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Pursuing Faith in Good Science: A Neuroscience Student's Argument for Including Science in Spirituality

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"If the concept of God has any validity or any use, it can only be to make us larger, freer, and more loving. If God cannot do this, then it is time we got rid of Him." This James Baldwin quote sums up my journey (and struggle) to place spirituality in the world. This quote implies an interest in God, paired with a resistance to adhere to any specific religious doctrine if it does not actually create love. Baldwin calls upon a spirituality that must be awake and alert: tuned in to the needs of the world. This kind of spirituality must include science. In some instances, science has been put at odds with religious doctrine, decreasing the knowledge, power, and general understanding of all involved. Including science within our sense of spirituality is essential. First, science allows us to truly appreciate the striking complexity of the physical world. Second, science allows us to better understand the iron clad connection between our biology and our psychology. Finally, science points to our tendency, as conscious beings, to look for meaning and create purpose. If we embrace science, our spirituality will grow due to the knowledge that we will gain. With this knowledge we have the power to help ourselves, to advocate for each other, and to protect our planet.

Spirituality, as defined by the Oxford Languages, is concerned with care for the human spirit rather than material things (Oxford Languages, n.d.). This definition of spirituality does not include the physical world. In this paper I will be advocating for a sense of spirituality that includes what is physical. Specifically, I will be advocating that we embrace the chemical, biological, genetic, and environmental mechanisms that produce our individual experiences of being human. What is often considered the human spirit is actually our subjective experience as it is produced via a physical system, the brain. Specifically, everything that we think, feel, and

experience stems from chemical and electrical activity within the brain (Churchland, 2014). This reality can be empowering if we take the time to understand it.

Most people will encounter science and spirituality during their lives. Weddings and funerals are often locations in which spirituality is called upon. Doctors' appointments, and discussion about health, require the input of scientific professionals. Additionally, many people engage in scientific discussions at school, work, or politics. Given the coexistence of these disciplines in our everyday lives, individuals often hold a cognitive dissonance when it comes to reconciling science and spirituality. The purpose of this essay is to close the gap between the two, by redefining spirituality to include what we can learn about the world through scientific research.

Each individual, whether religious or not, can increase their sense of spirituality by embracing scientific discovery. Religion is not empirical in the same way that science is, therefore these disciplines occupy different spheres. Science starts from the ground up, with falsifiable questions, testing phenomena that we observe in the world around us. Religion jumps straight to answering the "Why are we here?" and "How are we here?" questions of the universe. Despite these differences, both attempt to explain the nature of the world. In recent years there has been an increase in people who identify as agnostic, atheist, or simply without religious affiliation (Pew Research Center, 2020). This may indicate that the relevance of religion is decreasing in the lives of some individuals. Perhaps this trend is the result of science getting closer and closer to having answers for big questions, such as the origin of our existence in the big bang, the evolution of humans, or the mechanism of our consciousness.

God in the Gaps and Ambivalence

Throughout much of history, but most pervasive in the nineteenth century, belief in God has been centered around the gaps of human understanding. Take, for example, the instance of Galileo and the Catholic Church. Galileo was tried and put on house arrest in 1633 by the Catholic Church for supporting the Copernican theory of the solar system (Livio, 2020). The Copernican theory states that the earth is not at the center of the universe, but rather that the planets in our solar system circle the sun. When Galileo was using his telescope, he discovered that Jupiter's moons circle Jupiter, and that Venus circles the sun. From these observations, he understood that Copernicus must be right: the earth must also circle the sun (Churchland, 2014). Galileo's book publishing this hypothesis was banned and he was forced to recant his hypothesis (Leveillee, 2011; Livio, 2020). Nearly 400 years later, the Catholic church conceded to this hypothesis, acknowledging that the sun is the center of the solar system (Churchland, 2014). Unfortunately, Galileo died while still on house arrest (History, 2009).

Rene Descartes, influential mathematician, philosopher, and scientist in the seventeenth century, is most remembered for his dualist perspective. He believed that humankind was both soul and body. For his purposes, the soul is equivalent to the mind. Descartes made a clear distinction between mind and matter, the body is physical while the ability to think is intangible (Gazzaniga et al., 2019). From this perspective, conscious experience is outside of the realm of science because it is not physical and therefore cannot be measured. When I refer to the soul in this essay, like Descartes, I am referring to humankind's conscious awareness of a self, which includes the mind (Britannica, n.d.). In contrast to Rene Descartes, however, I want to argue that the soul and the body cannot be separate because our sense of self is produced by our brain. Interestingly, Catholic theologian Thomas Aquinas also argued that the soul was dependent on the human body (Britannica, n.d.).

In the case of Galileo, increased knowledge about the nature of our universe and thus our existence, that didn't point to humans as the very *center* of everything, led to rejection of the Copernican model. New ideas require individuals to adjust their previously held beliefs, and thus new ideas are often met with resistance. Psychology research on attitude ambivalence has shown that when information arises that increases ambivalence, the ability of individuals to process this information decreases. However, when information arises that decreases ambivalence, it can be processed more fully (Clark et al., 2008). Cognitive dissonance is uncomfortable, and it can be easier to elect not to believe in anything that challenges your beliefs, even in the face of evidence. In this case, it was easier to arrest Galileo and ban his book than to rethink church teaching about the universe.

This conflict between spirituality and science is unnecessary. Further, it does an injustice to both disciplines. A person can disregard what has been discovered and supported by scientific evidence if they so choose, but as a consequence they have closed the door to increasing their understanding of the natural world. Through science, we are gaining an ever-increasing awareness of the universe. Thus, the act of confining God to what is supernatural yields an ever-decreasing image of spirituality. With this logic, the more humans know, understand, and can explain about their world, the smaller their God becomes. To place the pinnacle understanding of spirituality on what is unknown, will only lead to a narrowing of spiritual understanding as more discoveries are made. Is there a way that we can redefine spirituality so that it is not entirely dependent on the existence of some immeasurable phenomena? How can we learn again what it means to be spiritual so that each time we make a new scientific discovery, it increases our sense of spirituality?

The World is Complex and Dynamic

Embracing scientific discovery does not have to decrease one's sense of spirituality or alienate one from their religion. Embracing scientific exploration reveals an incomprehensibly complex world that offers splendor and awe to those who look upon it. Any student of science is quick to learn that much of what is perceived as ordinary and simple, is actually very complex, such as the changing of the seasons or a heartbeat. Taking a moment to have reverence and respect for the intricate physical world, is one new way of understanding spirituality.

Does it make it any less "spiritual" to practice yoga or meditation if you understand that the state you are accessing has a biological basis? Neurophilosopher Patricia Churchland states that she is an atheist, but that when she goes kayaking early in the morning and watches birds fly overhead and takes a moment to take it all in, she feels spiritual. Churchland believes that the practice of philosophy should be based upon an understanding of neuroscience. In other words, "to understand the mind, we must understand the brain" (Churchland, 2022). The spirituality that Churchland experiences has the potential to be limitless because of the ways that she embraces learning about the world around her.

Recently, I volunteered in an elementary school in order to teach fifth graders neuron anatomy. They traced the outline of their hand and arm onto a piece of paper. Much like the hand-turkey activity at thanksgiving, we colored in our hand-neurons, labeling different parts. The fingers were dendrites, the part of the brain cell that receives information. The palm was the soma, the part of the brain cell that contains DNA. Finally, the arm was the axon, which carries information to other cells in the brain and body. My peers and I gathered the kids into a circle and had them join their neurons. There were fifteen neurons in our circle, or our "neural network." Fifteen hand-drawn images of neurons, and I was feeling blown away thinking about all of the glutamate, GABA, dopamine, or serotonin that might be flowing between fifteen

neurons. Several glial cells, known for their role as helper cells to neurons, would also be needed to sustain a neural network. We asked the students to guess how many neurons were in their brain. Someone guessed one hundred, someone guessed a trillion. The right answer is 86 billion neurons; 86,000,000,000 neurons are in your brain! Elementary schoolers also learn astronomy. For reference, there are one hundred billion (100,000,000,000) stars in the Milky Way galaxy (European Space Agency, n.d.). To those that do not think science can evoke reverence, awe, or spirituality, I would like to kindly ask them to reconsider.

We are Complex and Dynamic

Identifying the brain as the basis for what we call the soul can come across as demeaning if we gloss over the complexity of how this works. The idea that the self is the product of our brain life is not popularized. When individuals are confronted with this idea they often find it depressing or demeaning. When individuals such as Patricia Churchland (2014) have the audacity to ask, “What happens when we accept that everything we feel and think stems not from an immaterial spirit but from electrical and chemical activity in our brains?” they can often be met with resistance. One reason for this response from the public is lack of exposure to this concept. Learning that the brain is responsible for much of our emotional, motivational, and social life is commonplace in college-level cognitive neuroscience classes, but not commonplace (or required) in other spheres. Repeated exposure to this concept makes it easier to digest.

Another reason that this idea is often met with discomfort is that it is, for most people, a leap from the reality that they experience on a day to day basis. The idea that we are entirely physical creatures who are conscious via our biological mechanisms, is scientifically supported and logical to many experts. Yet, the truth of this concept is not dependent on our awareness of it. We live complex emotional and intellectual lives. These lives can feel far removed from the

reality that we are made of the elements on the periodic table. To remedy this perceived distance, one should be careful not to oversimplify. The progression from individual chemicals to humanity's sense of self, requires layers upon layers of organization. This organization was facilitated by billions of years of evolution. Nothing about this progression is simple, fast, or insignificant.

Make no mistake, we are not "just chemicals," or "just atoms!" We are not *just* anything. We are various types of atoms, bonded together to make an infinite number of chemicals, which are ordered and grouped into the macromolecules that sustain life. The chemicals in our brain can also be ordered and grouped into proteins which read and express DNA. DNA, with the help of proteins, copies itself so that a living creature can grow. During meiosis, or the replication of sperm and egg cells, an exchanging of genes between chromosomes occurs. This exchange, called crossing over, produces a genetic variation that ensures there is no one exactly like you, with the exact same genetic code (Dawkins, 2016). Likewise, there is no one who grew up in the same combination of emotional, cultural, circumstantial experiences as you.

As human beings, our biology interacts with the world around us. A strong example of how our experiences physically shape us is the way that connections in the brain, or synapses, strengthen after periods of learning. Conversely, if a skill is not used for a period of time, we lose the ability to perform it as easily because the synapses between neurons weaken (Purves et al., 2019). When we say that our brain constitutes our sense of self that is not to say that the brain is stagnant. The brain is adaptable. Thus, it is no trivial statement to point out that our identity is the result of electrochemical processes in the brain. It is not inherently degrading unless we believe it to be so.

A newfound understanding of spirituality should own our gaps in understanding, while also recognizing that our understanding is increasing rapidly. We do know that our biological mechanisms shape our psychological experiences. Conversely, we know that the psychological experiences that we have as we move through the world shape our biology.

Biology Impacts our Psychology

Biologist Robert Sapolsky asserts that there is just as much of a biological mechanism behind depression as any other kind of condition that we would undoubtedly identify as physical, such as type one diabetes. Specifically, the neurotransmitters norepinephrine, serotonin, and dopamine are all implicated in the psychological experiences of depression. Some of the common symptoms include anhedonia, or inability to feel pleasure, obsessive grief or guilt, and psychomotor retardation. The quality of life of someone with depression is impacted by these symptoms. Interestingly, each symptom can be associated with a specific neurotransmitter. Dysregulation of dopamine is related to anhedonia, serotonin is related to obsessive grief or guilt, and norepinephrine is related to psychomotor retardation. The physical mechanism of depression suggests that our biochemistry shapes our psychological reality (Stanford, 2009).

Another example of a biological process that impacts our psychological state is our endocrine system. Hormones act as chemical messengers, sending information through the bloodstream and into tissues (Endocrine Society, 2022). The study of sex hormones is a growing field, particularly how they facilitate more than reproductive function. Sex hormones also influence the way that we think, feel, and experience the world. During the follicular phase of a woman's menstrual cycle, levels of the hormone estrogen are high. During this phase naturally cycling women move more and eat less. They have more energy, higher sex drive, and better memory, as well as improved cognitive perseverance and learning capabilities. During the luteal

phase of the cycle the hormone progesterone is released at dominant amounts compared to estrogen, and this is the time in which PMS and menstruation are well known for making women feel less than perfect (Hill, 2019). Men, on the other hand, don't have monthly cycles, but their hormones fluctuate often. Testosterone plays a role in competitiveness and self-esteem. Low testosterone is linked with many issues, including sleep disturbances, low energy, and low motivation (Pietrangelo, 2018). Men and women are both hormonal beings; both members of the animal kingdom. Hormones are a part of us, not an external force acting upon us. They are utilized by the brain to help create the experience of being human (Hill, 2019).

Psychological Experiences Shape our Biology

Interestingly, this biological-experiential connection is bidirectional. Our biological processes powerfully shape our psychology, *and* the psychological experiences that we encounter shape our biology. Our biological selves are impacted by the experiences that we accumulate throughout life. For example, levels of testosterone are responsive to many environmental stimuli. Interestingly, both the presence of a woman and the presence of a gun increase levels of testosterone (Vandermeij et al., 2008; Klinesmith et al., 2006). Additionally, after Barack Obama won the 2008 election, a sample of male Barack Obama voters had testosterone levels that remained stable, while testosterone levels in a sample of John McCain voters declined (Stanton et al., 2009).

The universal experience of stress is another great example. During stressful situations, the brain, specifically the sympathetic nervous system, initiates the release of cortisol through the hypothalamic-pituitary-adrenal axis. Cortisol plays an important role in this process because it mobilizes stored energy in order to deal with stressful situations. After the stressor is gone, the parasympathetic nervous system promotes recovery.

Typically, cortisol levels are high in the morning and gradually decrease throughout the day. Particularly challenging or threatening situations elevate cortisol. Acute stress can impact your ability to sleep because cortisol prepares you for fight or flight. Additionally, chronic stress, or repeated activation of the stress response over long periods of time, can have damaging effects on the body (American Psychological Association, 2018). Cortisol is essential for dealing with stress because it has anti-inflammatory properties. However, chronic stress may lead to cortisol dysfunction, leading to increased inflammation (Hannibal & Bishop, 2014).

Just as uncontrollable stressors in our lives can impact our biology, the ways that we cope with this stress can modulate the potential negative impacts on our bodies. To release a period of acute stress and promote recovery via activation of the parasympathetic "recovery" nervous system, you have to complete the stress cycle. This can be done in a number of ways, including exercise, deep breathing, physical affection, a creative outlet, even laughing or crying (Nagoski & Nagoski, 2019). This completing of the stress cycle allows cortisol to return to normal levels.

Biology and Psychology are Interwoven Tightly

The theory of constructed emotion provides another example of how our biology and psychology are interwoven. The theory of constructed emotion is very different from the classical view of emotion that proposes that any given emotion, whether it is anger, happiness, or sadness, are universal across cultures and even have some sort of distinct biological fingerprint. Instead, your brain utilizes your context to produce your emotional experience. Context refers to both the situation of the moment, specifically what is going on around you, as well as your life experiences, culture, and social role. It also includes your internal bodily state (Feldman-Barrett, 2018).

In a famous experiment in the 1960s, psychologists Stanely Schachter and Jerome Singer gave participants epinephrine, also known as adrenaline, without the participants' knowledge. Depending on the context that these participants were in, they experienced the impacts of this neurotransmitter differently. If the participants were in the room with someone that was acting happy, they were more likely to experience the epinephrine as euphoria. If the participants were in the room with someone that was demonstrating anger, they were more likely to interpret the arousal as anger (Cherry, 2019). To the brain, the input from your body is another sensory stimulus, much like that of external sensory stimulus, that it must make sense of. A simple ache from your stomach may be interpreted, if it is before dinner time, as hunger, or if you are in a situation requiring you to make judgments about someone, you might understand the stomachache to be a gut feeling that they are untrustworthy (Feldman-Barrett, 2018). These examples further argue that what we experience as very personal (our emotions), have a neurological basis.

This biology-psychology connection is not only bidirectional, but also circular. We are born with a set of genes. Our psychological experiences help determine which genes are expressed. Expression of certain genes trigger the onset of biochemical processes that shape our psychology, such as in depression. To revisit an earlier example, experimental psychology has shown that repeated uncontrollable stress in an individual's life increases their risk for major depression. This is particularly true when a large stressor occurs at a young age. There is a gene that predisposes an individual to developing major depression, but it only results in depression if they come into contact with major stress (Stanford, 2009). The biochemical mechanism of depression produces a profound psychological impact. Because depression has both a biological and psychological component, treatments for depression include medication as well as

psychotherapy (Mayo Clinic, 2018). For the purposes of writing about biology and psychology in an essay, it is easier to discuss one component acting on the other. In reality, biology and psychology are interdependent.

Consciousness

Thus far I have defined spirituality as an act of recognizing the incredible complexity of the universe, as well as acknowledging that we experience the dynamic world in a physical way (via a system, our brain and body, that is dynamic as well). Next, I am going to introduce the connection between spirituality and consciousness. The most intimate and potent moments of our lives have their basis in hormone and neurotransmitter activity, but our subjective experience of these mechanisms cannot be measured. Take love, for example. The components of romantic love include lust, attraction, and attachment. Interestingly, testosterone in both men and women is implicated in the experience of lust, with some women reporting that high levels of estrogen also increase their sexual motivation. Dopamine, known for its role in the brain's reward system and governing role in addiction behavior, is implicated in the experience of attraction. Oxytocin and vasopressin are implicated in attachment (Wu, 2017). Oxytocin is sometimes referred to as the love hormone because it facilitates childbirth, promotes bonding, and is released when you fall in love (Watson, 2021). While lust and attraction are specific to romantic love, vasopressin and oxytocin are implicated in romantic love, familial relationships, and friendships (Wu. 2017). Your brain responds to the loved ones in your environment to create the multi-dimensional experience of love. Although the psychological experience of love is created by your brain's physical mechanisms, the feeling itself is not something that can be isolated.

Similarly, the default mode network (DMN) is a collection of brain areas that are active when individuals are not engaged in a cognitive task. Specifically, these brain regions are

detected during a resting state, and thus the DMN is thought to be implicated in internal mental state-processes, such as interoception, self-referential processing, future imaging, or autobiographical memory retrieval. The DMN includes the posterior cingulate cortex, precuneus, medial prefrontal, and inferior parietal cortices (Ekhtiari & Paulus, 2016). Although the activity in these brain regions can be identified using an fMRI, a specific individual's daydream itself cannot be captured in essence. Psychological concepts such as love and self-reflection are experienced by each individual through means of their consciousness.

The Mind-Brain Problem and Hierarchical Theory

Cognitive neuroscientists are familiar with the mind-brain problem: how can a physical system produce our intellectual and emotional consciousness? How can biology (something we can look at under a microscope), produce our consciousness (something subjective and unquantifiable)? Further, how is it that we have the experience of being one unified entity, when we are made up of various systems, circuits, organs, and anatomical structures?

Our brainstem, the evolutionary oldest part of the brain, is primarily responsible for core consciousness, defined as wakefulness or awareness of the organism in the present. Additionally, the cortex is primarily responsible for creating a sense of self and orienting the organism in time. This involves a memory of past events and prediction of future events. This is referred to as extended consciousness. When I refer to consciousness in this essay, I am referring specifically to extended consciousness. Another way to think about extended consciousness is that it is meta-consciousness, or subjective experience as a "self."

Consciousness is, according to one theory, the outcome of hierarchical organization. Understanding this organization can help bridge the gap that is the mind-brain problem, or the gap between the firing of neurons and our thoughts. As Gazzaniga et al. (2019) characterize it,

your brain is “a system of systems.” Some examples of systems in the brain are the olfactory, visual, and motor systems. Each of these systems is made up of multiple layers. In order for these layers to function as a joined system, they have a hierarchy. Layer 1 receives inputs and creates an output which it passes to layer 2. Layer 2 creates an output that becomes the input for layer 3, and so on. The individual processing details of each layer is hidden from the next layer. The only thing of importance is the output from lower layers to subsequent layers. In other words, in order to process the output from layer 2, layer 3 does not need to know how it was produced, it only needs an input structured in a specific way. We do not have to be aware of the way that our genes are transcribed from DNA to RNA, and translated from RNA to protein, in order to be impacted by the consequences of the expression of our genes, such as having curly or straight hair. Nor do we have to be aware of the anatomy of consciousness to be conscious individuals (Gazzaniga et al., 2019).

Higher and Lower Order Processing

We are consciously aware of deciding to perform more tasks, actions, and behaviors than we actually are in control of. This can be understood by learning about higher and lower order processing. Lower order processing is outside our conscious awareness. It is responsible for both sensory and conceptual experiences. Our higher order processing is responsible for making the outcomes of these processes known to us. There are many behaviors and decisions initiated and executed at a lower level of processing, that the conscious brain presumes responsibility for even when that is not the case. Experimental evidence to support this comes from studies on split-brain patients, who have the connection between the hemispheres of their brain severed.

A split-brain patient that received a visual cue to their left visual field to stand (processed by the right side of the brain), cannot remember being cued to perform this action. The left side

of the brain is language equipped, and so to this person, the desire to stand occurred outside of their conscious understanding. When asked why they stood up, the participant informed the researcher that either they had a sudden urge to stand or that they simply had an impulse to stretch. In other words, they make up a reason for standing. Our consciousness accounts for actions that were executed at a lower level, to maintain a sense of unity (Ledoux & Silva, 2020). Essentially, because the participant does not know why they suddenly decided to stand, they subconsciously made up a convincing reason. They have to deceive themselves because they don't have conscious access to the information presented to their left visual field, which contains the true reason for why they stood up.

This observed phenomenon in split-brain patients can be connected to consciousness, free will, and higher and lower order processing. Actions that our lower order processing performs, are made known to us by higher order processing, and our conscious selves come up with a reason for why we just performed such an action. Even if the action was executed outside of our conscious will, we still believe that we consciously decided on it. This is a powerful example of the recurring theme of eliminating ambiguity. The human mind is geared towards avoiding cognitive dissonance by resolving ambivalence (Ledoux & Silva, 2020).

It is fascinating that we are in conscious control of fewer of our behaviors than we think we are, and that our brain attempts to explain our lower-order actions in retrospect as something that we consciously decided. It is humbling, if not frightening, to think about. Regardless, it does seem that our consciousness and our reasoning do have control when needed, like the driver that can step in to guide the Tesla operating system out of danger. Are our lower-order processing behaviors that happen before we are consciously aware of them something to fear? Does the existence of this phenomenon mean that we have less free will than we think we do?

Respectively, no and maybe. Our lower-order processing behaviors happen outside of our conscious awareness, *and* they serve us well. The different levels of processing were produced by evolution, which is geared towards survival and efficiency. It is likely a much more efficient survival mechanism to have a substantial amount of processing occur outside of our awareness, because this takes some of the decision-making load off our conscious brain.

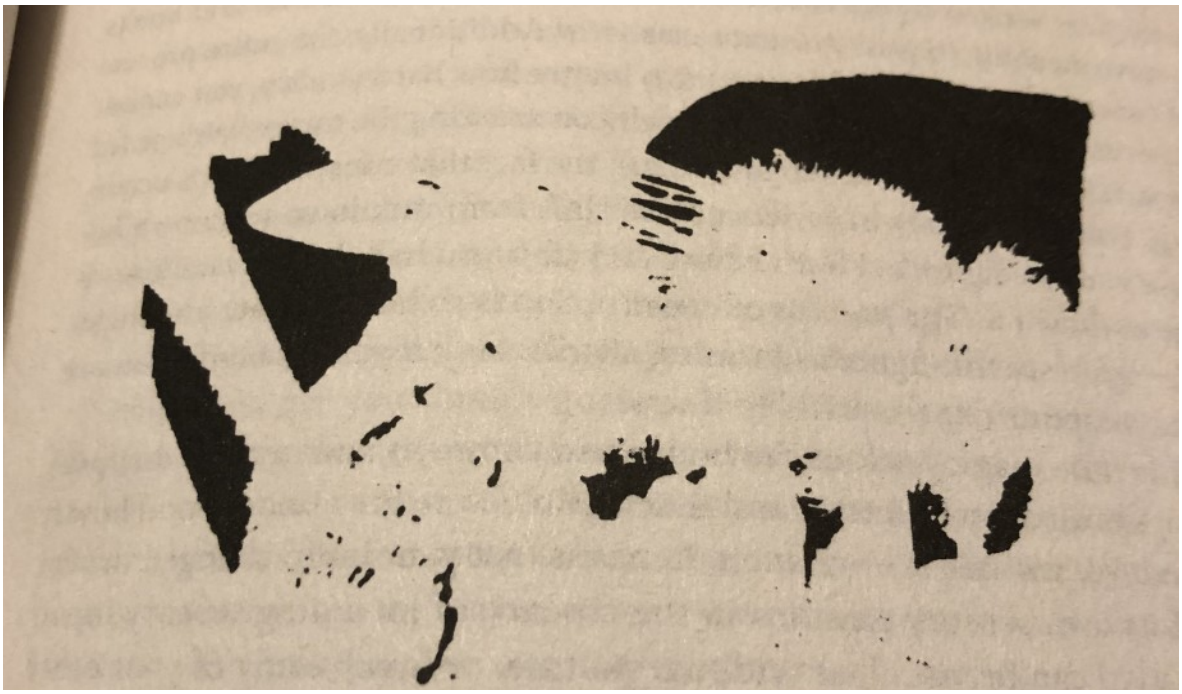
We Have the Ability to Create Meaning

The study of neuroscience through the lens of evolution reveals that the brain is concerned with identifying what is most useful rather than what is most true. Past experiences assign meaning to current stimuli (Feldman-Barrett, 2018). Specifically, context is something that the brain takes into account when identifying images. Feldman-Barrett demonstrates the importance of context in the visual system using two images. First, look at the black and white image at the start of the next page without reading further. Next, turn to the end of this paper and see the additional image. Now when you look back at the first image, it is difficult (read impossible) to "unsee" the bee in the black and white image. This is the transition from experiential blindness to perceptual learning. Once you have assigned significance to something it is difficult to undo it (Feldman-Barrett, 2018). This perceptual learning is robust because it is an advantageous and evolved mechanism (Gold & Watanabe, 2010).

This image is representative of how the brain is continuously constructing expectations for future events using past experiences. In each situation, your brain is working to predict what is most likely to occur. Prediction error occurs when your brain does this incorrectly. Take the following sentence as an example:

Figure 1

Experiential Blindness Image



Note. Image pulled from *How Emotions are Made* by Lisa Feldman-Barrett (2018).

Once upon a time, in a magical kingdom far beyond the most distant mountains, there lived a beautiful princess who bled to death (Feldman-Barrett, 2018).

If the last three words were unexpected, this is because you are used to stories about magical kingdoms and princesses ending happily. The surprise that you experience is the result of the context created by previous exposure. The knowledge of fairy tales that you have stored within your brain led you astray in this instance. From this example we can learn that the predictions that your brain is constantly making literally shape the way that you experience the world, because everything you encounter will be measured against these subconscious expectations (Feldman Barrett, 2018).

The environment that you expose yourself to actively shapes your brain's expectations for the next environment that it encounters. Therefore, this context is not stagnant, but always updating. Without settling the free will debate, this knowledge is empowering because it proposes that we can "nudge" the future predictions of our brain (Feldman-Barrett, 2022). We can indirectly exert some control over the lower order processing of our brain, even if we don't have conscious access to it. For example, maybe you are a reactive person, and you do not think you have any control over your reactivity. Yet, you can consciously choose to join a yoga or meditation class, which may help you be less reactive when the time comes.

When we embrace science, we embrace the complexity of the natural world, and our dynamic and individualized roles within it. When we embrace science, we understand that we have a consciousness that operates within a set of rules, but that which we still maintain a considerable amount of control over, mainly because the environment to which we expose ourselves to literally molds our brain.

A likely consequence of our tendency to look for patterns, is our ability to create meaning. Meaning can be defined as perceived coherence or connection between events in one's life; a feeling of purpose or a meaningfulness of one's actions, particularly in relation to a goal; or as global meaning, particularly referring to a set of beliefs or values. High levels of meaning are correlated with better physical health. This has been shown in several studies. Individuals with a greater sense of purpose were shown to have lower rates of mortality, decreased inflammatory markers, decreased physiological responses to stressful stimuli, lower rates of addiction, and faster recovery after knee replacement surgery, to name a few. In women with fibromyalgia, higher pain tolerance is correlated with greater purpose in life. Additionally, there are many studies demonstrating that individuals with greater purpose in life take more steps to

take care of themselves. These individuals have higher rates of exercise and lower rates of smoking. Interestingly, in a study of cancer patients, spirituality was associated with slower progression of cancer. Spirituality has also been associated with higher HIV treatment success. Finally, people with religious affiliation or a sense of spirituality show improved ability to cope with illness (Roepke et al., 2013).

As conscious physical beings, we have evolved the ability to create meaning because it is essential for survival. Religion is a powerful source of meaning in the world. As individuals who can understand our mortality and place ourselves in time, it is very possible that religion arose as a way to ease our existential dread. Additionally, religion is useful because it provides grounds for contextualizing and navigating the unpredictability of life. Does this understanding make religion less valid? If religion is easing suffering in the world, if it is spreading love, if it is creating meaning in a healthy way, then I do not think so.

The place of spirituality (whether religious or not) in our world should be in the here and the now. Science has shown that our ability to seek meaning and have a sense of purpose is healthy and hopeful. Just because this inherent tendency is the result of evolution, does not mean that it is not true or not real. Meaning, is in fact, an experienced reality. Pattern finding is advantageous for survival, but it also creates our sense of spirituality. A spirituality that includes science is one that has tangible impacts on the lives of people living in the world now. It must protect the planet and promote justice. A spirituality that includes science encourages individuals to make the physical world a better place.

Conclusion

It is normal for science and spirituality to diverge. Religious belief systems in the world will continue to include ideas that cannot be tested scientifically (such as is there a God, or is

there an afterlife). However, it is important that spiritual disciplines embrace what we know based on science. Scientific research enhances spirituality because it offers an increasing understanding of ourselves as a species and the world around us. Further, it could be catastrophic for religious groups to be resistant towards scientific research. For example, scientifically-oriented individuals may be driven away from religious circles if they hear at church that the theory of evolution is false. Being a part of this religious community would require them to carry an increased ambivalence to their scientific community at work or school. As we have seen from Clark et al. (2008), information that increases ambivalence is harder to process.

Although science and spirituality will never be exactly the same, they are not mutually exclusive. Your spirituality can actually be enhanced by embracing science. Within the life of each individual person, there should be space for these disciplines to overlap and interact. This can look different for different people. Still undoubtedly, individuals will come to different conclusions on topics such as free will, the existence of genuine altruism, the necessity or lack thereof for religion in our world, the location of the "self" within the brain, and onward and so forth. The point is not to land on a correct answer (if it exists). The point is to embark on the personal journey of closing the cognitive dissonance between science and spirituality. Science is the most powerful tool that we have for learning about the world around us. The more scientists know, the more they realize that they don't know. It is in this place of increased knowing, paired with increased unknowing, that spirituality lives.

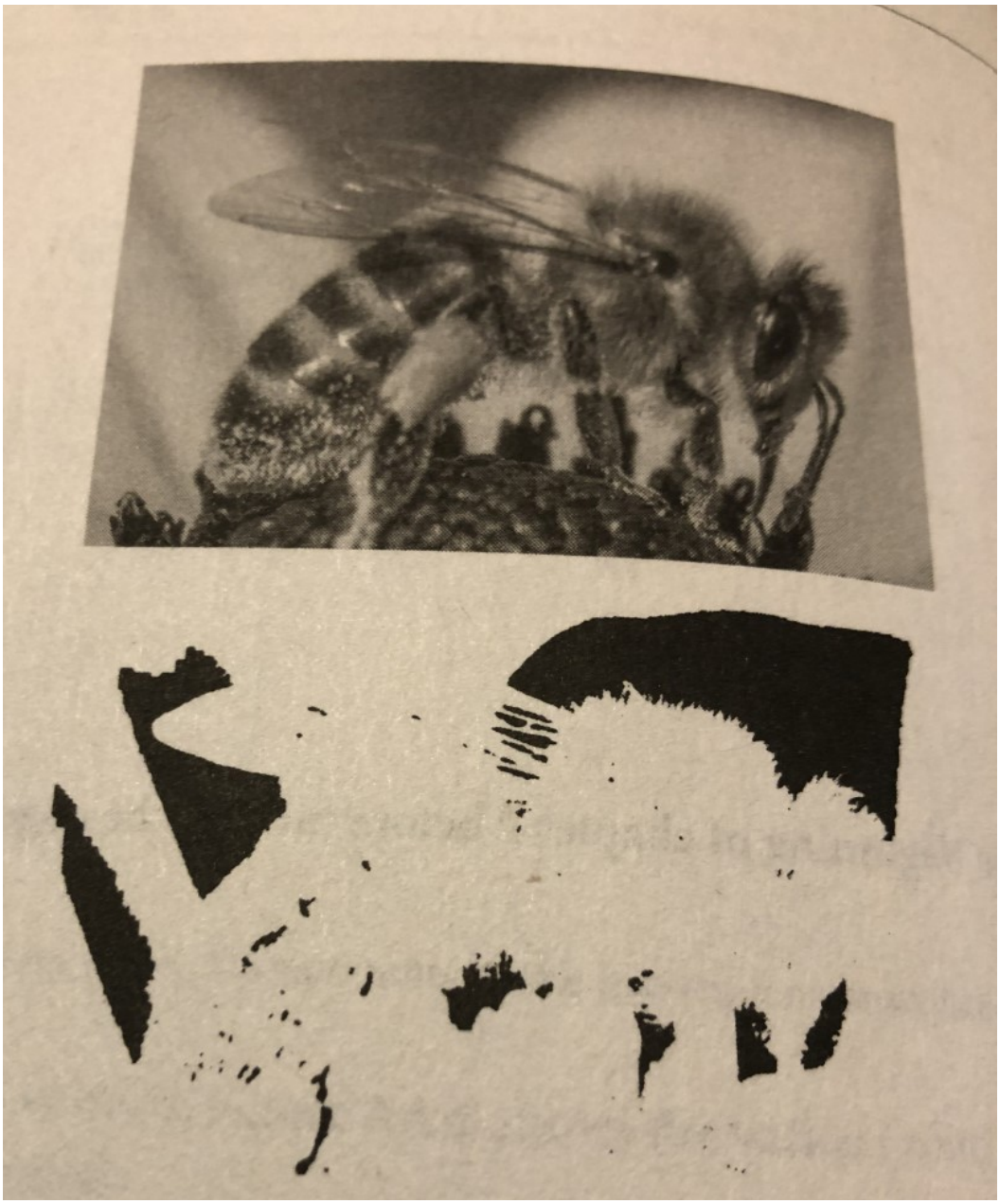
By embracing science, you can learn more about the dynamic role that you play in this ever changing universe. By embracing science, you will learn that you have an adaptable brain that is geared towards seeking meaning. By embracing science you will be forced to pause when you learn that you are biological matter that has the ability to self-reflect. Sometimes in this

pause I feel awestruck, and sometimes I feel discomfort. Either way, this cause for pause is where my spirituality resides. Spirituality does not have to be dependent upon a belief in anything immaterial.

The root of our spirituality is our consciousness, the ability that we have as conscious beings to teach and learn justice and generosity. We are our brains, or perhaps what our brains do. Our perception of the world, our memory, our emotions, and our personality all reside in the functions of the brain. We are physical creatures, *and* we are adaptable. We are constantly changing. Our psychology and biology are interwoven tightly, and both are responsive to the environment. Our consciousness does not occur in spite of our biology, but because of our biology. Our consciousness is produced by a physical brain that informs us of lower order processes on a need-to-know basis while also giving us the opportunity to (somewhat) override our nature and take the steering wheel when necessary. This physical brain gives us the ability to be self-aware. This ability to make a difference is produced by an electrochemical brain. Neuroscience points to our psychological self as what we have previously understood as the soul. This psychological self can learn and change and do good in the world. This choosing to do good, this spirituality, impacts our psychology via our adaptable brains.

Figure 2

Perceptual Learning Bee Image



Note. Image pulled from *How Emotions are Made* by Lisa Feldman-Barrett (2018).

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