, we know from political science that controversial curriculum is not taught equally across classrooms, as it is influenced by local public opinion and variation in teacher knowledge.[49] One policy response to the moral dimension is thus to encourage states to move toward scientifically assessed models of drug education.

Something that we must also wrestle with in the moral dimension is whether to continue domestic prohibition and international interdiction. The United States has spent a substantial sum of money in both efforts, with questionable results.[50] In addition, strict drug control policies can amplify suffering by preventing palliative care and the treatment of pain.[51] The question is how to retain a moral position on the issue of drug addiction while recognizing that criminalizing and incarcerating individuals with drug abuse and drug dependence is ineffective. Full prohibition has not worked, but full legalization removes any moral dimension to the problem.

Decriminalization for some drugs offers a potential middle ground for Christians. For example, Portugal in 2001 decriminalized the use of all drugs. This means that the country still jails and/or fines dealers and traffickers, but those found guilty of possession receive treatment instead of prison. In the first five years, Portugal saw reductions in overdose deaths, diseases related to drug use such as Hepatitis C, and prison crowding, while not experiencing increases in use.[52] State and local governments in the US are experimenting with decriminalization and treatment instead of incarceration. There is evidence that treatment can be less expensive, and certainly more effective, than imprisonment for those addicted to drugs.[53] The key for effective decriminalization, however, is a widespread and consistent approach, such as that of Portugal. Some states experimented with limited decriminalization of marijuana in the 1970s, but this approach demonstrated limited effects beyond a positive financial impact.[54] Decriminalization, as opposed to full legalization, with required treatment provides a policy option that retains the moral dimension, while also addressing the other three dimensions of the problem.

The Biological Dimension

Several treatments for drug addiction demonstrate effectiveness at helping addicts recover inhibition and critical thinking pathways that are altered by drugs. Though their use may be controversial, medications like methadone, buprenorphine (Suboxone), topiramate, and naltrexone demonstrate effectiveness in treating opioid and alcohol addiction.[55] Such drugs alleviate withdrawal symptoms and, over time, the brain repairs the reward, impulse control, and critical thinking pathways altered by drugs.[56] Medications like naltrexone also show promise in treating other chemical and behavioral addictions.[57] While still in the early phases of scientific assessment, brain stimulation of the prefrontal cortex (i.e., the brain's inhibition center) demonstrates promise in treating addiction, particularly for drugs such as cocaine that have no alternative pharmacological treatment.[58]

For Christians, a more complicated recent finding is that states with medicinal marijuana programs appear to experience declines in opioid overdose mortality.[59] While there are important criticisms of current research methodology[60] and additional research explicating such a relationship is necessary, the underlying theory carries face validity. Essentially, the expectation is that medical marijuana can be prescribed as an alternative pain management tool to opioids. As Toronchuck notes in her article, marijuana is less addictive than opioids. Additionally, there is little scientific evidence of a broad gateway effect for marijuana.[61] Thus, marijuana offers a compelling alternative to opioids for pain management.

The challenge for the church, however, is that marijuana is often demonized in concert with other illicit drugs. In fact, marijuana holds a somewhat unique place in the history of American drug prohibition and American culture. Its nativist roots were shared by opium prohibition, but marijuana experienced pivotal episodes in American popular culture. Such events include the publication of *Assassin of Youth*,[62] production of *Reefer Madness*, hippies, appearances in multiple musical genres, Bill Clinton not inhal-

ing, and Barack Obama inhaling frequently because "that was the point."[63] Throughout this history, marijuana's place in popular culture evolved from hysteria to acceptance. Catholic and Protestant churches remain active advocates against marijuana, including recent state efforts to legalize medicinal and/or recreational marijuana. In 2016, for example, the Archdiocese of Boston provided almost $1 million in the fight against Question 4, which legalized recreational marijuana in Massachusetts.[64] The question is where the church should stand if regulated medicinal marijuana use provides an alternative to more addictive, and deadly, opioids.

Some Christian thinkers are open to the use of medicinal marijuana, while still maintaining a prohibitionist stance toward recreational marijuana.[65] This may in fact be the appropriate middle ground that incorporates the moral concerns of Christianity toward overindulgence, while also recognizing the potential for saving lives and relieving human suffering. Approving medicinal marijuana (including removal from Schedule 1 of the Controlled Substances Act), while also decriminalizing other illicit drugs and consequently shifting resources into treatment instead of imprisonment, offers a more compassionate and more effective response than prison with sparse access to treatment.

Recognizing the brain disease model is necessary for Christians and public policy; bioethicists, however, raise important concerns regarding viewing the brain disease model in isolation. Namely, it can result in a shift from a moral definition of "otherness" to a disease definition of "otherness" that still results in individual and collective efforts to isolate those addicted to drugs.[66] Such isolation, regardless of whether it results from a singular focus on the moral or biological dimension, ignores the social dimension of addiction.

The Social Dimension

Carla Meurk and colleagues argue that focusing only on the brain disease model ignores the "we" of our social existence.[67] Johann Hari, author of *Chasing the Scream,* summarizes this dimension succinctly when he says, "The opposite of addiction isn't sobriety, it is connection."[68] Addiction and recovery each have important social elements. In terms of addiction, social experience during development (e.g., maternal separation) and the social context of drug use interact with underlying individual differences to explain addiction proclivity.[69] In terms of recovery, 12-step programs and cognitive behavioral therapy demonstrate long-term positive effects, while family therapy and group counseling show the largest positive benefits for adolescents.[70] The state of Delaware piloted an effective community addiction treatment program within its prisons.[71] It is further apparent that social attachment is a key to increasing resilience against addiction and rewiring the brain pathways that relate to addiction; however, this presumes a healthy social environment.[72] An unhealthy social environment, for example, social relationships with those who are users, otherwise reinforces dependence. As far as public policy is concerned, this research points us toward the most effective forms of treatment in a decriminalized environment.

The social dimension is also a key avenue of engagement for the church. As Lindsay Stokes writes for *Christianity Today*,

> If the Christian church has anything to offer those hurting from opioid addictions, it is connection: connection to a community, connection to resources, and most critically, connection to a God who saves.[73]

The church is already operating on the front lines of addiction, broadly speaking, and the opioid crisis, in particular, as churches are homes to both 12-step programs and Narcan (naloxone) availability.[74] Thus, the church plays an important role in offering community for the purpose of combating addiction. Community and relationship are deeply embedded in Christianity's views of humanity and God. The Trinity offers a model for human relationships, as the Father, Son, and Holy Spirit exist in (sacrificial) relationship with each other.[75] Moreover, humans were created to be in communion with God and one another. Finally, the early church is often pointed to as an example of Christian community (Acts 2:42–47). Members of the church held property in common, supported each other's needs, regularly broke bread together, and worshiped God corporately. Thus, the church should always offer a supportive community to fellow men and women struggling with addiction.

The challenge for the church is to make connections between week-night 12-step groups and Sunday mornings. Believing in a higher power is a cornerstone of Alcoholics Anonymous (AA) and its derivatives, but participants tend to express a vague

notion of spirituality. As Barbara Gilliam reminded the American Association of Christian Counselors, church attendance in America is on the decline, but AA attendance is increasing.[76] The church needs to address the disjuncture between offering a space for an "honest and transparent community" (i.e., AA) and building such community within the rest of the church.[77] There is no shortage of writing or evidence that both Christians and non-Christians today are more skeptical of institutionalized churches.[78] Given that the church is the bride of Christ, it is true, as Pope Francis and other Protestant writers have claimed, that one cannot dichotomize the two.[79] It is also clear, however, that the church has work to do in developing the types of authentic community necessary to merge the social and spiritual dimensions of addiction recovery.

The Spiritual Dimension

In the existentialist view presented above, only Christ/God can fill Pascal's "God-shaped vacuum." Specifically, it is salvation through Christ that allows us to become a new creation and bridge the estrangement with God, though while we remain in a physical body we are not fully healed, nor does the tension between spirit and flesh fully subside.[80] Jesus talks of being the bread of life (John 6:35). In his Sermon on the Plain in Luke 6:17–49, Christ tells his apostles that "blessed are you who hunger now, for you will be satisfied." Further, he tells the Samaritan woman at the well in John 4:13–14 that those who drink of the well from which she drew water will become thirsty again, but those who drink of his living water will never be thirsty. These appear to be metaphysical promises of future fulfillment, but Paul also writes of present contentment that comes from Christ (Phil. 4:10–13) and tells Timothy that godliness paired with contentment is of great gain (1 Tim. 6:6–10), as contrasted to a pursuit of money (i.e., worldly satisfaction/gain). Thus, we will receive fulfillment in Christ, but, as Augustine suggests, this occurs through ongoing submission to God. It is a process, not a moment.

The physiological and psychological aspects of addiction illustrate the dissatisfaction that emerges from dependence on worldly pleasures. Repeated usage of drugs does not lead to more euphoria; instead, it undermines the reward center of the brain, making an addict not so much long for a high, but for relief from the pain of withdrawal.[81] Thus, in addition to biological and psychological support, spiritual healing is necessary for addressing the idols in our lives. The need for submission to a higher power and continual support and healing was recognized by the creators of AA. In fact, the program is a combination of social support, spirituality, religiousness, life meaning, and 12-step programs that support long-term recovery.[82] In his extended discussion of the different models of alcoholism, addiction psychiatrist Christopher Cook argues for a theological model of addiction that builds on the notion of the divided will, but still recognizes the biological (psychological) dimension of addiction.[83] One reviewer describes the book's view as: "Cook reckons that theology can be an important corrective to the tendency toward reductionism and determinism in contemporary discourse, with their consequence of nihilism in treatment."[84] In addition to the moral, biological, and social dimensions, churches play a vital role in offering spiritual raiment that is essential to addiction recovery.

Conclusion

Drug addiction is a multifaceted problem that cannot be reduced to a single dimension. Effective treatment requires attention to all four of the hereinpresented dimensions: moral, biological, social, and spiritual. Of course, the state can only go so far in legislating these dimensions. Public policy responses to drug addiction can address the moral, biological, and social aspects of addiction by establishing appropriate consequences and restorative supports for the addicted. However, the church is a necessary partner in providing social support and spiritual redemption through the person and work of Jesus Christ. Even secular 12-step programs, like AA, recognize the importance of relying on a higher power. Christians offer a higher power that heals the broken and finds the lost. Likewise, the church must recognize the multiple dimensions of addiction. Reducing the problem to a moral failing and assuming addicts have full agency in making choices results in marginalization, punishment, and isolation.[85] Christ calls us to recognize the plank in our own eye before removing the speck in our brother's.[86] C.S. Lewis reminds us of the danger facing the self-righteous:

> The dangers of apparent self-sufficiency explain why Our Lord regards the vices of the feckless and dissipated so much more leniently than the vices that lead to worldly success. Prostitutes are in no

> danger of finding their present life so satisfactory that they cannot turn to God: the proud, the avaricious, the self-righteous, are in that danger.[87]

Drug addiction is not a special class of sin. It requires personal and social restoration, like any sin. Thus, the church, in light of Christian social ethic and science, should be a force in establishing a restorative addiction care and criminal justice system, more broadly.

Notes

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[2]For example, see George P. Shultz and Pedro Aspe, "The Failed War on Drugs," *The New York Times* (2017), https://www.nytimes.com/2017/12/31/opinion/failed-war-on-drugs.html.

[3]AA itself is said to have Christian roots. Specifically, its practices are viewed as Jesuit; this idea is often credited to the involvement of Jesuit Priest Father Ed Dowling who was the first sponsor of AA co-founder Bill Wilson.

[4]Matthew Loftus, "Is Addiction a Disease? Yes and Much More," *Christianity Today* 60, no. 10 (2016): 41.

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[6]Judith A. Toronchuk, "Addiction: Diseased Brain, Divided Will, or Restless Heart?," *Perspectives on Science and Christian Faith* 70, no. 4 (2018): 218–31.

[7]All references to the Bible are drawn from the NIV translation.

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[17]Toronchuk, "Addiction: Diseased Brain, Divided Will, or Restless Heart?," 219.

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Biology

THE RISE OF MARINE MAMMALS: 50 Million Years of Evolution by Annalisa Berta. Baltimore, MD: Johns Hopkins University Press, 2017. 212 pages, including contents, preface, acknowledgments, and index. Hardcover; $75.00. ISBN: 9781421423258.

Evolutionary transitions between terrestrial and aquatic environments have long fascinated evolutionary theorists. Going back to Darwin, biologists have recognized that evolution by common descent implies that all aquatic mammals—including modern whales, seals, manatees, and otters—must have descended from mammalian ancestors that were terrestrial. Such a situation poses a challenge for evolutionary theory, due to the fact that creatures living on land are under very different constraints and pressures than creatures living in the water. Thus, any proposed evolutionary transition between terrestrial and aquatic environments would necessitate a virtual overhaul in anatomy to accommodate such a profound shift in ecology.

For many years, these large-scale evolutionary transitions were poorly understood. However, in recent decades, the fossil record has allowed us to achieve a much greater understanding of how various groups of mammals have taken to life at sea. The evolution of cetaceans—including whales, dolphins, and porpoises—from terrestrial hooved mammals has become a sort of poster child for this type of evolutionary change, and rightly so. The fossil record documenting the origins of these creatures has exploded since the late 1970s, allowing paleontologists to reconstruct at high levels of detail how the earliest four-legged cetaceans adapted in various ways for life in water. But as much as this fascinating case study deserves the attention it has received, it is also important to recognize that cetaceans are only one of at least seven different groups of mammals who have returned to the sea from whence their ancient tetrapod ancestors came.

In *The Rise of Marine Mammals: 50 Million Years of Evolution*, paleontologist Annalisa Berta details the wide variety of mammals that have made a living in the world's oceans. Berta, who is emerita professor of biology at San Diego State University and former president of the Society of Vertebrate Paleontology, has spent her career studying the evolution of marine mammals, particularly pinnipeds—including seals, sea lions, and walruses—and cetaceans. She has written or cowritten multiple books about marine mammal history and biology. First and foremost, she is coauthor of the popular *Marine Mammals: Evolutionary Biology* textbook, now in its third edition, which is aimed at upper-level undergraduate students, graduate students, and professionals studying marine mammals. She has also written *Whales, Dolphins, and Porpoises: A Natural History and Species Guide*, which provides a comprehensive overview of the most diverse marine mammals in our oceans today. In 2012, she published *Return to the Sea: The Life and Evolutionary Times of Marine Mammals*, a book aimed at nonscientists that serves as a primer on many aspects of marine mammal evolution and ecology. *Return to the Sea* is full of wonderful grayscale photos and illustrations that nicely supplement the well-written prose. However, given the intended audience for this book, citations and references to primary literature are conspicuously absent, and the list of resources for further reading is very short. With *The Rise of Marine Mammals*, Berta takes a different approach, filling in the gap between her exhaustive academic textbook and her nontechnical treatise with an easy-to-read, lavishly illustrated book that provides ample details and resources for further exploration about the fossil record of marine mammals.

What the reader immediately notices when flipping through the book for the first time is all of the beautiful, full-color photos and illustrations. Many of these illustrations are life reconstructions of key fossils from noted artists, while others are figures from the primary scientific literature. There are also many photos of researchers excavating fossils in the field and working with them in museums. In a sense, given the quality and abundance of images on virtually every glossy page, this could be considered a coffee table book.

However, this assessment would sell the book short, as there is also so much valuable scientific information that is summarized clearly and concisely in the text. In the opening chapter, Berta sets the stage for the rest of the book, discussing how she aimed to present the fossil record of marine mammals in the context of major events in Earth history, while highlighting how advances in scientific research capabilities have enhanced the study of marine mammal evolution. She covers some of the basics of naming, classifying, and describing species; how fossils are discovered, collected, and prepared; and some basic geological principles that are necessary for providing important context for fossils, using helpful examples to clarify each of these concepts along the way.

The next five chapters focus on the fossil records of every group of marine mammals. Beginning chronologically with the oldest fossils, chapter 2 discusses the origins of cetaceans and sirenians, which include

modern manatees and dugongs, during the early Eocene epoch around 50 million years ago, mostly focusing on ancient, four-legged cetaceans called archaeocetes. Here, Berta deftly weaves historical narratives and the work of specific researchers into descriptions of key fossils and their characteristics. This pattern, which continues in subsequent chapters, effectively integrates the scientific process of discovery into the encyclopedic knowledge of marine mammal history. Chapter 3, the longest chapter in the book at 56 pages, continues to focus on cetaceans, discussing many of the trends that arose after cetaceans were living full time in the water, and elucidating the details of every group of cetaceans that has existed, including both toothed whales and baleen whales. In chapter 4, Berta moves on to discuss her other main area of expertise: the evolution of pinnipeds. She discusses all major groups of pinnipeds, both living and extinct, in a fair amount of detail, as well as highlighting different hypotheses for how all of these different groups are related to one another. Chapter 5 discusses later sirenians, which were first introduced in chapter 2, along with a completely extinct group of marine mammals called desmostylians, which were plant-eating, hippo-sized mammals that were restricted to the northern Pacific Ocean during the late Oligocene to middle Miocene epochs about 10–30 million years ago. Chapter 6 rounds out the roster of marine mammals, including discussion of polar bears, sea otters, and a radiation of extinct marine sloths from South America.

Berta concludes the book in chapter 7 with a discussion of how climate and human activity have affected the diversity of marine mammals through time. Topics include climate-related shifts in geographic distribution, the effects of habitat loss, and changing food webs. She also discusses the impetus for studying the dynamics of marine mammal evolution through time, as this work provides valuable information for helping us to evaluate the ecological changes we see happening in the world's oceans today. Following this concluding chapter, there are 20 pages that provide an exhaustive list of marine mammal taxa, a three-page glossary, 14 pages of references to the primary literature (sorted by the chapter in which they were cited), and a six-page index.

Throughout the book, Berta's expertise is on display, showing an excellent grasp of both older and newer literature for all groups of marine mammals. There are a few minor errors in figures related to labeling phylogenetic trees, but most of the summaries are accurate, fair, and up-to-date. However, the way this book handles contentious issues among marine mammal paleontologists is a bit uneven. For instance, her discussions of pinniped relationships do a nice job of describing competing hypotheses and areas of uncertainty, whereas interpretations of swimming behavior in some key early cetaceans are presented uncritically despite the fact that there is some debate in the literature.

But these minor quibbles do little to detract from this book's strengths. *The Rise of Marine Mammals* covers the breadth of marine mammal evolution while highlighting the key details. It discusses what we can learn from the fossils within a context that makes the reader feel as if he or she is part of making these discoveries. In exploring the changing ecologies of marine mammals over the past 50 million years, Berta provides insights into the dynamics of our world's oceans, both past and present. This visually stunning, yet informative, book should serve to inspire its readers—not only to give them a sense of awe and wonder at the marvelous diversity of marine mammals in eons gone by, but also to push them to preserve and steward the remarkable creatures that live in our seas today.

Reviewed by Ryan M. Bebej, Calvin College, Grand Rapids, MI 49546.

Environment

THE CARBON CODE: How You Can Become a Climate Change Hero by Brett Favaro. Baltimore, MD: Johns Hopkins University Press, 2017. 220 pages. Hardcover; $22.95. ISBN: 9781421422534.

The Carbon Code is a manual for action. Chapter 1, "The Cost of Carbon," gives a quick overview of the indisputable reality of human-caused climate change and its various effects on planet Earth. The rest of the book focuses on what we, mainly as individuals, can do to solve the problem. Chapter 2, "Solutions Start with You," defends the idea that the cumulative impact of many individuals is significant. The middle section covers personal electricity use (chap. 4), transportation (chap. 5), diet (chap. 6), and long-distance travel (chap. 7), with practical tips for reducing one's carbon footprint. The last section is "Sharing the Carbon Code." In "Winning the Conversation" (chap. 8), Favaro gives tips for communicating with friends, family, coworkers, and community members about climate change and what we can do about it, culminating with a case for running for public office in order to advance the cause. Chapter 9, "Policies for a Pro-climate Future," outlines nine policies that climate change heroes should advocate: (1) a carbon tax or cap and trade price on carbon; (2) tougher regulations and the elimination of coal; (3) making climate change a priority in public policy; (4) eliminate fossil

fuel subsidies; (5) subsidize clean energy; (6) divest from the fossil fuel industry; (7) develop infrastructure for bicyclists; (8) promote electric vehicle (EV) infrastructure; and (9) worker retraining for the fossil fuel industry.

Brett Favaro is the academic director of the Fisheries Science graduate programs at the Fisheries and Marine Institute of Memorial University of Newfoundland. Favaro received his PhD in biology from Simon Fraser University in 2013, and was a 2013 Liber Ero conservation fellow at the University of Victoria. His research focuses on designing and implementing sustainable fishing technology to reduce commercial fishing's impact on the world's oceans. He is also interested in science policy. His research puts him face-to-face with the effects of climate change on the oceans.

There are few surprises in *The Carbon Code*. Favaro gives the environmentalist/conservationist party line on every issue, whether it be coal, EVs, nuclear energy, public transportation, reduced red meat/vegan diet, LED lights, less AC use, sweaters instead of the furnace, or cycling (and many more). This is not to disparage the book. It is, unapologetically, an advocacy book. As such it is a useful compendium of state-of-the-art actions that just about anyone can take to reduce one's carbon footprint. If you are a climate change skeptic, denier, or luke-warmist, you will not find any new arguments, but you will find a concise statement of the arguments for human-caused climate change and its impacts. Perhaps reading Favaro's version will convince you. At the same time, the actions that are outlined have benefits other than solving climate change. Some of these will save you money and launch you into a global economy that is embracing renewable energy, public transportation, and electric vehicles. Favaro's tips and policies can give you a head start in this new world even if you do not accept the main arguments for its existence.

Chapter 3, "The Carbon Code of Conduct," is perhaps the most novel. Favaro adapts moral guidelines from live animal research to provide guidelines for managing our carbon use. These guidelines were initially spelled out in 1959 by W. M. S. Russell and R. L. Burch in *The Principles of Humane Experimental Technique*. The four R's are reduce, replace, refine, and rehabilitate. The fourth R (rehabilitate) was added in 1999 as a result of the Indian government implementing policies to guarantee humane and ethical use of animals in research. The idea is that using animals in research is a necessary evil, of sorts, for human well-being. That being the case, we should adopt practices that minimize the suffering of those animals used for such purposes. The comparison with carbon use is, at best, an analogy since the notion of suffering does not really transfer. However, the notion of damage does. If carbon use is damaging the planet, but is necessary for human well-being, we should adopt practices that minimize that damage. As applied to carbon use, the four R's are as follows: "*Reduce* your carbon use as much as possible"; "*Replace* carbon-intensive activities with those that use less carbon to achieve the same outcome"; "*Refine* the activity to get the most benefit for each unit of carbon emitted"; "*Rehabilitate* the atmosphere by offsetting carbon usage." If you have to use carbon, pay someone, somewhere, to do something to undo your use. Favaro calls us to make the following pledge:

> I, ____, am making a personal commitment to solving climate change. I commit to applying the carbon code of conduct to my daily life and will reduce, replace, refine, and rehabilitate my use of carbon. I commit to convincing others to follow this code as well. I do this because of my love for the biosphere, my love for humanity, and my desire to live a healthy and sustainable life.

As we make this pledge, he argues that it will streamline our decisions in the same way that athletes' training and diet regimen streamlines theirs. Going to the gym for regular training is not a daily decision that must be made. You just do it. The carbon code of conduct becomes part of our personal ethic.

Each chapter of *The Carbon Code* has an excellent and very useful summary, usually 5–10 bullet points. *The Carbon Code* contains no graphs or charts. This seems to have been the publisher's decision. If there ever is a second edition, I would heartily recommend that some be included. The 2012 book *Cooler Smarter: Practical Steps for Low-Carbon Living* by the Union of Concerned Scientists, a book with a similar message, was full of helpful charts and graphics. I think such charts and graphs would have significantly enhanced the message of *The Carbon Code*. The copyright date of the book is 2017, but it seems a bit out of date already, especially with the change in the political climate.

While there was some discussion about nuclear energy, it seems that Favaro is ignoring the recognition by some environmentalists—for example, those represented in the 2013 Robert Stone documentary *Pandora's Promise*—that nuclear is a necessary component to a low-carbon future. Problems with solar and wind, such as intermittency, were mentioned but barely acknowledged. Storage and a smarter grid are recognized as solutions but there is little admission of the difficulty of developing these solutions to

the point where we can move to 100% renewables. Issues of mining are mentioned as disadvantages of renewables, but renewables' dirty secret of toxic manufacturing and the tonnes of ensuing e-waste that will be upon us in a few decades is not mentioned. The problems of nuclear seem fewer and fewer when the big picture is considered. I would have liked to see more discussion of carbon capture, utilization, and sequestration (CCUS) technologies as a way forward. CCUS will allow the continued use of carbon at some level, but eventually will pave the way to a zero net carbon use. CCUS is going to be necessary to undo some of the damage that has already been done; namely, we must not only reduce carbon emissions, but we must also remove some of the carbon already in the atmosphere. And lastly, I think some mention of geo-engineering as a possible way forward would have been helpful.

One technical error worth mentioning is in chapter 2, where it is stated that the average person's carbon footprint globally is 4 tonnes per person. Of course, these numbers are hard to nail down, but with estimates of greenhouse gas levels at 50–55 Gigatonnes of CO_2 equivalents and 7.4 billion people on the planet, you get 6–7 tonnes per person. This makes the US footprint only three times the global average not four (still a disturbingly disproportionate amount).

While Favaro says there is still time to take care of climate change if we act soon, his general message was too apocalyptic for me. I am not sure that falling sky arguments are the best way to motivate the target audience to action. One memorable line from chapter 8 still rings in my head. "We need to be unafraid to react with disgust when someone denies climate change." Such language conveys his passion about the issue. It does little, I think, to move the conversation (and action) forward in a productive way.

Reviewed by Terry M. Gray, Colorado State University; Front Range Community College; ASA Executive Council.

History of Science

THE GENE: An Intimate History by Siddhartha Mukherjee. New York: Scribner, 2016. xi + 592 pages, including glossary, notes, selected bibliography, and index. Hardcover; $32.00. ISBN: 9781476733500.

By now most enthusiasts of science history have at least heard of Siddhartha Mukherjee, whose initial venture into authorship, *The Emperor of All Maladies*, earned him the 2011 Pulitzer Prize for general nonfiction. While in his residency training in oncology, Mukherjee wrote his so-called "biography of cancer" with a voice of authenticity that only seems possible for someone who is personally immersed in the story he is telling. But as Mukherjee himself admits, the exhausting experience of composing such a vast and personal story seemed to rule out the possibility that he would write another book on the history of scientific discovery. Thankfully, this turned out not to be the case.

Now a practicing oncologist and assistant professor at Columbia University Medical Center, Mukherjee has recently tackled another topic close to his heart, the development of modern genetics. Many of the best aspects of Mukherjee's second book, *The Gene: An Intimate History* (2016), reflect qualities that made his initial work an international best seller. Mukherjee excels at relaying fine detail without losing the broader context of his narrative, masterfully weaving his explanation of complex scientific concepts together with the stories of the people involved in their discovery. As one might expect, prominent figures such as James Watson and Francis Crick feature in this book, but so also do less famous individuals such as Theodosius Dobzhansky, who also contributed key pieces to the puzzle of modern genetics. One cannot separate the history of science from the actors that achieved the discovery, and in this respect the "biography of the gene" that we have today is inseparably connected to the idiosyncrasies of those who studied it over the past two centuries.

This is not to say, however, that Mukherjee's story is simply a celebration of human achievement through the power of science. *The Gene* is punctuated with frequent examples of scientific achievement placed side-by-side with miserable human failure, particularly when the emerging science of genetics was used as a tool to understand—or even engineer—society at large. Mukherjee carefully and honestly acknowledges the incredible evil that emerged alongside genetic science during the twentieth century, linking racism, Nazism, and the eugenics movement to errant interpretations of legitimate scientific discovery.[1] Human depravity is writ large in the history of genetic discovery, serving as a caution to those who want to see only this field as the panacea for humanity's ills.

In between the triumph of scientific discovery and the disaster of social engineering lies a significantly grayer area in which genetics intersects with behavioral psychology. Here the going gets a bit tougher—and more subjective—as the comfortable certainty of Mendelian genetics is blurred by the influence of environmental factors that are much more difficult to quantify. Mukherjee is especially engaging in this context and does not shy away from some of the more controversial aspects of genetics,

including those that touch on gender, gender identity and sexuality.[2] While readers may differ—even significantly—with Mukherjee's essentially secular worldview regarding these issues, he remains well balanced and apolitical in his approach to interpreting the role of genetics in complex social behaviors. Absent from the book is any suggestion that the role of biology in behavior allows for abdication of human responsibility regarding the choices we make.

This is a tenuous balance to strike. How is it that we are bound to our genetics, but at the same time responsible for the outcomes in our lives? Mukherjee's unique answer to this paradox is perhaps the most insightful of his comments regarding the connection between heredity and complex social behavior. Rather than using the somewhat worn-out nature/nurture dichotomy, Mukherjee instead turns to mathematics for an appropriate analogy to explain how genes contribute to who we are or might become. Our inherited genetic makeup, he suggests, is very much like "the first derivative of a point [which] is not its position in space, but its propensity to change its position" (p. 355). Or to put it more succinctly, our genes are directive, not determinative. While our heredity may indeed limit the scope of possible outcomes, both experience and environment—not to mention a stiff dose of providential serendipity—play equally important roles in who we become.

Our understanding of precisely how our inherited genetic composition interacts with the experiences and environment that flavor our life is still in its infancy. Mukherjee touches on these issues throughout the latter third of his book, providing a few prime examples of how our experiences in the world can alter the effect of our genes in ways that early geneticists would never have imagined.[3] This field of study, known as epigenetics, offers at least a partial insight into the remarkable flexibility and adaptability of our genome. Mukherjee states this elegantly:

> It is a testament to the unsettling beauty of the genome that it can make the real world "stick." Our genes do not keep spitting out stereotypical responses to idiosyncratic environments: if they did, we too would devolve into windup automatons. (p. 390)

And this conclusion that we are not merely products of our genes offers some degree of hope for individuals who fear their own inheritance. This is certainly the case for Mukherjee, as clarified by the medical history of his own family interposed within the narrative of scientific discovery in *The Gene*. Each section of the book begins with a brief glimpse into the story of mental illness that has plagued his family for two generations, culminating in the lives of two of his paternal uncles who struggled with schizophrenia. Mukherjee's personal grief and anxiety regarding the genetic blight on his family is what makes *The Gene* truly "an intimate history" for him. The biography of the gene is his story—and our story.

Notes

[1]See especially, the foresight of Bateson, 63; Francis Galton, Pride & Davenport, 120; rise of Nazism and its "applied biology" approach to genetics, 119–32.

[2]See especially, gender determination, 355–69; research on the "gay gene," 371–79.

[3]See especially, effects of the Dutch Hongerwinter, 392–413; cellular reprogramming, 404–7.

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Philosophy

NEUROEXISTENTIALISM: Meaning, Morals, & Purpose in the Age of Neuroscience by Gregg D. Caruso and Owen Flanagan, eds. New York: Oxford University Press, 2018. xviii + 372 pages. Paperback; $35.00. ISBN: 9780190460730.

Is humankind no more than a "victim of neuronal circumstances," "just a pack of neurons"? In other words, is humankind naïve in denying epiphenomenalism, the notion that all mental processes can be reduced without remainder to brain-biology? Is existentialism's "self," a self-making born of radical commitment with its inescapable risk, finally no self at all, and the anguish pertaining to such risk no more than a neurological twitch? Is the freedom essential to existentialism (the capacity for choice that issues in self-determination) as indefensible—and ridiculous—as a denial of the law of gravity? Despite the prevalence and force of assorted determinisms that bear upon the human, has neuroscience eliminated that self-determination apart from which human agency disappears, guilt is impossible, and the criminal justice system replaced by a social engineering that reprograms those heretofore deemed deviant?

In its exploration of and, for the most part, affinities with the above, the book identifies three kinds of existentialism. In two or three sentences it speaks of first-wave existentialism, found in Kierkegaard, Dostoevsky, and Nietzsche and probing human selfhood in light of God (or, in the case of Nietzsche, of God's absence). Again, briefly, second-wave existentialism, represented by Sartre, Camus, and de Beauvoir, is said to be a post-Holocaust attempt at creating a human authenticity (contrasted with the inauthenticity of Sartre's "bad faith" or Heidegger's "the herd" or even Nietzsche's "the they") with

respect to social transformation. Third-wave existentialism, neuroexistentialism, the book's dominating concern, avers that while neuroscience affords scientific truth concerning the brain and its functioning, it simultaneously disenchants in that it eliminates that self necessary for self-transcendence, deliberation, assessment, judgment, and uncoerced commitment.

This third wave maintains that the good, the true, and the beautiful have no meaning inasmuch as the human entity has no capacity for discerning, accessing, or discussing such: the foregoing is an illusion in that all that remains is a neuroplexiform item whose biological complexity may be greater than that of simpler life-forms, but whose personhood is no more than seeming even as theirs is never suggested.

The book consists of four major divisions: I—Morality, Love and Emotion; II—Autonomy, Consciousness and the Self; III—Free Will, Moral Responsibility and Meaning; and IV—Neuroscience and the Law.

Given the general tenor of the book, the reader is surprised initially at Maureen Sie's chapter, "All You Need Is Love(s): Exploring the Biological Platform of Morality." Here she maintains that our nature as loving beings can explain our nature as moral beings. Throughout she borrows overtly from C. S. Lewis's *The Four Loves*, electing to change his "charity" (*agape*) to "kindness" on account of her unbelief. Departing from Lewis (and from the trajectory of her argument), she introduces a discussion of oxytocin and vasopressin, hormones whose neurochemical properties foster attachment narrowly and sociability broadly. In light of her adducing that oxytocin can be administered through nasal spray, her argument, strong to this point on account of her use of Lewis, is weakened: the thesis she began with, our loving nature as the ground of our moral nature, is now no more than "appealing."

Other chapters invite a profound Christian response. Jesse Prinz explores "Moral Sedimentation," the "phenomenon of experiencing the world and acting in through the filter of the past, without necessarily realizing it." While his proposal that sedimentation may move from mind to brain remains speculative, his chapter calls forth Christian comment on the place of spiritual formation, the place of a faith-facilitated "deposit" in one's unconscious mind that continues to assert itself even when we aren't aware of it. Not least, his discussion of sedimentation should elicit a discussion of tradition, the manner in which the church's tradition can be beneficent teacher or brutal tyrant, and the peril of amnesia on the part of individual, congregation, or denomination; namely, those beset with amnesia (i.e., the absence of Christian memory) lack an identity; and lacking an identity, they can never be trusted.

Oddly, in a book that largely dismisses everything that existentialism has upheld, and denies self, agency, responsibility, culpability, and desert, the last chapter, "The Neuroscientific Non-Challenge to Meaning, Morals, and Purpose" by jurist Stephen J. Morse, argues compellingly so as to overturn much of the book. Morse maintains that neuroscience has not brought forward scientific grounds for a reductionism that reduces meaning, morals, and purpose to mere chimera. In addition, Morse argues that the denial of self, agency, responsibility, and desert collapses human dignity, undercuts justice, and fuels social coercion. Ironically, the last sentence of the book rebukes much of the book: "As C.S. Lewis recognized long ago (1953: "The humanitarian theory of punishment"), a system that treats people as responsible agents is ultimately more humane and respectful."

Readers with expertise in existentialist philosophy will be disappointed to find little recognition of, and less exploration of, features essential to this philosophy. While the book purports to be an attempt at relating existentialism's major tenets to neuroscience's discoveries, the book is largely a reductionist dismissal of all that existentialism regards as decisive. It remains puzzling that readers are told repeatedly that self, agency, assessment, and related notions have been rendered groundless because reducible to neurological processes, when readers, on every page, are asked tacitly to assess the evidence presented, weigh the arguments adduced, evaluate the proposals for social restructuring, and articulate consent or disagreement. What are these activities except those of a self, an agent—anything but mere synaptic firings? The title, *Neuroexistentialism*, appears to be a misnomer in that existentialism is mentioned only to be set aside; that is, neurology has rendered existentialism a phantasm.

Related to the above is the book's omission of the distinction between consciousness and self-consciousness. While it is indubitable that increasingly complex neural structures and mechanisms support increasing levels of consciousness, it is also recognized that increasingly complex neural structures are quantitative, while the shift from consciousness to self-consciousness is qualitative. There is no acknowledgment of this crucial matter on the part of those contributors who are most adamant about neurodeterminism (or near neurodeterminism). There is no suggestion of any acquaintance with, for instance, Roger Penrose's insistence that his book, *The Emperor's New Mind: Concerning Computers,*

Minds, and the Laws of Physics, cried out to be followed by his *Shadows of the Mind: A Search for the Missing Science of Consciousness* (by which he meant "self-consciousness"), which search remains "missing" for reasons that frustrate those wedded to naturalism but not those possessed of biblical faith. The latter are aware that human beings are human, ultimately, in that they are the recipients of God's address. According to scripture, the characteristic of God is that God speaks. Humans, then, are characteristically those who hear (and from whom God both invites and mandates a response). God is person par excellence; humans are person inasmuch as they are "personned" by the Person. Finite human self-consciousness, on this understanding, is an aspect of the image of that God who is possessed of infinite self-transcendence, and who therein allows us to know him truly and adequately yet never exhaustively.

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Science and Religion

PARANOID SCIENCE: The Christian Right's War on Reality by Antony Alumkal. New York: New York University Press, 2017. 256 pages. Hardcover; $35.00. ISBN: 9781479827138.

I was visiting Harvard University and could not resist the temptation to peruse the Harvard bookstore. After an hour or so of browsing science titles, I picked up some classic books on science, and this one caught my attention. Now that I have finished reading it, I have mixed feelings. First, I feel bad for this group of siblings in Christ (called here the Christian right) who are claiming to do apologetics by misusing science. Second, I am worried that several "normal" Christians are now paranoid.

Alumkal, Associate Professor of Sociology of Religion at the Iliff School of Theology in Denver, Colorado, writes with a strongly critical tone (as the book subtitle suggests) against the Christian right. But several of his critical affirmations could also be applied to mainstream Christianity. The book's thesis is that the Christian right in the United States, which he defines as a political movement of conservative evangelicals, uses a manipulative technique to influence society. This technique is defined as "Paranoid science." As a sociologist, the author describes how the Christian right misuses, fabricates, and misrepresents current science concerning origins, sexuality, bioethics, and environmentalism to fit its agenda, which is political control based in conservative Christianity. The Christian right's main point is to keep the Bible, or their interpretation of the Bible, as the rule for these topics. Any scientific affirmation against their view is considered a product of conspiracy, fraud, or an attack on moral values. Herein lies the paranoia.

The book is divided into four chapters, each one describing and criticizing the groups affiliated with the Christian right and concluding that they are paranoid and seek to spread their paranoia to the public to maintain political control. In the introduction, the author explains his approach and analysis. In chapter one, he critiques the intelligent design (ID) movement, particularly the views of Phillip Johnson. According to Alumkal, this movement considers its members to be loyal supporters of the truth and its critics to be biased due to their hatred of God. He concludes that ID is not just a pseudoscientific movement, it is a paranoid movement of neo-creationists.

In the second chapter, the discussion is on human sexuality and about the ex-gay movement, which considers homosexuality not only a sin, but also an aberration of human nature. They want to justify that affirmation not with the Bible alone, but also with science. After explaining the origin of this movement, he provides data that describes their wrongdoing by misusing the results of psychological studies. For Alumkal, it is impossible to change sexual orientations, and the movement's arguments to the contrary cause much damage to the LGBT community. Alumkal points out that some former leaders of the ex-gay movement are now detractors.

The third chapter is about bioethics. Alumkal muses on the discussion concerning the humanity of the embryo and the ethics of euthanasia. He argues that the claim that human life starts at conception, and the opposition to stem cell research, are based upon inaccurate data. While well-known evangelicals Charles Colson and Joni Eareckson Tada have argued that allowing abortion and euthanasia would collapse American society, Alumkal dismisses their beliefs as unfounded, just paranoia.

The fourth chapter deals with anti-environmentalism. Here Alumkal's focus is on the Cornwall Alliance and its leader, Calvin Beisner, with their aggressive campaign of "resisting the green dragon." For Alumkal, the efforts of moderate evangelicals, such as those in the Evangelical Environmental Network, to convince their fellows to become conservationists, have failed. He portrays Beisner and his association as hypocritical for accepting money from big industries to push a Christian right agenda on the environment. The opposition to climate change is not really scientific in nature, so they incited paranoia by calling on evangelicals to oppose those who put nature above God.

The dominion rule to subdue the earth should be "business as usual" for the Christian right.

In the conclusion, I was perplexed that Alumkal criticized Rick Warren's book *The Purpose-Driven Life* as a supporter of the false science of the Christian right. I read that book and also studied it in my congregation without noticing anything related to science or the Christian right. His criticism focuses on Warren's affirmation that the Bible is inerrant, which (to Alumkal) implies denying human reason. Furthermore, Alumkal quoted Mark Noll's books on the evangelical mind and affirmed that not much progress has been made. In conclusion, the Christian right is backing its affirmations with false science, promoting paranoia, and thus is highly detrimental to American society.

Christian readers (not just those sympathetic to the right-wing) will find some of the claims made in this book impossible to digest. Any conservative Christian who holds to the Bible as authoritative should note Alumkal's more liberal presuppositions about God, the Bible, and moral issues related to human sexuality. Sadly, Alumkal omits the moderate evangelical scholars who actively contribute to the conversations about these issues. After reading this book, anybody who is not familiar with Francis Collins, D. Gareth Jones, Mark Yarhouse, or Katharine Hayhoe would consider all evangelicals who comment on science as paranoid supporters of the Christian right. One wonders whether the author himself is, ironically, promoting an unfounded paranoia concerning evangelical Christians.

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TECHNOLOGY

TO BE A MACHINE: Adventures among Cyborgs, Utopians, Hackers, and the Futurists Solving the Modest Problem of Death by Mark O'Connell. New York: Anchor Books, 2017. 256 pages. Paperback; $16.95. ISBN: 9781101911594.

Mark O'Connell has produced a folksy account of his interaction with numerous leaders in transhumanism, "a liberation movement advocating nothing less than a total emancipation from biology itself" (p. 6).

Most of the book consists of accounts of visits with individuals and organizations representative of various emphases within this movement. The Alcor Life Extension Foundation is the world leader in cryonic preservation of a person's body (or just the head) after death, in anticipation of a time in the future when technology will exist to "resurrect" the person by uploading the pattern of neural connections in the cryonically preserved brain. (At the time of O'Connell's visit, it was preserving 117 "patients," including the head of baseball legend Ted Williams.) Carboncopies is representative of those seeking to develop "substrate-independent" minds, a technology that seeks to upload a person's mind into an emulation running on a computer. Grindhouse Wetware is representative of groups developing implantable technologies to enhance human sensory and other capabilities. (Even DARPA—the Defense Advanced Research Projects Agency of the Department of Defense—is supporting development of technologies to enhance the natural abilities of soldiers, such as exoskeletons.) Aubrey de Grey is representative of those working on radical life extension strategies that regard aging as a curable disease, making four-digit lifespans possible. The author also briefly discusses the idea of "the Singularity," an anticipated time when artificial intelligence will have surpassed human intelligence (somewhere around 2045 in the predictions of its most vocal proponent, Ray Kurzweil).

Though the emphases of those identifying with transhumanism are diverse, all look to technology to deliver them from the limitations associated with our physical bodies, including (but not limited to) aging and death, and hold "a conviction that we can and should use technology to control the future evolution of our species" (p. 2). Many view human beings as information currently encoded in a biological substrate that is a product of the vagaries of evolution, but which can (and should) be replaced by a superior version that is the product of technological design. Virtually all are devout atheists, looking to science rather than God for deliverance. As one put it, "Science is the new God … Science is the new hope" (p. 208).

O'Connell makes it clear that he is not a transhumanist, stating this explicitly at both the beginning and the end of the book. But he acknowledges a fascination with the ideas and aims of the movement, arising "out of a basic sympathy with its premise: that human existence, as it has been given, is a suboptimal system" (p. 2). While his basic approach is objective, there are numerous places where his sense of the strangeness of it all comes through.

Why should a reader of *PSCF* be interested in this subject? I admit that, as a reviewer, I approached reviewing this book with something of a sense of "why am I doing this?" Clearly, the foundational beliefs of the movement are directly antithetical to fundamental Christian beliefs about God, the good-

ness of his creation, and eschatology. (In fact, the author notes the affinity between the transhumanist aversion to the physical body and the ancient heresy of Gnosticism.) However, many of transhumanism's underlying ideas are part of the mental undercurrents of our time, such as the way we speak of ourselves in information-processing terms (for example, "I can't compute this"). Transhumanists take this perception of humanity to its limit. At the end of the book, the author sums up his experience this way: "I am not now, nor have I ever been, a transhumanist. I am certain I would not want to live in their future. But I am not always certain I don't live in their present" (p. 234).

Moreover, as the author notes throughout the book, the concerns that drive transhumanism (e.g., the reality of death) are similar to those addressed by religion and have a broad influence in society. For example, he notes that "Life extension [is] a long-term preoccupation for Google's founders Larry Page and Sergey Brin [and has] gradually become a part of the company's 'moonshot' culture" (p. 186). Additionally, Google's Vice President for Engineering, Ray Kurzweil, is the leading proponent of an upcoming technological Singularity. It is easy for Christians to forget the existential relevance of the fact that Christ has delivered "all those who through fear of death were subject to lifelong slavery" (Heb. 2:15 ESV).

This book was well written and enjoyable to read. It can serve as a helpful introduction to the subject for those desiring to know more about it.

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ALGORITHMS OF OPPRESSION: How Search Engines Reinforce Racism by Safiya Umoja Noble. New York: New York University Press, 2018. 256 pages. Paperback; $28.00. ISBN: 9781479837243.

Algorithms of Oppression is author Safiya Umoja Noble's polemic against the international search company, Google. Subtitled "How Search Engines Reinforce Racism," her book seeks to enlighten the reader on the impact that search results have upon the world, and how these search results commonly skew toward negative racial and social stereotypes. Her contention is that Google could change its algorithm to balance the results but refuses to do so, a contention which this reviewer questions.

The book of 186 pages, plus introduction and thirty-one pages of references, is divided into six chapters: (1) A Society, Searching; (2) Search for Black Girls; (3) Search for People and Communities; (4) Search for Protections from Search Engines; (5) The Future of Knowledge in the Public; and (5) The Future of Information Culture. It ends with a concluding chapter: (6) Algorithms of Oppression.

The author's points are as follows: First, the world relies on Google search results to gather, collate, filter, and deliver information, and the top 10 or 20 results are of utmost importance. Second, in the search space, Google is essentially a monopoly. Third, Google is not a public resource, but a company whose goal is to make money for its stockholders, not to deliver unbiased results. Fourth, Google's results are biased, although how their search algorithm works is private intellectual property. Fifth, the effects of biased results are far-reaching and destructive. Finally, Google could remove this bias from its algorithm but refuses, claiming that it is unable to do so.

Points 1, 2, and 3 are incontrovertible, and well supported by the author's references, anecdotes, and arguments. Points 4, 5, and 6 are not as well supported, yet they are the crux of the author's argument. The author certainly demonstrates that at the time of her writing, certain searches, for example, "black girls," provided top results that were primarily links to websites that were pornographic or hypersexualized advertising. Similar results are seen for "latina girls," "asian girls," and "hispanic girls." However, a search for "white girls," while producing some top-10 results that refer to pornographic sites, provided a much more balanced result.

The author produces a few examples of how Google seems to have "fixed" search results when some searches produced clearly racist results. One example is how Google responded to French and German laws stating that it is illegal to advertise or sell materials that deny the existence of the holocaust. When these governments informed Google that its search results provided links to such sites, Google responded by filtering the results to comply with the laws.

The author's contention from this example is that Google can alter its algorithm to produce unbiased results for *any* kind of search that may produce racist results. Google claims that its results are based on the well-known and well-published PageRank algorithm, and simply reflect what the public is searching for, what websites exist, and how they link to each other.

The book includes little proof that Google deliberately biases its results or can manipulate the results of any and all search queries that might produce socially and/or racially biased results. The author infers from news articles, interviews, research, and

anecdotes that the results could be manipulated to prevent the biases, but she has no proof, yet this is the raison d'être for the book.

Algorithms of Oppression is a difficult read. The book is full of long, convoluted sentences, and often reads like a PhD dissertation (and a cursory inspection online of the author's PhD dissertation seems to indicate that most of the thoughts, if not the actual text, are borrowed from her dissertation). For example, one part of a paragraph reads as follows:

> In this effort to try and make sense of how to think through the complexities of race and gender in the US, I resist the notion of essentializing the racial and gender binaries; however, I do acknowledge that the discursive existence of these categories, "Black" and "women/girls," is shaped in part by power relations in the United States that tend to essentialize and reify such categories. (p. 70)

Finally, the book, being essentially a polemic against Google, offers little in the way of solutions to the problem. We could protest against Google, and this might have an impact. Or we could take our business elsewhere. But, there are few alternative search engines to use that have the scope and depth of Google search. The author does highlight a few search engines designed to collect and curate references to more balanced and positive websites regarding African-American culture and racial issues. Yet, these search engines have little impact on the greater general public.

This book does offer important lessons: be cognizant of the issues, skeptical of search results, and thoughtful about the impact of search results. These are important lessons for users, including Christians, to remember. Google search is value-laden and Google is essentially a monopoly. Google generates revenue by promoting some companies' websites over others. Google's algorithm naturally promotes websites cross-referenced by other websites, and not all races, cultures, and subcultures are equally represented online.

As Christians, we should be informed about the factors that influence search results. Question what you find. Practice going deep into the results. Do not simply accept what you find in the first or second page. Scan lower-ordered results for alternative opinions and voices. Thoughtfully consider the impact the results may have on your decision making. Simply following the top results may lead you to have an incomplete understanding of important issues.

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THEOLOGY

EVOLUTION AND THE FALL by William T. Cavanaugh and James K. A. Smith, eds. Grand Rapids, MI: Eerdmans, 2017. xxix + 231 pages. Paperback; $26.00. ISBN: 9780802873798.

Books on the historical Adam and the Fall (into original sin) are multiplying in the current decade, particularly when considered against the backdrop of the ongoing dialogue of theology with the natural sciences. This book was sponsored by the Colossian Forum, an organization devoted to developing resources for churches to navigate cultural conflicts, funded by a grant from the John Templeton Foundation and mediated through the BioLogos Foundation's Evolution and Christian Faith project. As such, the ten chapters gathered together in this volume developed from a three-year initiative that took up the following question:

> If humanity emerged from nonhuman primates (as genetic, biological, and archaeological evidence seems to suggest), then what are the implications for Christian theology's traditional account of origins, including both the origin of humanity and the origin of sin? (p. viii)

The cumulative results are distinctive along the following lines when compared to the extant literature at this interdisciplinary intersection.

First, the conversation is ecumenically broad. The lead editors are a Roman Catholic systematician (Cavanaugh) and a Reformed charismatic and continental philosopher cum public intellectual (Smith), and contributors derive from confessions across the spectrum of Catholic-Anglican on the episcopal side to Wesleyan-Methodist on the more free church side, with others staked out all along the way in between. Although the various confessional identities are not conspicuous in every chapter, they are surely not absent, and, in a few cases, these are overtly factored into the analysis. The point is that the ecclesial dimensions of the discussion are neither muted nor marginalized, and when they are foregrounded, they provide windows into how to navigate the challenging questions at this interface in ways that involve, invite, and engage the richness and thickness of the church and its affirmations and even practices (see below) with the conversation.

Second, given the commitments of the BioLogos Foundation to foster Christian discussion about and openness to evolutionary understandings of the world and humanity's place in it, readers ought not to be surprised if the general scientific consensus

structures the discussion (the first two chapters in Part I on human origins and the biological sciences both presume and also establish the basic contours of the debate within an evolutionary environment). Hence, a first consideration of the book gives the impression that the authors have by and large accepted the evolutionary model and therefore sought to fit their work as biblical scholars, theologians, and cultural critics into that theoretical frame. Yet the essayists are also (mostly) established scholars in their respective fields and, when read carefully, can also be seen as working to clarify what the real issues are from their respective disciplinary perspectives, and to show how scriptural and theological commitments may foreclose certain understandings of evolutionary science but not all. In other words, there are nuances introduced, certainly, about how to understand the fall into sin, but there are also explications of the scientific data as well as implications for ongoing and further scientific exploration informed by theological (broadly considered) perspectives.

Last but not least, consistent with the Colossian Forum's mission to engage the ecclesial world, the project was infused from the beginning with a kind of liturgical flavor creatively adapted for the group meetings, and attentive readers might be invited to think about how some of the chapters of the book have been shaped by these Christian practices, providing the matrix from which theological theory emerges. In fact, this is the key feature of this text and its contribution to the theology-and-science (or religions-and-science) literature: that it is possible to engage the philosophical, scientific, and theological issues, not by avoiding, but by precisely situating in the context of practicing the faith.

So, for instance, one of the chapters ponders how ascetic practices are conducive for the formation of a more distinctively Christian way of looking at the world, so that we are attentive to cosmic fallenness on the one hand, but also imbued with eschatological hope for creaturely flourishing on the other hand. Or think about Eucharistic participation as initiation into the deepest mysteries of the Christian faith, and how such might prompt a poetically and aesthetically shaped vision of reality that then orients us toward the dark chaos of the so-called "first" Adam as well as to the luminosity of the "second" one. What is made explicit in these two essays may be less prominent in the rest of the book, but there are many other instances in which confessional practices and resources can be recognized as in play once the reader is primed to their presuppositional role in this project. As the editors put it in their introductory chapter, a substantively Christian imagination is honed through and fueled by liturgical and other forms of practices, so how might such practices be cultivated for perspective on these thorny questions of the present era? Put alternatively, specifically Christian thinking about science and faith, even about evolution vis-à-vis a fallen world, cannot but pass through the liturgical moments of faithful devotion.

Those for whom adjudication of the "evolution question" ought to be navigated empirically and scientifically may not appreciate the Colossian Forum's theological commitments and how such impinge on engaging even the scientific sides of such questions. On the theological side, the ecumenical breadth of the contributors ensures that however "the Fall" (in the book's title) is understood, such is irreducible to any dogmatic or confessional position, thus assuring that there is plenty of leeway for the various perspectives to comprehend such a fallenness within an evolutionary frame. It is perhaps also precisely in this vein that advocates of a more Augustinian or especially Calvinist notion of the Fall might object that theological sensibilities are hereby subordinated under currently popular scientific ideas that may turn out to be no more than fads in the long run. Or, of course, the scientific consensus could hold, in which case, the efforts to re-situate theological rethinking in relationship to such developments will continue to pay dividends to the faithful in that longer run.

Those looking for resources to inform faithful Christian engagement with the pressing questions posed by the evolutionary sciences in the contemporary context will come away with a broader sense for how matters are not merely theoretical but involve communities of faith. These can promote authentic Christian worship with and amidst, rather than silencing or purporting to definitively domesticate, such issues. *Evolution and the Fall* can be considered a success, although its use in ecclesial communities will need facilitators who can lay out the broader landscape and invite the group to consider that a variety of strategies are always needed to more adequately engage these complex matters.

Reviewed by Amos Yong, Fuller Theological Seminary, Pasadena, CA 91182.

Letters

The Fine Tuning of Life

In his article titled "The Fine Tuning of the Universe: Evidence for the Existence of God?" in the September 2018 issue of *PSCF*, Walter Bradley describes the extraordinary precision of the foundations of our universe that makes life possible. The amazing facts

that he presents fill us all with awe and wonder at the power and glory of God, the Creator of all things. He asks whether this might be considered evidence for the existence of God. His conclusion is that

> The "nature of nature," especially fine tuning, provides clear and compelling evidence for our all-powerful, loving Creator God, who can be seen through "the things that have been made, so that those who do not believe are without excuse" (Rom. 1:20).

I would like to suggest that rather than providing such evidence, the awesome magnificence of our universe is simply consistent with and understandable within the worldview of God the Creator of all things. I submit the following comments for your consideration.

The phrase "fine tuning of the universe" evokes the impression that the parameters of the universe are adjustable and that some agency is capable of making those adjustments. The question "why is the universe fine-tuned for life?" further presumes that the appearance of life ten billion years after the formation of the universe somehow affected that tuning. Since natural causes cannot anticipate the future, the obvious inference would be that an omniscient, omnipotent agent had an expectation for the appearance of life and adjusted the parameters accordingly. The perceived evidence of the existence of God may be due to the presupposition of the intention of life implicit in the way the question is asked.

However, the remarkable harmony between the universe and life can also be described as the "fine tuning of life." The question becomes, "Why is life fine-tuned for this universe?" This question has a natural sequence of cause and effect with the obvious answer of evolution. The awesome synergy between the universe and life arises from the evolutionary adaptation of life to this universe. The compelling inference from our observations is not that the universe was tuned for life but that life was tuned to thrive in this universe.

Furthermore, our concept of the origin of the universe is expressed in mathematical models, some of which are described by Bradley. In those models, it is easy to treat the constants as variables and to see what happens when they are modified. In this exercise, it is astounding to see the dramatic impact of even the tiniest variation to the point at which life could not exist. But the models give us no indication whether in nature those constants are in fact variable and could have had other values. We have no knowledge of how those constants obtained their values, whether any are related to each other, or if they could have been or needed to be adjusted by some agent. It may be only in our models that the values can be tuned. Perhaps the real mystery is centered on the very existence of the universe rather than its precision. We need to acknowledge a large dose of humility in our lack of knowledge of how the constants acquired their values.

The apostle Paul was not thinking of western scientific logic when he wrote the book of Romans. He was not predicting that cosmologists could and would someday discover facts that would provide evidence for the existence of God. Rather, he speaks to the emotive awe and wonder that every human being living in every era can experience in their perception of the world in which we live. That is a universal insight that leads to the inexcusability of unbelief for everyone, not just scientists studying the universe. Paul says that nature shows the eternal power and divine nature of God, presuming that the existence of God is a given. Bradley perceives from nature that God is "loving" though Paul gives no such indication. Only if love is defined as causing something to exist could it be inferred from the observations of our universe.

Instead of seeing the amazing precision of our universe as evidence for the existence of God, I suggest it is the existence of God that helps us understand our universe. Faith comes first and, as the writer of Hebrews put it, is the "evidence of things not seen." Once we acknowledge the existence of God, the Creator of all things, we can recognize his hand in the beauty of the universe and its amazing precision and mathematical structure. It seems analogous to the well-known quote from C. S. Lewis in *The Weight of Glory*, "I believe in Christianity as I believe that the Sun has risen, not only because I see it but because by it, I see everything else."

Randy Isaac
ASA Executive Director Emeritus

Response to Letter from Randy Isaac

I appreciate the letter that Randy Isaac wrote in response to my article "The Fine Tuning of the Universe: Evidence for the Existence of God?," *PSCF* 70, no. 3 (2018): 147–60. While we agree that God's creation provides some warrant in support of belief in theism, we follow two different paths to get there. I will try to clarify exactly what these differences are without misrepresenting Isaac's argument. We have been having a cordial conversation on this topic for several years.

First, Isaac interprets Romans 1:18–20 as Paul appealing *only* to the "emotive awe and wonder" that every

human being living in every era can experience. In the article, I claimed that the "nature of nature," especially fine tuning, provides clear and compelling evidence for our all-powerful, loving Creator God who can be seen through the things that have been made. Isaac argues that Paul does not claim that nature demonstrates God's love. My intention in the above sentence was to argue that God's existence is evidenced in nature (as Romans 1:20 clearly states), but not to claim that all of God's attributes are seen in nature. For example, God's love is demonstrated much more profoundly in Christ's sacrificial death on the cross for us.

I asked John Collins, Professor of Old Testament at Covenant Seminary (St. Louis), what he thought would be the consensus contemporary interpretation of Romans 1:18–20 by evangelical scholars. Here is his answer.

> My own research of late has involved studies in how Jews in the Greek-speaking world interacted with their philosophical environment, and how those interactions were picked up by the early Christians. In that light (as I have shown in a few places), it becomes pretty clear that Paul in Romans 1:20 is invoking a well-recognized design discussion in the Greek-speaking world, and that discussion is not limited to the perception of beauty (although that is included). This was certainly a common perception in the Greek-speaking Christian community.

I would agree with Isaac that if one already believes that there is a God, then the beauty in nature is consistent with and supportive of this belief. And in the early centuries of the Church when most people believed in some kind of God, the beauty in nature was a confirmation. However, centuries later with the development of modern science and enlightenment skepticism, the emerging recognition of the mathematical forms in nature and other design features, provided clear and timely support for the theistic worldview "through the things that have been made so that those who choose not to believe are without excuse." In my article, I quoted Leonard Susskind, one of the leading agnostics and a string theorist (p. 158), who calls "fine tuning" the "silent elephant in the room … and a huge embarrassment to physicists …" I found not one agnostic who was troubled by "the beauty in nature."

Second, Isaac seems to be troubled by my presumption that the universal constants could have potentially had different values or that the mathematical forms of the laws of nature could have been different than they are today. We do not know why our natural world has the forms and values that it does, though I presume that God did ultimately create a universe with mathematical forms and a group of universal constants that he knew would provide the necessary habitat(s) for life.

Third, Isaac argues that whatever this universe was like, evolution might prove to be sufficiently robust to facilitate adaptations that could accommodate to a wider range of life forms. This article has described in detail the minimum requirements for life of any imaginable type and why these requirements are so difficult to meet. Looking around our solar system and the larger universe, the complete absence of any evidence of life outside of planet Earth is telling. Life does not seem to be inevitable. It can only exist, and even flourish, under very special conditions which our solar system and planet Earth provide uniquely.

Fourth, Isaac claims that the real mystery may be "the very existence of the universe rather than its precision." I would agree that how the universe exploded into existence out of nothing is a mystery, and I suspect that this phenomenon is well beyond the reach of modern science.

Isaac concludes with Hebrews 11:1 and the claim that faith must come first and then "evidences" can be used to support that which I have chosen to believe. As I read the gospels, it seems to me that Jesus does not usually call people to accept him as the Messiah because he claims to be. Rather, Jesus performs miracles which he calls signs, in order to provide warrant for people to accept his messianic claims. John 20:30–31 says, "Many other signs Jesus therefore also performed in the presence of the disciples which are not written in this book; but these have been written that you may believe that Jesus is the Christ and that in believing you may have life in his name." In John 15:24, Jesus said, "If I had not done among them the mighty works which no one else did, they would not be guilty of sin; but now they have both seen these mighty works and hated me and my Father as well." God had Moses do five miracles for Pharaoh who hardened his heart and rejected the supernatural signs Jehovah God had provided. Thereafter, God hardened Pharaoh's heart.

In each of these stories and many others, God gives more than ample warrant for people to believe in him, but he seldom seems to ask people to believe without some kind of evidence. God does not call people to "blind faith." His resurrection from the dead, which he predicted at least twelve times, was his ultimate Christian apologetic. Alternatively, there are several examples in which followers of Jesus exclaim that "I have believed and have come to know …" It appears that mustard seed faith and

evidence are both essential for a person to develop a healthy, well-rounded faith. My faith growing up was primarily experiential, but during my college years (out of necessity) became better balanced with evidential support.

Famous Christian apologists of our time such as Norman Geisler and William Lane Craig use a two-step apologetic in which evidence for the existence of God such as "fine tuning" is offered to demonstrate the possibility that there might be a Creator-God after all. Once belief in God's existence has been shown to be plausible (but not yet proven) using scientific apologetics such as fine tuning, then the historical evidence for the resurrection becomes more compelling. It seems to me that a two-step apologetic is much more effective than a single-step apologetic. It appears that Jesus often used it in his ministry, doing miracles before claiming to be the Messiah.

Most importantly, Isaac believes that one should not posit fine tuning as the starting point to justify belief in a theistic God. Rather, he believes that we should posit the existence of God first and look for evidence in nature that seems to support this belief, including characteristics of nature that appear to be fine tuned. I prefer inference to the best explanation, which in the case of "fine tuning" would be an intelligent cause. Does the universe seem to have "just happened" or does it appear to be a finely tuned universe that plays an evidential role in providing warrant for belief in a theistic creator? Isaac prefers to believe that faith is primary with fine-tuning and other arguments being supplemental and confirming. I believe that fine tuning provides one of the best arguments for the existence of an intelligent creator, which makes historical arguments for the resurrection all the more plausible, which in turn make the step of faith to belief in the Christian message accessible.

Walter Bradley
ASA Fellow

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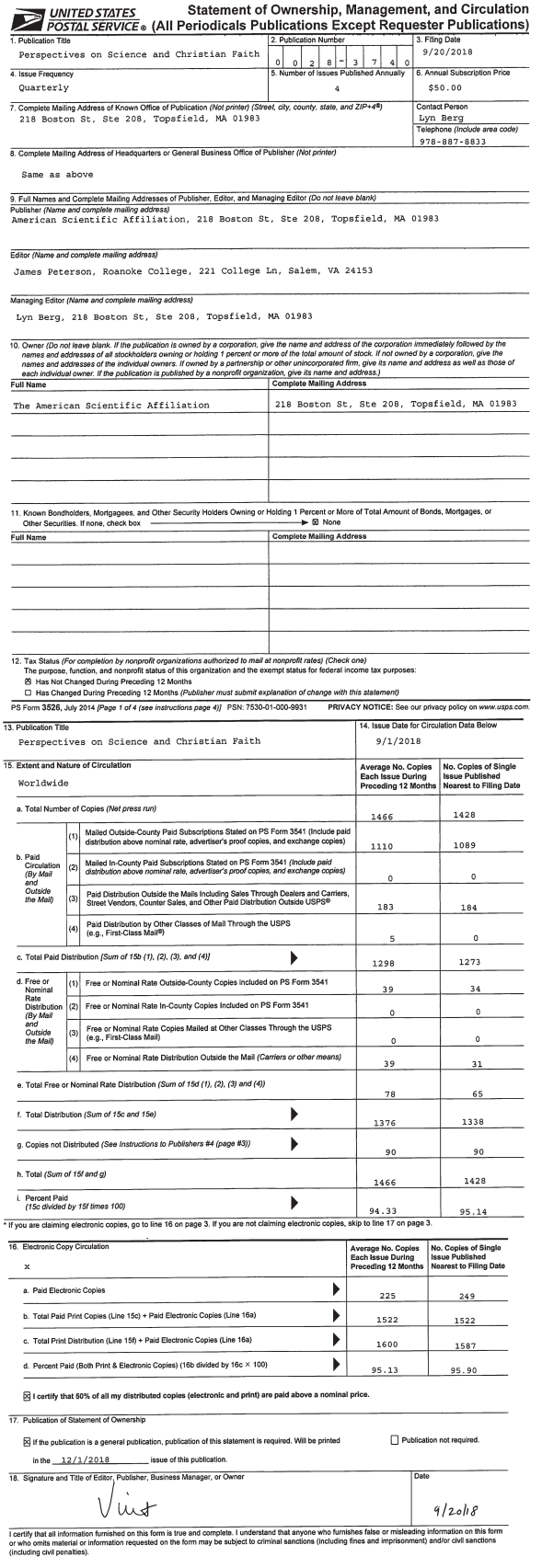

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