

Cognitive Enhancement by Elective Psychopharmacological Intervention in Academia

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Abstract

Cognitive enhancement by elective psychopharmacological intervention in academia is a salient and controversial topic in contemporary bioethics. Cognitive enhancement through literacy, numeracy, and the Internet are deemed ethically acceptable; however, enhancement by psychopharmacological agents like modafinil and methylphenidate prove to be ethically more complex. Resolute critics oppose cognitive enhancement predominantly on a philosophical basis while proponents support enhancement as they find it to be philosophically acceptable and potentially beneficial to society. Safety concerns exist and accelerated research programs are needed in order to better understand the effects of these medications in the cognitively intact. The prevalence of psychopharmacological enhancement in undergraduate students, graduate students, and faculty is rapidly increasing. Moreover, academia and academic success are dependent upon cognitive ability and one's ability to improve innate cognitive abilities. It is advantageous to pursue cognitive enhancement by elective psychopharmacological intervention in a responsible manner because it is not just ethically validated but also ethically mandated as these enhancements may substantially benefit society and the greater good.

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Those who study the brain do so because they seek to understand how the brain functions. Many of these neuroscientists and physicians are involved in determining how to repair or ameliorate traumatic brain injury, motor and speech disabilities, and pathological disease states that involve the brain. These scientists are interested in improving cognitive ability and, ideally, curing damage and diseases of the brain such as dementia, Parkinson's disease, Huntington's disease, and Alzheimer's disease. These scientists do not aim to provide the cognitively intact with more focus, more willpower, and better memory, let alone create super-intelligent "posthuman" individuals or manipulate human nature. Their goal is far less electrifying, but humane and healing. In the area of cognition, they want to use novel understandings of the brain to enhance cognition by various cognitive enhancing drugs in those who are cognitively impaired, be it due to injury or disease.

Nonetheless, cognitive enhancing drugs have the potential to enhance cognition, whether it is for those who are cognitively impaired or those who are cognitively intact. The bioethicist Arthur Caplan argues that a drug capable of "helping an Alzheimer's patient retain memory function might also provide some enhancement to those who simply have poor memory skills; and that the market possibilities for selling a drug such as a memory enhancer are huge."¹¹ Interest in brain enhancement is immense and growing daily as the media report more and more frequently on brain enhancement. Pharmaceutical and nutritional supplement companies see immense value in products that increase focus, decrease need for sleep, and improve overall brain function, as enhancement could easily become a multi-billion dollar industry.

Brain enhancement is hardly a novel undertaking. Historical forms of brain enhancement include various manifestations from the founding of cities, the formation of

political systems, potent herbs and hallucinogens, and, most succinctly, literacy and numeracy. Currently, brain enhancement is an everyday event. We are constantly tethered to cell phones, the Internet, laptops, and numerous other forms of technology that allow us to function beyond our native abilities. Brain enhancement is a troubling term, as it implies enhancement arises from a general enhancement of the brain in its entirety. It is far more accurate to refer to this enhancement as cognitive enhancement because it improves different cognitive functions, such as memory or attention.

Cognitive enhancement is common in colleges and universities. Undergraduates, typically known for their affinity to marijuana and alcohol, are flocking to cognitive enhancing drugs in order to gain an academic edge. In a 2007 study, 8.3% of undergraduates at a large mid-western university admitted to using amphetamine or methylphenidate for cognitive enhancing purposes over their lifetime.ⁱⁱ This generation has been raised to believe that a miracle pill exists for every ailment, and they have experienced the medicalization of many human conditions, such as hair loss and urinary incontinence, thus making this generation view prescription drugs in a relatively nonchalant manner. Likewise, the undergraduate population is often young, generally naïve, living away from home, and subject to great stresses, such as performing to meet high academic standards. This combination of circumstances produces a population of students who are comfortable with prescription medication and under immense pressure to perform well academically in an increasingly competitive world. However, it is not only students who admit to abusing cognitive enhancing drugs. This phenomenon permeates all tiers of academia, as professors in both the United States and United Kingdom also admit to taking cognitive enhancers.ⁱⁱⁱ

Why not enhance cognition with pharmacological cognitive enhancers? We do so every day by other means and very few ethical objections have been raised against the

Internet or smartphones, let alone literacy. For example, without literacy this paper would not exist, and humans would be remarkably less intelligent and successful than we are today. Pharmacological cognitive enhancement, particularly in academia, presents numerous ethical considerations, predominantly centered on philosophical, societal, and safety issues. Consequently, cognitive enhancement proves to be a controversial subject, staunchly defended by some as beneficial to individuals and society while others argue that cognitive enhancement may destroy society as we know it. This paper, through a lens of science and society, examines cognitive enhancement, the ethical arguments for and against it, provides recommendations, and delivers a *pro tanto* proposition in favor of pursuing cognitive enhancement based on current knowledge and research.

I. Defining Cognition, Cognitive Enhancement, and Cognitive Enhancement in Academia

1.1 Cognition

Cognition is the assembly of mental processes necessary to gain knowledge and comprehension. These processes include attention, memory, judgment, problem solving, decision-making, language, planning, perception, and imagination. Cognition is the foundation upon which the abstract concept of intelligence rests. Intelligence is generally necessary for success; however, cognition is always necessary for intelligence and therefore, in turn, for success. There are numerous differences between cognition and intelligence; most importantly, cognitive function can be measured with a battery of cognitive tests that assess specific mental functions (e.g., response time, short term memory) while intelligence tests assess general intelligence. Researchers contend that intelligence is stable over time, while cognitive ability is variable.^{iv}

There is no single, universal definition of intelligence, let alone a widely accepted theory, as scientists and philosophers continue to debate over a singular, generalized view of intelligence, measured by the *g* factor, versus numerous theories of multiple intelligences. Howard Gardner, who developed multiple intelligence theory (MI) as a critique to the concept of *g* factor, states that human intellect is better described as consisting of a set of semi-autonomous computational devices, each of which processes certain kinds of information in an appropriate manner.^v Gardner identifies 8 or 9 major intelligences, including logical-mathematical, spatial, and interpersonal. For the purpose of this paper, cognition will be examined as a set of complex mental processes that are unfixed in their capacities. Cognition is highly plastic in that optimal conditions can produce an enhanced state of cognition, while detrimental conditions can produce impaired cognition.

Should I sleep an extra hour? Should I go for a run? Should I eat a sweet snack while studying? These decisions are generally given little thought and occur daily; however, that extra hour of sleep or glucose in a snack can enhance cognition. Whether intentionally or unintentionally, every day we make lifestyle decisions that have great impact on our cognition and cognitive abilities. Sleep deprivation is a common theft of cognitive ability, especially among undergraduate and graduate students who have notoriously poor sleep hygiene. Sleep deprivation causes impaired cognition, resulting in a marked decline in psychomotor and cognitive speed, vigilance, executive attention, working memory, and higher cognitive abilities, such as decision-making and problem solving.^{vi} Conversely, good sleep hygiene, exercise, and nutrition contribute to optimal cognitive function.^{vii}

1.1.1 Measures of Cognition

Studies addressing cognitive ability and its connection to sleep and cultural activity

have been published in respected, peer-reviewed scientific journals because their conclusions are empirically supported by rigorous research. As mentioned, cognition is composed of various mental processes, which can be individually tested. These tests prove immensely helpful in not only diagnosing pathologies of the brain, but also in testing particular processes under different conditions. There are numerous cognitive measures, including measures of simple reaction time, sustained attention, short-term memory, psychomotor vigilance, and executive function. Executive function is an umbrella term given to the mental skills coordinated in the frontal lobe and is considered to be higher-level cognition. This includes planning, organization, integration of past with present, strategizing, paying attention to detail, and regulation of behavior.

A cognitive battery of tests is often used to measure cognition and simultaneously assess different mental processes. Cognitive battery tests can be designed to test for certain abilities relevant to the study through the selection of tasks from different tests; commonly, however, a general battery such as the Cambridge Neuropsychological Test Automated Battery (CANTAB) is administered. CANTAB was developed by the University of Cambridge in the 1980s and remains a highly regarded series of tests. Cambridge Cognition has made the CANTAB commercially available and touts the tests as simple, computerized, non-linguistic, and culturally neutral.^{viii} The full CANTAB measures induction, visual memory, executive function, attention, semantic/verbal memory, decision making and response control, and social cognition.^{ix} Other measures, such as the Wisconsin Card Sort Test (WCST), Walter Reed Computerized Performance Assessment Battery (PAB), Stroop Color and Word Test (Stroop), and Weschler Adult Intelligence Scale (WAIS) are additional highly reliable measures of cognition and cognitive ability.

The metrics and tests used in studies of enhanced cognition and impaired cognition are closely related and frequently the same. Studies of cognitive decline are salient in modern neuroscience due to an immense growth in the elderly population as life expectancy increases. Cognitive decline and dementia, a disease causing cognitive impairment, are correlated with natural aging processes. Studies measuring cognitive enhancement or decline are simple to administer and produce results with vast implications. These tests measure an individual's cognitive abilities at baseline and again under enhanced or impaired conditions. For example, administering the CANTAB to Student A provides a baseline of cognitive function. Next, Student A could be instructed to sleep for 8 hours and then take the CANTAB to provide a measurement of enhanced cognitive function. Conversely, sleep deprivation might cause Student A to be cognitively impaired and likely test below baseline on the CANTAB. This demonstrates the fluidity of cognition and how easily cognition may be manipulated.

1.2 Cognitive Enhancement

Cognitive enhancement (CE) is an intoxicating subject, as humans inherently crave enhancement and improvement. Barbara Sahakian, a professor of neuroscience at the University of Cambridge, states, "The desire for cognitive enhancement is very strong, maybe stronger than for beauty, or athletic ability."^x Although this belief is likely to be uncommon in the general population, members of the academic community are likely to agree. Neither beauty nor athletic ability ensures survival, let alone success in an ever-increasingly competitive world; however, cognitive enhancement is beneficial in goal achievement and success. Cognitive enhancement is defined as the "amplification or extension of core capacities of the mind through improvement or augmentation of internal or

external information processing.”^{xi} Cognitive enhancing supplements, also known as smart drugs or nootropics, enhance cognition in the cognitively intact. A cognitively enhanced person is “not necessarily somebody with particularly high (let alone super human) cognitive capacities” and is instead a person who “has benefited from an intervention that improves performance of some cognitive subsystem without correction of some specific, identifiable pathology or dysfunction of that subsystem.”^{xii}

Historically, medications for attention deficit/hyperactivity disorder (ADHD), such as the stimulants, amphetamine and methylphenidate, have been used for cognitive enhancement. Amphetamine and methylphenidate improve focus and attention by increasing catecholamine levels in the prefrontal cortex through a variety of methods, including inhibiting reuptake, and these mechanisms are responsible for an improvement in the attention systems of the brain.^{xiii} In recent years, potent medications have been developed to treat cognitive impairment associated with neurodegenerative diseases, such as Parkinson’s, Alzheimer’s, and Huntington’s diseases. Numerous drugs are in the therapeutic pipeline and undergoing clinical testing for increasing cognition in dementia patients, such as Eli Lilly’s solanezumab and Baxter International’s gammagard. As dementia disorders are generally age-related and as life expectancy increases, pharmaceutical companies are eager to create the next blockbuster drug to decrease the burden of these diseases and generate a profit. Currently, donepezil (Aricept) is the gold standard in treating Alzheimer’s-related cognitive impairment. Similarly, modafinil (Provigil) has become a sought-after treatment for narcolepsy and “shift work sleep disorder.” Donepezil and modafinil are intended to increase cognition in those with a significant pathology or deficit in cognitive ability, making these drugs far more potent than

amphetamine or methylphenidate and highly appealing to those seeking cognitive enhancement.

The illicit (i.e., non-medical and non-prescription) use of stimulants by undergraduates is an increasingly prevalent form of drug abuse. Unlike other drugs experimented with by this population, stimulants are not taken for recreational purposes. Instead, amphetamine and methylphenidate have been dubbed “study drugs” and “study buddies” and their primary use is “to help study,” “to help with concentration,” and “to increase alertness.”^{xiv} Various studies have found a range from 3% to nearly 36% of students illicitly using prescription stimulants in the past year; however, as this a huge span, Teter and McCabe’s 2006 publication can be used to provide a more precise measure. Teter and McCabe surveyed 4580 students at a large Midwestern university with a sample that closely resembled the demographic characteristics of the national student population and found an 8.3% lifetime and 5.6% past year prevalence of illicit stimulant use.^{xv} It is evident from a comparison of studies from 2001 to 2009 that both lifetime and past year use have drastically increased.^{xvi} Similarly, a PubMed search on this topic yields no results prior to 2000, reinforcing the notion that this issue has only recently emerged. Currently, there is no precise data regarding national illicit use among college students. With the most conservative of estimates, at least 500,000 of the 8,000,000 undergraduates in the United States abuse prescription stimulants for cognitive enhancement.

1.3 Academia

The discussion of undergraduate CE drug abuse leads us to the world in which enhancement is most prevalent—academia. Post-secondary academia is a convenient and appropriate environment in which to study cognitive enhancement, as both students and

professors strive to perform optimally in order to pursue further forays in academia. Likewise, both students and professors admit to taking drugs for CE purposes. For example, an undergraduate might take methylphenidate to increase focus and allow the student to achieve high marks in order to enter a prestigious graduate program, while a professor might take the same drug to write a book or publication with the hopes of advancing his academic career in order to achieve tenure. Often, it is imperative for an undergraduate to thrive academically in order to build a strong résumé for job and graduate school applications. Professors in the United States and United Kingdom admit to taking cognitive enhancing medications with similar motives as undergraduates, primarily to improve productivity and mental energy.^{xvii}

Additionally, academia provides an enticing realm for cognitive enhancement studies for academia is inherently entwined with testing cognitive abilities. From a young age, students are tested on an eclectic variety of subjects, from language to mathematics to physical education, and assessed on their abilities to succeed at given tasks within each subject. Academia at the undergraduate, graduate, and faculty levels tests different subjects in an immensely more rigorous manner than students have experienced before. Different academic subjects engage different mental processes, meaning that in order to be successful in academia one must be strong in a number of cognitive abilities.

Similarly, to be successful in academia, executive function must be robust as these processes are essential to the planning, organizing, and regulating of other mental processes. One can safely deduce from the previous statements that academia does measure at least a few dimensions of cognitive ability. This becomes exceedingly evident in the examination of a hypothetical student. Student A is enrolled in 1) an upper level language class, which

requires short-term memory, 2) a tedious history lecture, which requires attention, 3) an advanced engineering class, which requires problem solving, and 4) is employed part-time. In order for Student A to be successful in all her classes, she must have strong cognitive abilities in a number of different areas since each class tests a specific cognitive ability or combination of abilities. Student A must also have strong executive function capabilities in order to manage her time so that she can be academically successful while also leaving time for her job.

An array of strong cognitive abilities is necessary for success in academia at the undergraduate, graduate, and faculty levels thus making academia the ideal place to study CE. Academia has taken on a gladiator-like environment that strongly encourages competition for scarce resources, be it an A in class, a tenured faculty position, or a publication in *Nature*. In this paper, cognitive enhancement, when designated as CE, is defined as the elective pharmacological intervention (through e.g., modafinil, donepezil, methylphenidate, amphetamine) by cognitively intact members of the academic community (students and professors) with the intention to enhance performance in academic endeavors including, but not limited to, test preparation, concentration, focus, attention, intellectual performance, task efficiency, and alertness.

II. A Brief History of Cognitive Enhancement

Human beings have always endeavored to enhance themselves in order to improve mental, physical, and emotional capabilities. CE is a particular form of enhancement within the broader goal of human enhancement that is focused solely on improving mental capacities. Enhancement is as old as *Homo sapiens* and an intrinsic part of our evolution

from a nomadic hunter-gather society to our modern, technology- dependent state. John Harris, a British bioethicist, argues that it is irrational to be against human enhancement, as humans “result from an enhancement process called evolution (mixed as the benefits are) and moreover inveterate self-improvers in every conceivable way.”^{xviii}

All material and technological progresses are cognitively enhancing, though some, such as literacy or methylphenidate, are more directly cognitively enhancing than others. It is utterly impossible to live without human enhancement, and it is safe to assume that the vast majority of, if not all, people are grateful for prior acts of human enhancement that have generated enormous progress. To be against human enhancement would be to reject every technology, every mental algorithm, literacy, and language. Without historical enhancements and associated progress, the contemporary state of enhancement could not exist.

2.1 Historical Cognitive Enhancement

Historical cognitive enhancements have produced immense progress in the cognitive abilities of humans. Without these enhancements, society as we know it would not exist. Although enhancements such as the invention of the wheel or the agricultural revolution have been immensely beneficial to the evolution of society, historical examples of cognitive enhancement and associated progress in cognitive abilities are more relevant to CE.

The agricultural revolution allowed cities to be formed, governments to be created, and civilizations like ancient Egypt and Rome to flourish. Literacy, numeracy, cities, political institutions, and farming emerged as a direct result of the agricultural revolution. Once cities were established, transportation technologies were developed to facilitate travel. Over the next 9,000 years, various other enhancement technologies were developed such as

calculus, the compass, and gunpowder. Each of these technologies serves to enhance human abilities beyond our inherent, native skills. This approximately brings us to the 15th century and Johannes Gutenberg, who spurred an unprecedented generation of enhancement and knowledge that immeasurably improved the world.

Johannes Gutenberg was a German blacksmith, printer, and publisher who incited the European printing revolution with the invention of the movable type printing press. The movable type printing press is arguably the most significant invention of the Common Era, and numerous sources have named Gutenberg as the most influential person of the second millennium.^{xix} Gutenberg's printing press was essential to the Renaissance, Reformation, Enlightenment, and Scientific Revolution. The Gutenberg press was truly an agent of change that allowed knowledge and learning to spread and was a foundation for our modern knowledge-based society. The advancements made during the Enlightenment and Scientific Revolution resulted in enhancements in our ability to think and gather information like Diderot's *Encyclopédie*, the Royal Society, and the scientific method. These advancements allowed humans to do what was previously impossible and gain previously novel knowledge. For example, no one person could memorize every item in the *Encyclopédie*, but one could now easily look up an item in the *Encyclopédie* because the Gutenberg press allowed it to be widely available. This demonstrates technology's ability to augment the native capabilities of the brain and serve to enhance cognition.

Later, electricity, telephones, and cars were developed; all improved human capabilities. Cars and airplanes are the most recent evolution in transportation technology. Prior transportation technologies include riding horses, sailing, and railroads. We certainly cannot walk as far or as fast as we can drive, but contrary to CE, we find no ethical objection

to cars. Likewise, literacy, the foundation of most cognitive enhancements is itself not ethically objectionable. These enhancements all have an effect on cognition, be it directly or indirectly, and are invaluable to human progress. Moreover, these non-biomedical enhancements, such as the agricultural revolution or cars, have fundamentally altered even the human genome and human biology. In this vein, it is imperative to recognize that both non-biomedical, or non-pharmacological, and pharmacological interventions can alter human biology.*

It is evident from the past 10,000 years, if not longer, that human beings aim to improve native cognitive capabilities. The myriad of historical cognitive enhancing technologies and progress that occurred before the 20th century set the foundation for contemporary enhancement. Without this constant pursuit of progress, life as we know it would not exist.

2.2 Contemporary Cognitive Enhancement

The most salient examples of contemporary human enhancement technologies include modern medicine, the computer, and the Internet. Modern medicine is the most enhancing of all contemporary enhancements as it directly improves the human condition. Treatments of the 20th century, from penicillin to chemotherapy, and technologies, such as X-ray imaging, allow humans to live longer now than ever before. A simple infection that would have likely killed a child in 1900 can now be treated and cured completely within 10 days with penicillin. Modern medicine is replete with awe-inspiring enhancement after awe-inspiring enhancement each extending human capacities and transforming lives. In the 21st century, we have come to take for granted the medical breakthroughs of the last century

* This will be elaborated upon in 4.1.3

and, instead, focus on technologies like the computer and the Internet.

While all material and technological progress is cognitively enhancing, some advancements have more direct and ubiquitous effects than others. The computer and Internet are daily, commonplace enhancements. These technologies would have been inconceivable fifty years ago but now allow ordinary people, including students and faculty, to access immense knowledge. Until recently, the computing power of a laptop required a room full of equipment, which demonstrates the immense progress of modern technology. Many people are unaware of how strongly these technologies enhance humans and, in particular, human cognition. At the most rudimentary level, computers allow us to perform arithmetic operations impossible for the human brain, store vast amounts of data that would be impossible to remember, and solve highly complex logic problems. Therefore, computers enhance our cognition as a sort of advanced proxy with better memory skills and problem-solving skills than a human. Similarly, the Internet provides access to a near-infinite amount of information and facilitates the instantaneous sharing of knowledge. Historical and contemporary cognitive enhancements, such as literacy and computers, are not regarded as ethically objectionable. We are cognitively and morally more sophisticated than our predecessors, and this was achieved with simple technologies such as the passing of knowledge between generations through literacy.^{xx}

III. Arguments in Opposition to Enhancement

Conservative intellectuals, such as Leon Kass and Francis Fukuyama, as well as liberals concerned with fairness, like Michael Sandel, are the strongest opponents of cognitive enhancement. Conservative bioethics is fundamentally focused on what is natural although no definitive explanation of the “natural” is ever provided and originates with

Edmund Burke's theories. The conservative view often focuses on how "technology could adversely affect the essence of humanity."^{xxi} Kass and Fukuyama embrace this fear of technology changing society and, unsurprisingly, draw parallels between CE and Aldous Huxley's *Brave New World*. Conservative thought is based upon three central tenets. The first two tenets are statements regarding human nature and the third addresses society's efforts at radical reform or improvement.

The first tenet states, "human nature is a fixed essence created by God or Providence, as an enduring element in an overall Divine plan for the world...According to this first tenet, it would be wrong to try to change human nature because to do so would be to rebel against Divinity..."^{xxii} I will not address this tenet as this paper aims to examine CE in a secular manner and to acknowledge a belief founded in religion would discredit my assessment. Additionally, religious interpretation and definition of an "overall Divine plan" are personal. The second tenet claims that human nature is severely and permanently constrained, meaning that limits exist on the possibilities of human improvement through social reform.^{xxiii} The third tenet states that efforts to relax the constraints addressed in the second tenet "are very likely to damage human life, and that such efforts are motivated by a distorted picture of humans or human society, or both."^{xxiv} Conservative scholars believe that new technologies could be vastly damaging to humanity, that human capabilities are purposefully limited, and that to seek enhancement demonstrates a distorted understanding of humanity. Proponents of the eugenics movement serve as a chilling example of what these conservatives fear. Eugenics, in the name of improving the genetics of a population or race, was a central tenet of Adolf Hitler in Germany and forced sterilization in people deemed undesirable in the United States.

Conservatives have been immensely influential in public policy. For example, the

notable conservative, Leon Kass, chaired the President's Council on Bioethics (PCB) and published *Beyond Therapy: Biotechnology and the Pursuit of Happiness* in 2003. His report is critical and highly skeptical of the benefits of using biotechnological interventions for enhancement, which the PCB dubbed "beyond therapy." In the report's "Letter of Transmittal," Kass modifies the old expression, "to a man armed with a hammer, everything looks like a nail" to apply to the current situation. Kass writes, "To a society armed with biotechnology, the activities of human life may seem more amendable to improvement than they really are."^{xxv} In the letter's conclusion, Kass states that he hopes we can keep in mind the meaning of our founding ideals, and, consequently, "find the means to savor the fruits of biotechnology, without succumbing to its most dangerous temptations."^{xxvi} Beyond the PCB, conservatives have a successful network of think tanks and journals that publish papers, make media appearances, and hold meetings with politicians to influence policy and circulate their beliefs.

Kass writes, "We are in an area where initial repugnancies are hard to translate into sound moral arguments."^{xxvii} Despite this admission, critics passionately present arguments in opposition to CE from philosophical, societal, and safety perspectives. The philosophical objections are the most abstract while the safety objections are the most concrete of the arguments. Although none of these objections applies explicitly to academia, all can be examined through the lens of CE in academia. The following pages will introduce salient objections to CE, and, where possible, the objection will be refuted by substantive evidence.

3.1 Philosophical Arguments

3.1.1 Desire for Perfection and Mastery

Critics believe that to pursue improvement through CE demonstrates a desire for

perfection and mastery, demonstrating poor judgment and character. They find this pursuit to be dangerous to individuals and society as CE has the potential to alter humanity. In *Beyond Therapy*, the pursuit of enhancement is described as "...A Promethean aspiration to remake nature, including human nature, to serve our purposes and satisfy our desires."^{xxviii} Michael Sandel, a traditionalist liberal, wrote a book titled *The Case Against Perfection* (2007) dedicated to the criticism of perfection and mastery through biotechnologies. Sandel believes that advancements in biotechnology present us with a predicament in which enhancing technologies will encourage and allow parents to design children, selecting for certain desirable traits, such as intelligence or hair color. Not only do "designing parents" chase perfection when selecting traits for their children, but also Sandel claims that they seek to demonstrate an unrivaled level of mastery over nature. Moreover, Sandel believes that enhancement represents a desire for mastery and perfection, and, consequently, an inability to be "open to the unbidden," which demonstrates poor character and tainted motivation. Sandel believes that "the deepest moral objection to enhancement lies less in the perfection it seeks than the human disposition it expresses and promotes."^{xxix}

Kass raises alarms at the notion of the "seductive promises of a perfect, better- than-human future, in which we shall all be as gods, ageless and blissful."^{xxx} The use of "gods" implies perfection and a complete control, or mastery, over human nature, as the "gods" are Divine beings, the omnipotent creators of nature. The prospect of perfection and mastery by man through enhancement technologies is seen as "men playing god" or an unacceptable act of hubris.^{xxxi} Kass believes that using god-like powers in the absence of god-like knowledge is dangerous because the human body and mind are "delicately balanced as the result of eons of gradual and exacting evolution" and are "almost certainly at risk from any ill-considered attempt at 'improvement.'"^{xxxii} In order to remove the religious aspect from this argument

and adapt it to CE in academia, it can be concluded that Kass would believe that using a CE medication is a “god-like” act that demonstrates a desire for perfection and mastery over academia. Critics conclude that the pursuit of enhancement is unequivocally linked to a desire for perfection and craving for mastery and is driven solely by corrupt motivations.

These critics’ arguments are flawed for numerous reasons. The pursuit of CE demonstrates neither a desire for mastery, nor perfection, but instead a desire for improvement. True mastery and perfection are unattainable. Moreover, motivation is highly complex and cannot be deemed “corrupt” as the result of pursuing enhancement. As Salvador Dali once adeptly stated, “Have no fear of perfection—you’ll never reach it.”^{xxxiii} CE technologies do not defy this statement and never will for perfection requires no improvement or enhancement, which is wholly unattainable. Likewise, complete mastery is inaccessible. Moreover, the desire for mastery, which in this debate truly means “improvement,” is profoundly different than actual mastery.

The motive behind enhancement may not always be ideal; however, this alone does not make enhancement morally impermissible. Even if one assumes enhancement is driven solely by poor character, enhancement remains permissible, contrary to critics’ views. For example, nations cooperate with one another for selfish reasons, and if the benefits of cooperation are great enough, cooperation becomes not only morally permissible, but also morally obligatory, regardless of the underlying motivation.^{xxxiv} Additionally, it is likely that many individuals pursuing enhancement, particularly in academia, are of good character and altruistically motivated. The “desire for mastery” is often a means to some other end, such as intelligence or health. A scientist who finds a cure for blindness by pursuing mastery in order to achieve his goal of helping thousands of people may be viewed as having good character. Conversely, the scientist may instead be motivated only by a desire

to master nature in order to gain fame, yet could still find a cure. Regardless of motive, a desire for mastery has created a cure for blindness in both scenarios and benefitted society either way. The cure truly matters, not the motive. It must be acknowledged that some enhancement may be motivated by poor character; however, a desire for mastery is not necessarily indicative of poor character, which consequently makes enhancement morally permissible. It is likely that the majority who choose CE do so as a result of good character and morally acceptable motivations.

3.1.2 Cheating and the Authenticity of Experience

Opponents use “cheating” to address two independent arguments. First, “cheating” through CE is described as analogous to cheating in professional athletics. This is one of the most ubiquitous arguments against CE, as allegations of doping are commonplace in professional sports. Additionally, “cheating” refers to the notion of cheating oneself and achieving successes that are inauthentic because they were achieved under the influence of CE.

3.1.2.1 CE and Cheating in Professional Athletics

Critics often cite cheating as an obvious objection to enhancement not only because it is a common topic in professional sports but also because the public easily understands the argument. Colloquially, ‘cheating’ is used to describe numerous forms of fraud and deception that are intended to gain a benefit for oneself. “Cheating” can be described in relation to CE as “the intentional violation of a rule, in order to gain an unfair advantage,” which generally involves deception in order to mask the unfair advantage from others.^{xxxv} In sports, clear guidelines have been set to prohibit the use of enhancing substances by the

International Olympic Committee and the World Anti-Doping Agency. Doping checks occur at all major competitions to uphold rules and identify cheaters, who are subsequently disqualified and sanctioned.

In athletics, there must be winners and losers. As young children we learn this firsthand, for example, when playing soccer or other schoolyard sports. As we grow older, our interest in sports grows, be it as an athlete or as a fan of a professional team. We see our favorite teams lose playoff games, grown men cry in defeat, and victors kiss their trophies. Unequivocally, there can only be one winner, and everyone else is a loser. In the Olympics, medals are given for first, second and third place; however, the gold medal winner stands higher on the platform than the silver medal winner, who in turn stands higher than the bronze medal winner. Even when multiple winners are announced, a clear hierarchy exists. This intense spirit of competition has enticed athletes to enhance for over seventy years beginning at least in the 1940s with the use of amphetamine. Modern enhancements outlined by the World Anti-Doping Agency in the “The 2012 Prohibited List” include anabolic androgenic steroids (AAS), other anabolic agents, peptide hormones, growth factors, beta-2 agonists, hormone and metabolic modulators, oxygen transfer, as well as many other prohibited substances and methods.^{xxxvi} In turn, governing bodies create anti-doping tests, claiming that enhancements violate the notion that achievement in sport should be based on native ability and practice.

Critics are justified in viewing cheating in athletics as ethically wrong because cheating involves the violation of established rules. In sports, there are clearly articulated and generally accepted conventions that govern their activity; therefore, any use of a prohibited substance in order to gain an advantage in a competition or contest can

undeniably be considered cheating. However, critics leverage the concrete argument that enhancement is cheating in sports in their evaluation of cheating in CE. They draw an easy parallel, almost a shortcut, between sports doping and CE. It is almost as though the critics hope that the sullied reputations of Barry Bonds and Lance Armstrong will discourage CE as well as permanently bond sports doping to CE.

Sports doping, however, is not a suitable comparison because professional athletics focus solely on competition whereas the use of CE, particularly in academia, focuses on learning, studying, and improving one's cognition with competition as only a secondary motivation. CE is focused on self-improvement rather than competition, though admittedly neither often appears in context wholly without the other. Moreover, professional athletics operate within a framework of global rules and guidelines set by governing organizations that do not exist in academia and are set by overarching organizations. Since this paper focuses on the United States, the domestic governing body will replace the World Anti-Doping Agency as a point of comparison. The United States Anti-Doping Agency (USADA) is the national anti-doping organization charged with ensuring the integrity of American athletes competing in the Olympics and Paralympics. The USADA's mission is to preserve integrity of competition, inspire true sport, and protect the rights of U.S. athletes.^{xxxvii} Consequently, the USADA is responsible for preventing cheating in sports through drug testing and banning certain substances. Many of the most prominent doping scandals, including Barry Bonds' and Jose Canseco's steroid use, have occurred in professional baseball. In Major League Baseball (MLB), the MLB Players Association and the Office of the Commissioner of Baseball created the Joint Drug Prevention and Treatment Program. Their rules aim to deter the use of banned substances, such as anabolic steroids

and other performance enhancing drugs, by making doping a punishable offense with serious consequences, such as sanctions and being stripped of titles.

In professional sports, rules are explicitly stated and athletes agree to these regulations in contracts and by partaking in organized athletic leagues and competitions. These rules are in place for numerous reasons, but most importantly to ensure that there is a level playing field. It can be argued that there can be no such thing as a level playing field, as some win in the genetic lottery while others lose; however, that is not relevant to this argument. Fundamentally, cheating can only occur when two conditions, the existence of rules and the conveyance of an unfair advantage are met. Currently, despite academia's numerous rules and regulations, CE is not forbidden. Admittedly, academia is replete with rules, many of which apply specifically to cheating, like rules forbidding plagiarism or copying a fellow student's exam, but academia does not explicitly forbid CE. Thus, the critics' argument falls flat regarding CE because the two conditions of cheating, explicit conventions or rules and unfair advantage, are not met, making cheating an invalid conclusion. As long as colleges and universities do not issue rules explicitly forbidding CE, students and professors will continue to engage in CE as they please.

3.1.2.2 CE and the Authenticity of Experience

Critics believe authentic experience is the result of native or achieved excellence. Authentic experiences are more valuable than experience that is bought or acquired through other means, such as CE.^{xxxviii} They fear enhancement technologies provide experiences that are inauthentic, not valued, and not morally commendable, as the experience has not been earned. To gain benefit from an inauthentic experience is to cheat oneself of the gratification and significance of the experience gained solely through diligence and

perseverance.

The President's Council on Bioethics (PCB) and Sandel opine that achievements realized through CE are not truly the achievements of the enhanced individual. Sandel believes a student who achieves a high mark, as the result of methylphenidate is unworthy of admiration. Instead, the pharmacist dispensing the medication, not the student is responsible for the achievement and thus deserves admiration.^{xxxix} The PCB and Kass suggest that achievement, as the result of an extraneous intervention, is detachable from the agent whose achievement it purports to be.^{xi} Kass states, “‘Personal achievements’ impersonally achieved are not truly the achievements of persons” and that human progress is not the result of the accumulation of external achievements.^{xli} Critics believe that achievements are not admirable or morally commendable if accomplished through enhancement, as the enhancing technology is separate from the individual.

Critics of enhancement technologies are concerned that enhancement threatens humanity's efforts at achieving authenticity and that enhancement will separate us from “what is most our own.”^{xlii} “What is most our own” denotes acting in an authentic manner with innate abilities and feeling fulfilled by achievements gained in such a manner. Critics, particularly the PCB, believe that an individual under the influence of psychotropic medication, such as CE drugs, becomes mentally detached and is thus insulated or removed from the “highs and lows of real life,” and, thus, authenticity.^{xliii} Furthermore, the PCB indicates that the loss of authenticity creates the possibility for “self-alienation” and the loss, confusion, or abandonment of identity.^{xliv}

Additionally, success without toil troubles critics. Critics believe that people should work hard for their achievements and that “nothing good comes easily.” Although we may respect the grace and effortlessness of a natural athlete, we deeply admire those who

overcome obstacles and achieve the excellence of the former, who serves as the standard of success or failure.^{xlv} Success as the result of innate ability is acceptable; however, when one bypasses strenuous effort and utilizes an enhancing technology, the success is claimed as inauthentic. To enhance is to show a disregard for the authentic self and the authentic self's abilities. Moreover, the frame that "nothing good comes easily" suggests that achievements that occur easily are bad (i.e., inauthentic). Individuals engaging in enhancement are not true to their "authentic" selves and will ultimately harm themselves and find the experience unsatisfying. Ultimately, a child who has learned to appreciate the internal logic of chess, including the achievement of a highly particular kind of analytic skill, strategic imagination, and competitive intensity, will not defeat the *opponent* by cheating, but instead will defeat and cheat *himself*.^{xlvi}

Critics do not provide an explicit definition of authenticity, as it is unlikely a consensus was reached. "Authenticity" is very difficult to define, meaning different things at different times to different people. Charles Taylor, author of *The Ethics of Authenticity* (1992), defines the moral idea of "authenticity" as how each individual finds his own way in the world.^{xlvii} Furthermore, Taylor believes, "It is my own job as a human being to find my way of flourishing, of being true to myself. If I am not true to myself, I miss the point of my life, I miss what being human is for me."^{xlviii} The crux of this definition is the use of "me," implying that an individual must act true to himself and only himself. It is not just a selfish definition but also an individual one; "authenticity" is fundamentally different among individuals and, thus, their means of achieving authenticity is likely to differ. If being "authentic" is behaving in a manner that is "true to oneself" then it is authentic to enhance an action with a CE drug so long as it is congruent with one's self-concept. The application of Taylor's definition of "authenticity" dismisses the aforementioned critics' arguments

since authenticity supports all that is “true to oneself,” including CE.

The argument that success must be a direct result of toil and struggle in order for such success to be satisfying is easily refuted by daily events. Taking the chairlift to the summit versus hiking the mountain does not diminish the achievement of skiing a black diamond trail. In Caplan’s assessment of *Beyond Therapy*, he criticizes the notion of “fraudulent happiness,” which is defined as the idea that success achieved without sweat and drudgery is not satisfying and therefore inane. Caplan thinks aloud, “One is tempted to ask who is writing this stuff – is the Council somehow psychically channeling our Puritan Protestant Ancestors?”^{xlix} Albeit in dramatic rhetoric, Caplan astutely states that the critics’ logic is outdated and inappropriate in contemporary society. Furthermore Caplan writes:

Life is full of many pleasures that are not earned by testing our limits but that are fully and thoroughly enjoyed. Think of the pleasure in winning the lottery; or in being reassured that your friends like you even though you cheat at cards, cannot stop smoking, eat too much, or are sometimes boring; or in solving problems using computers and any other form of technological assistance you can muster to aid your fallible brain. We do not always have to ‘earn’ our happiness to be really and truly happy. Nor do we reject as fraudulent those things that make us happy that we have done little or nothing to earn.¹

It is resoundingly true that we appreciate and enjoy benefits that result from luck and serendipity, such as a beautiful day or finding money on the sidewalk as we walk to work. If one wins the lottery, one must have first bought a ticket, meaning the ticket’s purchase was consistent with the notion of being true to oneself. Authentic happiness can result from the luck of winning the lottery, a completely arbitrary experience; therefore, authentic happiness can result from achievements involving enhancement.

A mother who elects to deliver her child via caesarean section does not have a less authentic birth experience, nor would many Americans question the integrity and authenticity of her experience. Although she bypasses the historic birthing process, the

caesarean section mother and child may bond just as authentically as the traditional birthing mother and child. A caesarean section is an example of a technology that has saved lives and been immensely enhancing. Not only has the procedure been medically beneficial, it has also provided women with another birthing option and conveyed a societal benefit. Furthermore, caesarean sections are an enhancing technology in that they allow the physician or parents to schedule delivery in advance. CE should be seen in the same frame. Although CE may allow one to realize achievements more easily than one who is not enhanced, this does not mean that CE is inauthentic. Instead, as long as the choice to enhance is true to oneself, the subsequent achievement is as authentic and satisfying as an achievement gained through blood, sweat, and tears.

3.1.3 Giftedness and Gratitude for the Given

Sandel is particularly concerned that pursuing cognitive enhancement demonstrates a lack of appreciation for the given, which, furthermore, is indicative of flawed moral character. Moreover, Sandel worries that enhancement will prevent individuals from exerting effort in order to attain success. He considers striving for excellence to be based on unassisted character building, a classical idea. Sandel argues that the drive for mastery through CE demonstrates a lack of appreciation of the gifted characteristics that one may naturally possess. Sandel believes it is necessary to acknowledge the giftedness of life in order to recognize that human talents and powers are not wholly our own doing.^{li} Furthermore, Sandel worries that the effort to enhance both expresses morally flawed attitudes and undermines virtuous ones, such as gratitude for the given.^{lii} Sandel believes that excellence is the point of sports, as well as academia, and “excellence consists at least partly in the display of natural talents and gifts that are no doing of the athlete (or academic)

who possesses them.”^{liii} Fundamentally, Sandel believes that enhancement demonstrates a drive for mastery that is indicative of a lack of appreciation for giftedness or the given which, in turn, is detrimental to the central human good. Buchanan summarizes Sandel’s argument as the following:

1. The sense of giftedness is a central human good or an important aspect of good character.
2. The drive for mastery is incompatible with the sense of giftedness.
3. The employment of biomedical enhancements demonstrates a drive for mastery.
4. Thus, the employment of enhancement is incompatible with the sense of giftedness.
5. Therefore, the employment of enhancements is incompatible with a central human good.^{liv}

To Sandel, enhancement is a serious character flaw, as the pursuit of enhancement is indicative of morally flawed attitudes, values, and character defects. Sandel believes that a sense of “giftedness” is a precondition for having proper humility, as “giftedness” and “gratitude” are basic values.^{lv} Moreover, Sandel believes that the rejection of “given gifts” or “nature’s gifts” is a threat to humanity by eroding human agency.^{lvi}

Sandel’s argument rests on the assumption that human traits and abilities are gifts. A gift is an object, or trait in this case, given by one to another without payment or expectation of reciprocity. The notion of a human or character-based gift inherently requires a gift-giver, a higher being; however, this does not apply in secular reasoning.^{lvii} In secular thought, the idea of a “gift” is invalid because the giftedness argument is an invalid concept without a higher being as the gift-giver. Upon the dismissal of the “gift” argument, the gratitude argument becomes illogical. Gratitude is only appropriate in response to a benefit purposefully conferred by an agent and, as there is no gift-giving agent, gratitude is not appropriate. Therefore, seeking enhancement and rejecting the “given” is not evidence of character or moral defects, as gratitude is not required in the given situation.

In Sandel's discussion of the given, he omits that the given contains both good and bad, focusing solely on positive givens. More accurately, the given can be positive, such as intelligence or good health, but also negative, such as disease or a violent personality. The normal human aging process involves many bad givens, including deteriorating eyesight, hair loss, and cognitive decline. The use of glasses to improve deteriorating eyesight, a negative given, is hardly a controversial issue, let alone demonstrative of moral or character flaws. The given, when defined as inherent, biologically dictated traits, will always be necessary and appreciated in success, as no number of enhancements will be able to remedy all negative givens.

3.1.4 Treatment vs. Enhancement

The definition and role of medicine is an important philosophical question that greatly influences CE. In CE, a physician prescribes drugs not to treat, but to enhance. Therefore, the distinction between treatment and enhancement is a primary concern to critics. To critics, therapy is the treatment of disease, whereas enhancement is the improvement of normal abilities.^{lviii} Critics draw a definite line between disease states, which require treatment, and normalcy, which can be improved with enhancement. Treatment must conform to what culture and medical professionals deem proper objects of medical intervention. Therefore, disease is what medicine deems pathological, while enhancement is the improvement of the physiological, and, therefore, not within the scope of medicine. Critics opine that a physician's role is that of a "healer," and that to partake in enhancement is beyond the purpose of medicine.

Sandel states, "The moral quandary arises when people use such therapy not to cure a disease but to reach beyond health, to enhance their physical or cognitive capacities, to lift

themselves above the norm.”^{lix} Sandel believes that enhancement is an invasion of the moral standing of medicine. Likewise, Fukuyama believes that the purpose of medicine is to heal the sick, not to turn the healthy into gods.^{lx} Although not explicitly stated, one can conclude that medical necessity is imperative to the critics’ argument on the treatment-enhancement debate. Private and public insurance monies are allocated based on medical necessity, meaning that insurance companies draw a line between what is medically necessary treatment and what is merely elective treatment. Ultimately, critics believe there is a more or less distinct line between treatment and enhancement and that enhancement extends beyond the purpose and moral goodness of medicine.

Despite these critics’ beliefs that a clear distinction exists between treatment and enhancement, modern medicine actively rejects the notion and finds the line highly blurred. Kass, an outspoken critic, states that the distinction between treatment and enhancement is of limited ethical or practical value.^{lxi} Moreover, psychiatry in particular vehemently rejects the notion of a clear distinction. Steven Hyman, former Director of the National Institute of Mental Health, writes that in psychiatry there is “no bright line or point of rarity between illness and health.”^{lxii} Unlike many illnesses, psychiatric diagnoses are not confirmed by blood test or imaging, but instead by a set of criteria, much of which is dependent on a patient’s self-reported symptoms. A blood test identifies liver disease through enzyme levels, but does not identify a disease like schizophrenia. This further blurs the distinction between treatment and enhancement, particularly because there is no generalized definition of “normal” in mental health. Normalcy is a continuum in which “normal” psychiatric functions may differ greatly between individuals.

Psychiatrists are not the only physicians to reject a distinction between treatment and enhancement. Cardiologists, primary care physicians, pediatric endocrinologists, plastic

surgeons, and ophthalmic surgeons fervently disregard the distinction and enhance patients as part of their medical practice daily. Cardiologists and primary care physicians have broadly prescribed statin drugs, approved for lowering LDL cholesterol in those with the highest levels, even to healthy patients without cardiovascular risk in order to improve overall blood lipid profiles.^{lxiii} In the past, this proactive, preventative approach would have been considered unacceptable in “normal” patients; however, statins decrease LDL cholesterol to a level that a healthy individual could not reach with diet or exercise, thus potentially benefitting his or her overall health. Primary care physicians prescribe sildenafil for erectile dysfunction and minoxidil for baldness, which are often “normal” in aging and not universally considered diseases, thus making these medications enhancements. A striking example of the lack of clear boundaries between treatment and enhancement in medicine is evidenced by growth hormone treatment in children.

Pediatric endocrinologists’ use of growth hormone (GH) in growth hormone deficient (GHD) and non-GHD patients is indicative of how widespread enhancement is and how many consider it to improve quality of life. For example, consider Boy A and Boy B, both of whom are treated with GH. Does it matter if their short statures are the result of GHD or unrelated causes? A 1996 study on national treatment patterns published in JAMA indicates that physicians barely acknowledge GHD versus non-GHD status when recommending GH treatment. Physicians report that approximately 58% of their current patients undergoing GH therapy are GHD while the remaining 42% are non-GHD.^{lxiv} The non-GHD children are of short-stature but otherwise in normal health. The vast majority of physicians, more than 94%, report having recommended GH treatment for a non-GHD child in the five-year period prior to the study. These physicians pervasively believed that

prescriptions for GH in non-GHD children were “increasing somewhat” or “increasing significantly.”^{lxv} Analogous to CE, GH treatment for non-GHD patients is not covered by insurance and is an immensely expensive treatment, costing on average between \$13,000 and \$16,000 per year. GH treatment was developed to treat GHD patients; however, the prevalence of GH treatment in non-GHD patients demonstrates a great desire for this costly enhancement and shows that physicians have few qualms with recommending the treatment to non-GHD individuals.

When applying the medical necessity argument, immunizations must be explored. Per insurance company guidelines and reimbursements, immunizations are a “medical necessity,” paid for by insurance monies, which do not treat a disease state. Instead, immunizations provide immunogenic protection to develop adaptive immunity. Fundamentally, an immunization introduces a foreign pathogenic molecule to the immune system, thus exposing the immune system to a pathogen in a controlled manner. Although introduced at very low concentrations, immunizations are capable of causing disease, as vaccinations can carry a disease-causing pathogen. An increase in immunity conveys a benefit or enhancement to an immunized individual and protects against mortality or morbidity from infection. The widespread use of immunizations reflects physicians’ willingness to provide immunizations and that insurance companies reimburse for vaccinations. From the perspective of the insurance companies, the price of vaccination is negligible when compared to the cost of full-blown treatment of an infection. Nonetheless, vaccines undermine medical necessity as a cogent argument in the treatment-enhancement debate.

Critics of CE seem to believe that treatment and enhancements cannot co-exist and

that to adopt enhancement would be to neglect treatment. This is untrue. CE medications were not developed for enhancement but instead to treat specific disorders, such as ADHD and narcolepsy. Even cosmetic surgery, arguably in many circumstances as far removed from treatment as possible, was initially developed for reconstructive purposes. Scientific progress will continue with the aim to treat illness, and CE poses no threat to this goal and may enhance it as new uses for medications develop.

The majority of physicians, those who by definition are trained in discerning the distinction between disease states and health, do not perceive such a clear distinction. Critics may believe this definite line exists; however, as evidenced by statin use and GH treatment, physicians disagree. Physicians actively reject the treatment-enhancement distinction in many specialties, following the movement historically championed by psychiatrists who advocate against the concept of “normalcy.” Moreover, as science progresses, especially in relation to genetics because it provides us with the ability to predict disease, “healthy” and “normal” may completely lose meaning, erasing the already blurry line between treatment and enhancement.

3.2 Societal Arguments

3.2.1 Distributive Justice

Critics fear that CE has the potential to harm society. Those espousing distributive justice protest that enhancement will not be fairly distributed throughout society. Since CE is not an essential medical treatment, it is highly unlikely that CE would be paid for by insurance companies or socialized healthcare systems. Thus CE, like many costly commodities, will not be distributed equally between socioeconomic classes. Cost barriers and social barriers may prevent individuals from lower socioeconomic classes from

obtaining these medications. Critics worry that CE will contribute to the advantages of the elite and result in the less fortunate falling further behind.^{lxvi}

These critics worry that a society of chemical “haves” and “have-nots” will arise from CE in which the wealthy benefit from CE and the poor remain unenhanced. Are we allowing the emergence of two classes, the chemical “haves” and the “have-nots”? Are we going to create a wealthy class whose children will have not only the latest computers and special test preparation classes, but also pharmacological advantages?^{lxvii} Sandel argues that CE may create two classes of human beings—those with access to CE and those without. Sandel worries that “the enhanced” and “the merely natural” will become subspecies of humanity in which “the enhanced” are superior. To critics, CE is unacceptable, as it will not be equally distributed.

However, cognitive ability is already not distributed equally. Instead, cognitive ability is the result of genetics and advantages conferred through education and enriching experiences. Society accepts wide disparities in education, nutrition, and shelter. CE is hardly different. It is plausible that the wealthy will gain further advantage through access to CE and the poor will fall further behind. Although troubling, this is not a lucid ethical critique of CE, as following this logic would require the prohibition of all unevenly distributed enhancements and not just those of CE. Society is replete with such inequalities. Cosmetic surgery, nutritionists, and personal trainers all transfer a benefit to the user yet are not prohibited on the grounds that they are unequally distributed.^{lxviii} In academia, this logic would require a ban on private schools, tutors, test preparation classes, and numerous other unequally distributed resources that enhance cognition.

Duty to another is a serious responsibility in which one has a moral, legal, military, or otherwise binding agreement to behave in a manner that is founded on certain role-

specific or relational obligations. A soldier's obligations to the military and his country, a mother's obligations to her child, and a physician's responsibility to her patient are examples in which duty is applicable. As a free society, we are not responsible for one another's total well-being. One does not have the responsibility or duty to do everything that could make oneself or someone else better, and if one has no duty, then one is not at fault and so cannot be blamed.^{lxix} It is not an individual's duty to force an overweight person to the gym in order to improve his health, and, therefore, that individual cannot be blamed for another's failing health due to the other's lack of activity. The choice to enhance is also individual and the same logic applies. This lack of blame is ethically and morally soothing, as critics' impassioned arguments regarding distributive justice endeavor to create guilt in those who enhance. Unequal access is not grounds to prohibit CE and is akin to prohibiting private school or SAT tutoring, not only because there are already wide disparities in cognitive enhancing technologies, but also because it is no individual's duty to make someone else better beyond a set of role-specific obligations.

3.2.2 Coercion

Critics express concern that coercion, both direct and indirect, may drive non-users to employ CE drugs in order to remain competitive. The fear is that in a "winner take all" environment, in which more people compete for fewer prizes, pressure to better oneself may transform CE into a coercive force. If CE becomes widespread, there will inevitably be situations in which people are pressured to enhance. Employers will recognize the advantages of a more attentive and less forgetful workforce, and teachers will find enhanced pupils more receptive to learning.^{lxx} Although ethically corrupt, direct coercion is a lesser concern because it can be regulated and prohibited. For example, employers and teachers

could be prohibited from mandating employees and students to take CE drugs. On the other hand, direct coercion may also result if superior performance is deemed necessary for the greater good, such as in the military.

Indirect coercion is the principal concern because critics fear that matters of choice will evolve into forces of coercion. Therefore, in order to remain competitive with enhanced peers, individuals will enhance to compensate for what is seen as a disadvantage. To not take advantage of enhancements may mean falling behind as the standard of normalcy increases. For example, if the majority of students used modafinil and their doing so vastly improved the standard of academic performance, then non-users would feel pressure to follow suit in order to remain competitive.^{lxxi} The Red Queen Principle, adapted from *Through the Looking Glass*, in which the Red Queen and Alice are constantly running, yet remain in the same place, can be applied here in that an individual must continue developing in order to maintain ability relative to competitors. Critics find indirect coercion a sizable concern because it can be perceived as an attack on personal freedom.

Critics seem to believe coercion is a serious concern with few possibilities to assuage the issue; however, this is untrue. Direct coercion, in particular, is preventable through law and regulation. Moreover, legal precedent exists and relevant issues have been previously addressed. In academia, Connecticut General Statutes 10-212b, “Policies Prohibiting the Recommendation of Psychotropic Drugs by School Personnel,” is an appropriate model for future regulation. The statute defines “psychotropic drugs” and “school personnel” explicitly in order to prohibit the recommendation of psychotropic drugs by any school personnel. The statute implements policies that prohibit school personnel from suggesting medication to any student, under any circumstances.^{lxxii} Regulations like these can be

applied to academia and employers in order to protect students and employees from direct coercion.

Indirect coercion is undeniably an unsettling notion, but it is unlikely that indirect coercion will become a significant concern in CE. For a member of the academic community to be indirectly coerced, several criteria must be realized:

1. CE drugs must provide a substantial improvement in performance such that not taking them would place one at a distinct academic disadvantage against those who do.
2. The majority of students must engage in enhancement in order to promote the perception that “everybody else is taking them.”
3. The most successful students must be enhancing in order to validate the assumption that it is either impossible or prohibitively difficult for a drug- free student to attain high grades.^{lxxiii}

Although cognitive improvement has been demonstrated in healthy individuals, the results are mixed and depend upon the medication and the individual. For the most part, it is untrue and an exaggeration to say that current CE drugs provide a “substantial improvement.” The majority of students will not be enhancing, as CE drugs are limited resources that will not be equally distributed, making it impossible for “everyone” to be taking them. Finally, the most successful students are unlikely to all be enhancing since genetic intelligence and environment are factors in succeeding in school. Although some may benefit from CE drugs and vigilance against indirect coercion is justified, currently the essential criteria for indirect coercion are not met.

During undergraduate and graduate education, other coercive forces are far more prevalent in academia than CE. Students who are not employed and are able to focus solely on academics are more likely to perform better academically than those who are employed.^{lxxiv} Consequently, CE is no more coercive than the compulsion that one should not work in order to remain academically competitive. To forbid CE on the grounds that it

is a coercive force is an attack on the personal freedom of those who choose to enhance. Moreover, a recent study of enhancement stakeholders, including healthcare providers, students, and parents, find the most common opinion is that CE is the result of an individual and autonomous choice.^{lxxv} The inability of the necessary criteria to be filled and reports of CE being an autonomous decision indicate that indirect coercion is an unlikely threat.

3.3 Safety Arguments

The Food and Drug Administration (FDA) approves prescription medications prior to commercial availability, declaring that the medication has been deemed as a safe and effective treatment for a specified condition or conditions. A crucial aspect of the approval process is that the FDA must find an acceptable balance between the risks and benefits of a drug. For example, in amphetamine and methylphenidate, the side effects, such as potential irregular heartbeat and seizure, are so rare that the benefits of the drug, such as stabilizing a child's behavior and allowing proper development, are deemed worth the risk. Critics are troubled by the safety of enhancement because they believe the risks do not outweigh the benefits and also because someone choosing to enhance does not receive the same benefits as someone who is being treated. Fundamentally, critics find enhancement unacceptable because it introduces the risk of harmful side effects to an individual who would otherwise be in good health. Kass argues that "it surely makes sense, as an ethical matter, that one should not risk basic health trying to make oneself 'better than well.'"^{lxxvi} Safety is a focus of all medical interventions; however, when an intervention is elective, such as CE, safety becomes more significant and valued.

Beyond risking basic health, critics express concern regarding long term or hidden effects of CE drugs that might evade FDA precautions. Kass boldly states, "To generalize:

no biological agent used for purposes of self-perfection will be entirely safe.”^{lxxvii} Martha Farah, a cognitive neuroscientist, worries that “perhaps a youth spent scaling the heights of academic and job success thanks to enhancement by Ritalin will be followed by a middle age of premature memory loss and cognitive decline.”^{lxxviii} Critics claim that thorough studies of long-term use of CE drugs do not exist, and thus rare side effects or delayed pathologies, such as cognitive decline, could result from CE use. Fundamentally, critics do not believe that individuals can be safely enhanced.

Amphetamine and methylphenidate, the most common prescription CE drugs, entered the market in 1930 and 1956, respectively.^{lxxix} These drugs have been studied in great detail and rare side effects have been documented, which critics neglect to mention. These side effects are documented and made available to the public. In fact, thousands of patients have been followed in hundreds of clinical studies, demonstrating the efficacy of these stimulants in improving cognitive function. A large-scale review of controlled studies on long-term efficacy and safety of treatment with stimulants in adults with ADHD concluded that long-term therapy is highly beneficial and well tolerated.^{lxxx}

The safety issue is far from settled and remains a serious concern for critics and proponents of CE. Long-term effects are worrisome with chronically dosed CE drugs, particularly newer compounds; however, critics neglect to acknowledge that long-term effect worry plagues non-enhancements as well. Long-term harm or rare risk is a serious issue in treatment, not only enhancement, and is evidenced by the Vioxx recall and the FDA’s frequent addition of boxed warnings to medications after approval in order to inform physicians and patients of serious risks discovered in new medical studies and post-approval use. Safety will be further addressed in 4.3. Although safety is a concern, numerous

strategies are available to mitigate the risks associated with CE.

IV. Arguments in Favor of Enhancement

4.1 Philosophical Arguments

4.1.1 Personal Freedom

The United States values personal freedom and autonomy. This is evidenced by our democratic political system, the Bill of Rights, lack of censorship, and autonomy of citizens. Our nation encourages personal empowerment and encourages the growth of its people. Personal freedom is of foremost importance and is one of the defining factors of the United States of America. Personal freedom is a highly valued aspect of American identity, indicated by the adoption of the First Amendment in 1791, hardly four years after the Constitution was adopted. As Americans, we value autonomy, rights, and choice as free individuals. In some respects, a libertarian perspective is endorsed; as long as the individual is aware of the risks, he is given the freedom of self-determination.

Respect for personal autonomy is one of the fundamental guidelines of clinical ethics and a Constitutional right. Society's respect for the rights of the individual allows the individual to act autonomously and in a self-determined fashion. In medicine, autonomy is respected and reflected in the individual's right to treatment options, such as do not resuscitate orders. However, autonomy is contingent upon the individual's ability to make a sound, informed decision. In clinical settings, the pervasive belief is that each individual who is competent has the fundamental right to control who can touch his body.^{lxxxix} Autonomy is contingent not only on mental competence but also on the availability of choice. Mental competence is assessed by two self-evident criteria. The law asks whether an individual has a mental impairment and, if so, if the mental impairment would prevent the

person from making a specific decision. In academia, mental competence is rarely an issue because one must be a highly cognitive functioning individual to be a member of the academic community in the first place. Choice is appropriately given, as evidenced by critics' weak argument of coercion.

Behavioral choices can have long-lasting, harmful effects. Alcohol, cigarettes, and indiscriminate sexual activity can greatly harm an individual, including death from lung cancer or infertility due to a sexually transmitted disease (STD). Teenagers are thoroughly educated about the risks of alcohol, cigarettes, and STDs; regardless, many individuals choose to partake in high-risk behaviors. The government, through law and taxation, has tried to dissuade participation in these behaviors; however, autonomy grants individuals the right to make choices. For example, one can decide to drink and drive, but the consequences are severe, such as prison time or serious bodily harm or death, whether one's own or others. Autonomy allows this choice, however foolish and irresponsible. Food selection and physical activity provide other examples of choices that have profound health implications. Immobility and obesity pose serious danger to many individuals. Individuals decide what to put into their bodies and how active they are. In comparison, the known dangers of CE are far less daunting.

4.1.2 Evolutionary Shortcomings

Natural selection is (normally) the extremely gradual change in which biological traits become more or less common in a population as a function of differential reproduction. The imperfection of biological design is the foundation of the theory of natural selection, in which genetically diverse organisms compete for resources and those that are best suited for the given environment thrive and reproduce offspring with naturally

selected genetic attributes, which we know as evolution. Critics and proponents of CE are likely to agree that evolution has produced numerous design flaws. The following lists examples of serious design flaws that are harmful, and, potentially fatal, to human beings:

1. The urinary tract in male mammals passes through, rather being routed around, the prostate gland. This can cause swelling of the prostate and block urinary function.
2. Poor drainage in the sinuses can lead to severe pain and infection.
3. The inability of humans to synthesize vitamin C has led to countless deaths from scurvy.
4. The vertebrate “blind spot” required vertebrates to develop elaborate and costly perception-correcting mechanisms.
5. The dual function of the human pharynx—air intake and food intake—significantly increases the chance of death by choking, particularly in comparison to other animals.
6. The hasty shift from quadruped to biped resulted in back and knee problems and a birth canal that passes through the pelvis, resulting in greatly increased risks to both mother and child in the birthing process.^{lxxxii}

These flaws are referred to as “suboptimal design” and are congruent with Darwin’s statement that nature is “clumsy, wasteful, and blundering.”^{lxxxiii}

Evolution has slighted human beings in more subtle ways. A poignant example of this resides in human motivation, a result of evolution. The dominant view among evolutionary psychologists proposes that the fundamental features of human motivation were shaped during the Pleistocene era more than ten thousand years ago.^{lxxxiv} Motivation was molded to fit a profoundly different environment than the one in which we function today. Human motivation is not insufficient; however, it is outdated and could benefit from a refresh that will take thousands of years to occur evolutionarily. Recent advances in neuroscience and psychopharmacology have the potential to convey a vast benefit in a timely manner. Moreover, the consumption of CE drugs does not influence evolution, as taking a pill causes no genetic change and, thus, cannot interfere with evolution.

Evolutionary theory suggests that if humans are advanced enough to develop a technology, they should be free to use their resource. Michael Gazzaniga states, “One could

argue that evolutionary theory suggests that if we are smart enough to invent the technology to increase our brain capacity, we should be able to use it. It is the next step in the survival of the fittest.”^{lxxxv} Amphetamine, methylphenidate, modafinil, and donepezil are all technologies developed by human beings to increase cognitive function or “brain capacity.” Following Gazzaniga’s logic, CE is necessarily acceptable as we are evolved enough to bring about enhancement technologies. The promise of CE is alluring as a technology that exists to improve brain function, which would take thousands, if not millions, years if left to evolution. To quote Corneliu E. Giurgea, “Man is not going to wait passively for millions of years before evolution offers him a better brain.”^{lxxxvi}

4.1.3 Pharmacological and Non-Pharmacological Interventions Influence Brain Function

For many, the notion of CE through pharmacological alteration of brain function is unnerving and far more unnerving than non-pharmacological intervention. CE drugs influence the most complex and important human organ, the brain. The brain is not well understood, which is further complicated by folk psychology’s influence on the perception of the brain as a mysterious organ dictating identity. Although CE drugs alter brain function, this is hardly as daunting as it sounds. Pharmacological agents are not distinct among CE interventions in that they elicit benefits through altering brain function. Cognitive interventions, both pharmacological and non-pharmacological, influence brain function and biological changes have been identified. Recently, non-pharmacological CE interventions, such as nutrition, exercise, and sleep have proven to enhance cognition through beneficial neural changes.^{lxxxvii}

Enhancing cognition through nutrition involves simply modifying what one consumes in order to elicit cognitive benefit beyond a healthy and balanced diet. Common

substances such as caffeine and nicotine are often used to augment cognition. Caffeine, sugar, and ginkgo biloba are currently the primary nutritional means to enhancement and have been studied thoroughly by scientists interested in enhancement through nutrition. Caffeine acts as an adenosine receptor antagonist. Adenosine functions as a regulator of activity by decreasing neuronal firing and inhibiting the release of various neurotransmitters like dopamine. The stimulating effect of caffeine is due to indirect action on dopamine receptors that is secondary to antagonism of adenosine receptors.^{lxxxviii} Typical behavioral responses include elevated mood, increased alertness, improved sustained attention, better motor-skill performance, and increases in the speed of encoding and response to new stimuli.^{lxxxix} Sugar, or more specifically glucose molecules, enhances cognition several minutes after glucose administration. The results of glucose administration, like a sweet snack during an exam, are improved attention, response speed, and working memory.^{xc} Ginkgo biloba has long been used as a natural form of cognitive enhancement. Currently, ginkgo remains one of the most widely used natural CE interventions. Ginkgo may improve cognitive ability, particularly memory, by stimulating blood flow to the brain.^{xcii} Indisputably, nutrition is a non-pharmacological intervention that influences brain function, just as a pharmacological intervention does.

Physical exercise is not only beneficial to cardiovascular health in controlling weight, improving mood, and boosting energy, but also in improving cognitive ability. In the early 20th century, a study demonstrated that athletes outperform physically inactive individuals in measures of cognitive function, which inspired the theory that aerobic exercise is related to beneficial effects on cognitive function and ability.^{xciii} A meta-analysis of randomized controlled trials found that aerobic exercise training is associated with

modest improvements in attention, processing speed, executive function, and memory.^{xciii}

While data on the neural mechanisms of physical exercise on cognition are sparse, however, it is known that regular exercise improves resting functional efficiency in higher-level cognitive networks and increases hippocampal cerebral blood flow and hippocampal connectivity.^{xciv} Significant brain volume increases in gray and white matter, in particular the size of the anterior hippocampus, have been shown to be associated with aerobic exercise training.^{xcv} The increased size of the hippocampus is likely related to enhanced spatial memory. Although the mechanisms are not well understood, there is a clear correlation between physical activity and enhanced cognitive ability, making exercise a non-pharmaceutical CE intervention.

Sleep is immeasurably important, and the average adult spends one third of his life asleep. Sleep deprivation is prevalent in the United States and is detrimental to health. Unsurprisingly, adequate sleep is necessary for optimal cognitive functioning. Sleep deprivation produces impaired cognitive function due to increased sleep propensity and instability of waking neurobehavioral functions. The cognitive functions most affected by sleep deprivation include psychomotor and cognitive speed, vigilant attention, executive attention, working memory, and higher cognitive abilities.^{xcvi} Sleep deprivation causes the blunting of cortical responsiveness of incoming stimuli, reflecting impaired attention.^{xcvii} Biologically, sleep deprivation is associated with increased levels of the neuromodulator adenosine, which has a general inhibitory effect on neural activity.^{xcviii} The cognitive decline associated with sleep deprivation is reversed by adequate sleep, improving cognitive ability, albeit it to a “normal” degree. Additionally, sleep is necessary for memory consolidation. Sleep is a luxury to many for careers and family can prevent good sleep hygiene, leading to impaired cognition. Maintaining proper sleep hygiene is a non-

pharmaceutical intervention that enhances cognitive ability as well as general health.

If one's concern with pharmacological intervention is that it is invasive, this can easily be assuaged by the numerous invasive non-pharmacological interventions that are ethically accepted. Nutritional enhancement involves changing what we ingest, which is invasive in a way that reading or sleep is not. The non-pharmacological interventions of nutrition, exercise, and sleep all have documented biological and neural implications in the brain. Consequently, pharmacological intervention should be regarded as morally equivalent and accepted alongside more common interventions because both influence brain function.

4.1.4 Enhancement as Obligation

Enhancement is an obligation and responsibility undertaken by the vast majority of individuals, parents, and academics. A desire for personal improvement is universally respected and CE should be evaluated like any other technology leveraged for personal improvement, such as a library membership or college education. Enhancement is not an obligation in that one is forced to partake, as that would be coercion, but it is instead an obligation in the form of an individual's responsibility as a parent, student, or professor. In academia, the obligation to enhance permeates across an individual's development from kindergarten to professional retirement.

The birth of a child transforms a woman and man into a mother and father, which are radically new identities. Instantaneously, the responsibility of parenthood sets in, bringing with it worries about the child's health, happiness, and safety. Most parents accept enormous responsibility when having a child, as the privilege of parenthood is paired with an obligation to provide the best possible life for the child. A child's cognitive ability is of

great importance and thus motivates the parents' obligation to enhance. Parents sacrifice greatly for their children and devote immense resources to their children, particularly in order to provide good education and enhance cognition. A single mother may work an extra job on the weekend in order to provide her daughter with the opportunity to attend private school, have a tutor, or engage in any number of enhancing activities. One hopes that parents want success for their children; therefore, one can conclude that enhancement, such as access to technology, good schools, and books, is an obligation, as this is the surest means to success.

In elementary school and high school, it is difficult to discern when students realize the importance of their education and that one should strive to better oneself. Most likely, this realization sets in as students begin to think about college and how competitive their grades and backgrounds are; however, by a student's freshman year of college, this realization is often fully accepted. As an undergraduate, enhancement is an obligation, as matriculation to an undergraduate institution is an acknowledgement of a desire to better oneself and admission is seen as a privilege that cannot be wasted. Undergraduates are aware that their time as students will not only immensely influence their future education and career plans but also their lives and overall wellbeing. An undergraduate has an obligation to enhance himself—that is, to graduate with more knowledge than was accumulated during high school in order to create a foundation for future successes. Moreover, students are indebted to whoever is paying their tuition, be it a parent, a scholarship program, or the student himself, and must strive for enhancement in order to demonstrate appreciation.

Educators of all levels, from third-grade teachers to college professors, are required

to enhance their students and provide students with novel information and perspectives. Fundamentally, this is the job of an educator. In academia, when an individual accepts a position as a professor, he also accepts the responsibilities of the job, primarily to enhance the knowledge and thinking abilities of his students. As academic faculty are not arbitrarily decided and instead are selected for specific positions in defined areas of interest, faculty have the obligation to enhance themselves and contribute to the generation of knowledge in order to benefit themselves and other academics. Additionally, faculty are obligated to enhance their students in order to prepare the next generation of academics. Academic faculty have a vested interest in the future of their discipline, as this is necessary to maintain a high caliber of academics in a given field.

The word “obligation” is charged with undertones of duty, commitment, and apprehension; however, in academia “obligation” is associated with responsibility and the privilege of education. Moreover, working in academia is an opportunity to give life meaning for academic responsibility carries with it great emotional and intellectual benefits. Some academics may find that CE amplifies the opportunity to find meaning in life, and these faculty members may lead more fulfilled lives. We know that with great power comes great responsibility, and we must focus on the notion of responsibility. Responsibility and the obligation to enhance are inherently entwined with the privilege of parenthood and academia and, therefore, must be honored. Enhancement is an obligation for those who decide to accept a role, such as parent or educator, in which enhancement is an inherent responsibility.

4.1.4.1 Enhancement as Obligation in Medical Profession

CE has been studied in medical students, residents, and attending physicians, as well

as (though less exhaustively) in pilots. Attending physicians are a particularly interesting group to study through the lens of enhancement as obligation because CE has the potential to greatly benefit both physicians and patients. Physicians are charged with the enormous responsibility of caring for the ill and making difficult treatment decisions. Physicians are notoriously sleep-deprived, as many work 24 to 48 hour shifts and can be on-call for simultaneous days severely limiting sleep. On-call surgeons receive a median total sleep time of 1.5 hours, ranging from 0 to 3 hours per night.^{xcix} Such surgeons whom we entrust with patients are cognitively impaired due to sleep-deprivation, which is hardly in the patient's best interest. Is it not in the interest of patient safety for physicians to undergo enhancement?

Sleep deprivation and fatigue are unequivocally linked with cognitive dysfunction and impaired clinical performance.^{cci} Even relatively moderate levels of sleep deprivation and fatigue can impair performance to an extent equivalent to or greater than is currently acceptable for alcohol intoxication.^{cii} An intoxicated physician would never be allowed to practice medicine, as not only is it against best interests of the patient, but also because it makes the physician and hospital vulnerable to massive malpractice suits. Furthermore, sleep deprivation increases rates of medical errors resulting in an increase in harm to patients.^{ciii} In a 2001 study, Teodor Grantcharov demonstrated that surgeons show impaired speed, dexterity, and accuracy in simulated laparoscopic performance after a night on-call.^{civ} In the same study, Grantcharov disproved the theory that sleep deprivation does not affect cognitive performance until at least 36 hours without sleep. Instead, the study demonstrates that significant deficits in psychomotor performance occur after only 17 hours on call.^{cv} Similarly, anesthesiologists' performance is impaired by sleep deprivation, as the cognitive demands of intraoperative patient care require constant data collection, development of

treatment plans, monitoring outcomes, and evaluating patient outcome.^{cvi} These tasks require sustained attention, which is particularly vulnerable to the effects of fatigue. Fatigued physicians, functioning at suboptimal cognitive abilities, may commit serious errors, ultimately harming the patient.

Modafinil, a treatment for narcolepsy and shift work disorder, has been studied in healthy adults as well as in sleep-deprived physicians. Modafinil is well tolerated and has demonstrated the ability to ameliorate the cognitive impairment in sleep-deprived healthy individuals. Colin Sugden, et al., demonstrated that 200 mg of modafinil administered to physicians after one night of sleep deprivation increased subjects' performance on at least one important measure for each of the CANTAB administered cognitive tasks in comparison with the control group.^{cvii} A similar study testing the effects of 400 mg of modafinil on fatigue and associated cognitive decline concluded that this dose of modafinil significantly reduces subjective sleepiness and cognitive decline following 24 hours of sleep deprivation.^{cviii} Although further studies are necessary to determine optimal dosage and address safety concerns, modafinil is a strong candidate to aid physicians in providing patients with the best care possible, even when sleep- deprived.

Physicians are not the only medical professionals subjected to sleep deprivation. Medical students and residents suffer from fatigue as well. Medical students, as members of academia, are under immense pressure to perform well, manage a heavy workload, treat patients, and are frequently on-call. Additionally, medical students are constantly under evaluation, which is mentally and physically exhausting, adding to their fatigue from long hours. If sleep deprivation was viewed as a side effect of medical training, and then compared to the side effects of modafinil, medical training would be considered markedly more dangerous.^{cix} Sleep deprivation is associated with fifteen common side effects, while

modafinil is unlikely to cause side effects unless used at high doses.^{cx†} CE in academia is not only applicable to students but also to physicians with academic appointments and physicians working in hospitals associated with a university. Physicians at academic hospitals must manage medical students and residents but also treat their patients, which is highly time-consuming. Moreover, academic hospitals tend to be very busy, which leaves little time for academic physicians to sleep.

In medical school, every physician is taught the principle tenet of clinical medical ethics, *primum non nocere*, “*first, do no harm.*” Although not stated in the Hippocratic Oath, “*first, do no harm*” is a wise and valuable statement from Hippocrates and is a central principle of medicine. It is highly evident that fatigue and sleep deprivation have serious effects on physicians and that medical errors can result from fatigue-related cognitive impairment. A physician rejecting modafinil or other potentially cognitive enhancing or wakefulness promoting drugs is accepting the responsibility that he may “do harm” as a result of impaired function. It is currently acceptable to practice medicine when sleep-deprived, which violates *primum non nocere*. The medical profession is stressful, intellectually demanding, high-pressure, and immensely important. If safety concerns were resolved, the rejection of an enhancement in a situation where the enhancement could convey a benefit to the patient and reduce the risk of medical error would be unethical. Therefore, if safety is established, enhancement may be an obligation in certain situations.

4.2 Societal Arguments

4.2.1 Increased Productivity

4.2.1.1 Increased Productivity and Society

[†]See Table 1 for “Comparison of Side-Effect Profiles of Sleep Deprivation and of Modafinil”

CE possesses the potential to increase productivity, which is advantageous to both the individuals choosing to enhance and society as a whole, as previous increases in productivity have been the platform for increases in human well-being. Historical non-biomedical enhancements have fit this pattern, including the agrarian revolution, literacy, the industrial revolution, railroads, and computers.^{cxii} The increased productivity that resulted from these enhancements has provided significant and widespread benefits to human wellbeing. Fundamentally, productivity is defined as “how good we are at using existing resources to create things we value.”^{cxiii} Governments have a keen interest in increasing productivity, investing heavily in education and public health, not for the good or rights of the individuals, but instead because they want to “build a stronger nation” or promote “economic growth.”^{cxiii} An increase in productivity can improve well-being and strengthen the nation because a more productive country is stronger and, consequently, more powerful.

To prosper, a society must capitalize on all resources, both material and cognitive. Material resources have overshadowed cognitive resources for many years, but this is likely to change as cognitive resources become highly valued. Countries must learn to maximize citizen’s cognitive resources, dubbed “mental capital,” if they are to prosper, both economically and socially.^{cxiv} Mental capital includes an individual’s cognitive ability, his flexibility and efficiency, social skills, and resilience under stress.^{cxv} Moreover, mental capital establishes the extent of an individual’s contribution to society and predicts the likelihood of a high quality of life. Mental capital has a significant effect on a nation’s economic competitiveness, prosperity, and well-being.^{cxvi} CE is a logical addition to the theory of mental capital. CE allows citizens to capitalize on their cognitive resources and

more greatly contribute to society. To improve mental capital with CE could be hugely positive and markedly improve society.

An increase in productivity is truly a win-win situation for society. Increased productivity is likely to improve well-being and may increase citizens' free time, allowing them to pursue other interests. Additionally, increased productivity may decrease unrewarding work, lower the price of products, and create free time for individuals to pursue activities beyond making a living.^{cxvii} The Industrial Revolution represents a striking example of this. New technologies, particularly in manufacturing and the replacement of waterpower and physical power by steam power, profoundly improved social, economic, and cultural conditions at the time. Textile manufacturing changed dramatically resulting in an enormous increase in productivity. In 1785, the spinning wheel and handloom, inefficient and work intensive technologies, were replaced with the shuttle loom. The shuttle loom produced textiles at unprecedented speed with less labor. Consequently, cloth became more affordable, demand increased, and exports blossomed, which caused an increase in employment.^{cxviii} Concurrently, the invention of the cotton gin increased productivity by easily separating cotton fibers from seeds, a job previously performed painstakingly slowly by hand. The cotton gin caused vast growth in the production of cotton in the United States and spurred economic growth.

Increased productivity does not benefit society in a solely economic manner. It also provides the opportunity for individuals to pursue other activities. Before the invention of railroads, travel was a hugely time consuming activity where weeks were spent on horseback. Similarly, we now use air travel to conserve time versus car travel. The ability to accomplish tasks more quickly and efficiently leaves time for other activities. This may

increase individual well-being, as time can be spent on chosen activities, such as recreational activities and hobbies. Moreover, societal well-being may be increased as some of these individuals may contribute their free time to activities that benefit the greater good, such as volunteering in food kitchens or cleaning a local park.

It is not guaranteed that increased productivity through CE will increase well-being although historical examples indicate this is very likely. Steven Hyman writes, “A fair reading, however, could find the implication that enhancement strategies could play a role as part of an integrated strategy to improve well-being in an increasingly competitive and unforgiving world.”^{cxi} Given the historical increases in societal well-being resulting from increased productivity, it would be naïve to discourage the use of enhancements that promise marked increases in productivity and well-being or to refrain from maximizing mental capital.

4.2.1.2 Increased Productivity in Academia

Society inherently operates within a greater good frame, meaning that some individuals have a disproportionate impact on the greater good of society because their contributions are more significant than the average individuals. The level of function of these disproportionately beneficial individuals bears directly on societal health and protection.^{cx} The greater good frame does not conflict with personal autonomy because whether or not the individual acts with the intention of benefiting society or himself does not influence the benefits provided to society. A variant on this greater good frame states that CE clears the way for “one’s natural talents to be revealed” and these talents can be leveraged to increase productivity and the good of a nation.^{cxi} Those in academia can be generalized as highly intelligent, driven, compassionate, inventive, and hardworking, as

these are necessary qualities to join the academic community. Moreover, as the reputation of the academic institution constitutes great importance in society, it is generally accepted that the most prestigious academic institutions are replete with individuals of the highest caliber who contribute greatly to society.

Academics, from biologists to sociologists, uncover new knowledge, generate discoveries, and enhance society through their contributions. Academia is responsible for novel technologies, such as those of medicine, and more abstract theories and creations, like the theory of relativity. Therefore, it can be concluded that, as the public greatly benefits from academia, the public “would want academics at the peak of their potential, because their product serves a greater good.”^{cxixii} Talented academics are gifted and serve as innovators of discovery, insight, creativity and medications, such as CE, that facilitate the delivery of academic products that are highly desirable.^{cxixiii} To enhance academics could be hugely beneficial to society, as progress will accelerate and address issues including global warming, healthcare, and the economy. Allowing professors the opportunity is imperative since it potentially allows these individuals to more effectively contribute to the good of society.

4.2.2 Non-Zero Sum Situation

Life is not always a competition. There is no gold medal or home run record. Nonetheless, many assume that CE follows in sports’ zero-sum framework; however, this is untrue. In zero-sum situations, each individual has an interest in others not getting the good in question because what the others get diminishes one’s share of the good.^{cxixiv} Essentially, in a zero-sum situation, what one gains, the other loses. To partake in CE is to benefit oneself, not defeat another. For example, Student A may take amphetamine to write an

essay and receive an A, and Student B may not enhance yet still receive the same grade. Student A's use of enhancement does not prevent Student B from obtaining an A, the good in question.

Differences in human ability are inherent, as ability is a result of biological and psychological functions. A particularly strong cognitive ability or skill in a particular specialty does not mean no one else can excel in the given subject. Society is lucky to have talented mathematicians studying the economy, dedicated scientists striving to cure diseases, and devoted teachers. This creates a division of labor, which ensures life is not a zero-sum situation. An artist does not lose because he does not understand economic models. On the contrary, society benefits from talented individuals who excel in their professions. Differences are inherent and beneficial. Imagine the disastrous results if doctors were randomly selected.^{cxxv} CE will not create a hyper-competitive environment in which only one can win. Conversely, CE will improve the quality of life for many, as those who enhance will make great contributions to society through network effects.

4.2.3 Network Effects

Literacy, numeracy, and computers are productivity-increasing enhancements characterized by network effects: the value of these enhancements to the individual increases as more individuals have them.^{cxxvi} CE will create beneficial network effects. The more widespread CE is, the more beneficial it will be to those who are enhanced. A single cognitively enhanced individual is without contemporaries with whom to share the experience; however, with a similarly enhanced peer, the individual can collaborate and be productive. The more cognitively enhanced individuals, the more valuable enhancement becomes, as a vast network of enhanced individuals will form, all of who would be

operating at optimal capacity. A small group of cognitively enhanced individuals, let alone thousands, can achieve great things, whether together or individually, as network effects of CE will benefit all who decide to enhance.

Furthermore, those who are not enhanced still benefit in the sense that a greater pool of knowledge exists for them to access. Those who choose not to partake or do not have the opportunity to partake in CE will still benefit from CE indirectly. An individual who does not enhance still benefits from the productivity and successes of those who enhance. For example, Patient A may not enhance, but his disease may be treated with a novel medication developed by an enhanced chemist. As previously mentioned, CE is likely to bring increases in productivity and create the potential for increases in the well-being of many.

4.3 Safety Arguments

4.3.1 Physicians as Gatekeepers

The physicians as gatekeepers argument is only valid if physicians are prescribing CE drugs off-label or if the FDA approves these medications for enhancement purposes. Nonetheless, the following thought experiment demonstrates the importance of physicians as gatekeepers to access of CE drugs:

Physicians are the initial gatekeepers of prescription medication; however, once prescribed and filled by the patient, the patient becomes the gatekeeper to the medication. Physicians assess their patients prior to prescribing medication in order to determine if a particular medication is appropriate. For example, a patient with heart problems would not be a suitable candidate for prescription stimulants, as these can exacerbate cardiac troubles. If a patient is deemed suitable, the physician follows the patient closely as he starts a new medication to monitor the drug's efficacy and side effects. Additionally, physicians educate

patients about the risks of their medications and will advise patients not to mix certain medications. The physician's assessment and education of the patient is immensely important, as the patient is then better equipped to assume the role of gatekeeper. Sadly, some patients with prescription stimulants, particularly undergraduates, sell or share their medication and are unfit gatekeepers of a highly desired medication.

In the undergraduate community, the most common method of illicitly obtaining prescription stimulants is through friends and peers, with nearly 70% obtaining drugs in this manner.^{cxxvii} This is particularly alarming, as not only are those prescribed medication not following their therapeutic regime, but also because students are taking potentially dangerous drugs without appropriate medical oversight. Medical oversight is necessary in order to ensure safe usage of these drugs, as potential risks can be very serious, particularly in individuals with underlying conditions or taking medications that amplify the effects of stimulants. The majority of adverse events reported during prescription stimulant treatment occur during the titration period, generally the fourth week of treatment.^{cxxviii} A physician can ensure that the treatment is beneficial and that no adverse events have occurred by monitoring the patient during this initial period. Moreover, the physician can change the patient's prescription if an adverse event were to occur and can terminate the patient's treatment if the patient is selling his medication.

There is no guarantee that an individual requesting a medication will receive it. If a student requests a stimulant from his physician and his physician believes that because of the student's high blood pressure this is risky, the physician will refuse the patient's request and explain the risks to the patient. Consequently, it is unlikely that this student will illicitly pursue enhancement in the future, as he realizes the serious harm it may cause. Individuals

will only receive the enhancement if a physician deems the risk factors are minimal and that the individual is responsible and competent.

Doctors are not waiters; they do not simply respond to the orders and preferences of their patients.^{cxxix} In contemporary medicine, the Internet provides access to information from which some patients self-diagnose and others feign symptoms in order to procure medication. Physicians are aware of this phenomenon and wary of negligently prescribing medications, particularly in pharmacological cognitive enhancement. Physicians report being the least comfortable with prescribing cognitive enhancers to 25-year-old patients, with comfort level increasing as age increases, indicating that physicians are aware of CE abuse.^{cxxx} In this patient age group, “fear of misuse” and “patient does not need the drug” were the two most common reasons physicians were uncomfortable prescribing cognitive enhancers.^{cxxxi} Allowing physicians to remain gatekeepers of CE medication is advantageous. This protects the minority who are at risk for adverse events from accessing these medications and allows physicians to monitor a patient’s tolerance of the medication.

4.3.2 Safety of Amphetamine and Methylphenidate

Amphetamine and methylphenidate have rich histories and have been extensively researched since these compounds have existed for over sixty years. In the late 1920s, when Alexander Fleming discovered penicillin, Gordon Alles, a young chemist, created amphetamine. Initially, amphetamine and methylphenidate were marketed for depression and weight loss. The stimulating effect of amphetamine was well known, most recognizably demonstrated by the wide acceptance and use of amphetamine in the military during WWII. Within the military, the drug was called “go” pills or “wakey-wakey” pills and distributed by German, British, and American forces. The administration of prescription stimulants to

those who are hyperactive or have learning and behavioral disabilities has a paradoxical effect. Instead of further stimulating the individual, prescription stimulants seem to calm and benefit these individuals. Consequently, the FDA approved amphetamine and methylphenidate as ADHD treatments. Currently, amphetamine and methylphenidate are the best-known and most widely used treatments for ADHD.

Amphetamine and methylphenidate studies focus on tolerability in ADHD populations; nonetheless, the results of these studies are highly likely to be analogous to tolerability in the normal population. Amphetamine therapy of ADHD is well tolerated, effective in treating symptoms, associated with symptomatic improvement for up to 24 months, and causes positive changes in outcome measures.^{cxxxii} Likewise, methylphenidate is well tolerated by patients.^{cxxxiii} A common misconception propagated by the non-scientific community is that prescription stimulants are toxic to the cardiovascular system and increase the risk of adverse cardiovascular events in healthy individuals. The public is concerned that prescription stimulants may be associated with adverse cardiovascular events such as stroke, myocardial infarction, and sudden death. This concern is amplified by conflicting scientific evidence and the intense media coverage of extremely rare events in which a prescription stimulant was implicated in an individual's death. A recently published systematic review of available literature on prescription stimulants and adverse events concludes that although the association between prescription stimulant use and adverse cardiovascular outcomes are mixed, there is no direct, causal relationship.^{cxxxiv}

Amphetamine and methylphenidate have been extensively studied and are generally considered safe, despite documentation of adverse effects, which indicates that enhancement in the cognitively intact is likely to be relatively safe. Hyman writes, "One should not be

cavalier, but these drugs have been in use for decades, and long-term cohorts have been followed for a variety of reasons, making it unlikely that we are missing some truly awful long-term side effect.^{»^{xxxxv}} Studies of CE drugs in the cognitively intact to examine efficacy and tolerability are highly necessary and imperative to ensure the safety of CE drugs in healthy individuals. Nevertheless, for the sake of argument, the current acceptance of amphetamine and methylphenidate as safe is encouraging to CE proponents. This indicates that, at least in the cases of amphetamine and methylphenidate, side effects have been documented and very rarely cause significant harm, making these compounds attractive to those who choose to enhance.

V. Application of Selected Ethical Arguments to CE in Academia

5.1 Application of Critics' Arguments

Critics are concerned with the philosophical and societal consequences of CE. In academia, the most relevant philosophical arguments are that to engage in CE is to desire mastery and to cheat. Additionally, critics are concerned that CE use will cause distributive justice problems and coercion in academia. Ultimately, the arguments against CE are generally unconvincing but particularly so when applied to academia, as all are based on false assumptions.

5.1.1 Application of Philosophical Arguments

5.1.1.1 Desire for Mastery

Critics believe that to pursue enhancement demonstrates a desire for perfection and mastery that is fueled by corrupt motivation. When applied to academia, this argument relies on the assumption that perfection and mastery are attainable in academia. It is

impossible to know all, as there is always more to be studied and new knowledge is generated daily, making it impossible for one individual to master a subject. Physicians complete medical school, internships, and residency before becoming attending physicians charged with caring for patients. A physician's education does not end after residency. Many states require physicians to complete continuing medical education (CME) courses each year in order to maintain their licenses to ensure physicians maintain competence and become familiar with novel procedures. Even the most accomplished surgeon, who has never been sued for malpractice and has an impeccable record, must partake in CME in order to remain current. For example, a 55-year-old surgeon may be highly successful in his procedures yet have no knowledge of newer laparoscopic surgery, which is a great disservice to his patients. Additionally, perfection in general is impossible in academia, as perfection may be subjective. One undergraduate might think her poem is marvelous, while the teacher finds it to be ordinary. As much as one might know, there is always more to be learned, and this is particularly true in academia, as academia is replete with individuals with insatiable curiosity who are eager to uncover new knowledge and learn more and more.

Corrupt motivation is inapplicable in academia, as even the most "tainted" motivations are grounded in the desire for education. The closest example of corrupt motivation present in academia is that some students and professors see education as a means to a better financial future through securing a job with their knowledge. This is truly not corrupt, and this population is a minority, as it is well known that academia for the most part is not a realm for those who crave wealth. One could say a student who attends college in order to enter the professional world is selfish and motivated by a desire to be financially successful; however, this is false. Fundamentally, the student acknowledges he must learn

more in order to be prepared for a career, making education the primary motivation. The vast majority of motivation in academia is overwhelmingly pure and simple. Students and professors yearn to learn more, to know more, and to use their knowledge in an advantageous manner.

5.1.1.2 Cheating

Cheating is only possible if an established rule is broken, and this confers an unfair advantage. No such rules exist in academia regarding CE, making cheating an anemic argument against CE. Cheating relies upon the assumption that the primary goal of the task is to win, which is invalid in academia. The primary goal of academia is not to win, but instead it is to acquire new information and develop skills. Moreover, the argument that CE provides an inauthentic experience and is “cheating oneself” is not pertinent. The fact that academia does not forbid CE is not the result of a lack of related rules, as academia is sated with rules and regulations to prevent cheating. In academia, explicit and implicit rules govern students’ and professors’ behavior. Explicit rules are clearly stated and published in student and faculty handbooks. Implicit rules are more difficult to determine for these are based on social norms. In academia, the most prevalent implicit rules dictate appropriate interaction between students and faculty, appropriate attire, and best practices, such as arriving to class on time or refraining from eating noisily during an exam. Academia’s explicit and implicit rules do not forbid CE, voiding the cheating argument. Furthermore, CE does not interfere with the authenticity of experience, as one is still learning when using CE drugs.

5.1.2 Application of Societal Arguments

5.1.2.1 Distributive Justice

In academia, issues of distributive justice already exist. CE would not provide an advantage beyond that of the many other resources that are not equally distributed. On a macroscopic level, the distribution of the most intelligent, successful, and prolific faculty to the Ivy League confers an enormous advantage to Ivy League students, as their professors, a resource, provide a superior education through excellent teaching. Moreover, the Ivy League is far wealthier than the majority of colleges, allowing these schools to provide students with enhancing technologies such as computer rooms in dormitories or complimentary tutoring centers. On a microscopic level, resources like private tutors or reference books are not equally distributed. Student A may be able to afford a private physics tutor, while Student B cannot afford a tutor. The tutor is conferring an advantage to Student A that is widely accepted in academia. Distributive justice is not a plausible argument against CE in academia. In order to forbid CE in academia, one would have to forbid not only CE drugs, but also similar enhancing technologies that are not equally distributed (e.g., private tutors), which will never occur.

5.1.2.2 Coercion

Critics worry that coercion, both direct and indirect, may lead individuals to enhance in order to remain competitive. Coercion occurs in highly competitive environments in which there are very few winners and these winners are immeasurably successful in comparison with others. The criteria for coercion are not met in academia. In academia, a limit is not placed on the number of winners, as winners do not exist. In academia, “winning” is subjective, in that for one student earning an “A” constitutes “winning,” while another student consider himself “winning” with a lesser mark. Once a member of the

academic community, be it as a student or faculty member, one is in rarified company. Consequently, a member of the academic community cannot be immeasurably more successful than another, as both must be successful in order to be members of the academic community. Furthermore, if coercion emerges as an issue in academia, simple rules and regulations will impede coercive forces.

5.2 Application of Proponents' Arguments

5.2.1 Application of Philosophical Arguments

5.2.1.1 Personal Freedom

An individual's personal freedom and autonomy is a vital right, particularly in academia. As autonomous individuals, we value choice, accept responsibility, and, consequently, our actions are uniquely personal and our personal prerogative.

Undergraduates and graduate students in particular tend to be a young, generally naïve population who are subjected to the great stress of performing to a high academic standard.

It is not uncommon to see freshmen struggle, as the transition from high school to undergraduate life is difficult. Moreover, newly independent undergraduates have the personal freedom to use their time wisely or wastefully and to complete assignments or fall behind. Should I study for my midterm? Should I read research more for my essay?

Undergraduates frequently ask themselves these questions and, consequently, make decisions that have serious academic implications. To study for a midterm provides an enhancement, as it improves the student's baseline comprehension of material. Students are responsible for themselves and make decisions daily that influence their cognitive ability. It is a right in academia to do the best one can, be it through studying or taking CE drugs, and just as a student must determine whether or not to eat properly, the decision must be

autonomous.

Faculty, although neither young nor naïve, are subject to great responsibilities and have the right to make autonomous decisions in how to fulfill responsibilities. A professor has the right to make an autonomous decision to take CE drugs if he believes this will help him complete his teaching, advising, and research obligations. Personal freedom is not only a central belief of the United States but also of academia. Undergraduates select classes, majors, and minors grounded in the individual student's interests. Graduate students become more specialized. For example, a doctoral student in a cell and molecular biology program selects a discipline (e.g., cancer biology), rotates through numerous labs, and, finally, picks a lab and a highly specialized project upon which the Ph.D. dissertation is based. The faculty have the most personal freedom and autonomy in the academic community, as a combination of personal interests and academic credentials have led to professorship in a specialized area. Faculty teach, research, and write on the topics of their choosing, which are based on the interests of the faculty and the result of previous autonomous decisions. Personal freedom and autonomy are embraced in the academic community and the choice to enhance cognition is an analogous autonomy.

5.2.1.2 Enhancement as Obligation

In academia, students and faculty are expected not only to fulfill their duties but also to excel and perform to an extremely high standard. To members of the academic community, enhancement by learning more and adding to knowledge is an obligation. Undergraduate and graduate students are obligated to enhance through learning since they have made the choice to pursue upper-level education, which is a privilege. Matriculation is an implicit contract between not only the student and the academic program but also the

student and himself, in which the student acknowledges the immense opportunity of education and the obligation to enhance through learning new topics and accumulating knowledge. Likewise, upon the acceptance of employment in academia, faculty agree to fulfill certain responsibilities, particularly to enhance students through their teaching and research. Furthermore, obligation of enhancement is amplified as a professor since they are charged with teaching, training, and mentoring the future generations of professors. This allows specialized subjects to be passed down and further researched by the next generation of academics.

To say enhancement is an obligation in academia is to assume students and faculty members take their positions seriously and strive to teach, learn, and generate new knowledge. Undoubtedly, there are members of the academic community who are not committed to such obligations and are sub-par educators and students. This is not the population that may have an interest in cognitive enhancement. Instead, this is the minority of the academic population that is unlikely to pursue enhancement, as they accept that they “skate by” and see no issue with this. Truly, it is those who value their education and responsibilities as educators who may be obliged to enhance, as cognitive enhancement may be highly beneficial.

5.2.2 Application of Societal Arguments

5.2.2.1 Increased Productivity

Increased productivity in academia, as elaborated upon in 4.2.1.2, would be greatly beneficial to society and may address societal troubles, such as illnesses or pollution. Society operates within a greater good framing, in which each individual has a disproportionate impact on the greater good of society. Undoubtedly, members of the

academic community provide a disproportionate impact on society. Academics are responsible for the majority of discoveries from novel medical technologies to abstract mathematical theories to innovative energy sources. Enhancing cognition allows academics to perform at the pinnacle of their abilities and develop products that serve a greater good. To enhance academics and increase the productivity of these talented individuals is hugely beneficial to society, as progress will accelerate scholarship and address issues including global warming, healthcare, and the economy. Enhancing cognition and the use of CE drugs is highly desirable in academia because it increases productivity, which allows these individuals to better contribute to the good of society.

5.2.2.2 Non-Zero Sum Situation and Network Effects

Academic CE is not a zero-sum situation and has the potential to create immensely positive network effects. In academia, enhancing cognition benefits one yet does not hinder another. There are circumstances that resemble zero-sum situations; however, these are very rare exceptions and do not challenge the conclusion that academia is a non-zero sum situation. For example, there can only be one head of an academic department, who may be construed as the “winner” while the faculty not chosen for the position are considered the “losers.” In actuality, this situation is not zero-sum, as the department head’s gain is not exactly attained through the losses of the other faculty. Enhancing cognition in academia is not the gain of ability through the loss of another’s ability. Instead, CE is an extension of individuals’ native capacities and cognitive abilities.

Enhancing cognition in academia has immense promise in improving society through network effects. CE provides a network effect in that the value of enhancement to the individual increases as more individuals enhance. The Internet demonstrates the blindingly

obvious and incredible benefits of network effects. Internet is an invaluable resource because hundreds of millions of people provide content and interact with one another. One person on the Internet would hardly benefit society; however, the more people that use the Internet, the greater the benefit to those on the Internet. Network effects apply to CE in academia because the more members of the academic community who enhance, the more valuable the enhancement will become to the enhanced individuals. A single academic community, let alone numerous academic communities, of enhanced individuals will benefit one another and, consequently, achieve great successes together.

VI. Recommendations

Further investigation into CE in cognitively intact individuals is necessary to gain insight into tolerability, safety, and efficacy in this population. Education is advantageous, as it will provide the public with the necessary information to formulate coherent opinions. Moreover, the enhancement debate must be reframed as a tool for conversation and the generation of knowledge instead of a rivalry between critics and proponents. CE use is already prevalent, making it unlikely that CE use can be prohibited. Consequently, regulations are likely to be updated in order to minimize harm and maximize benefits; however, it is impossible to have strong policy without strong information. Therefore, I call for accelerated research programs, cohort studies, education, and reframing of the debate in order to generate the necessary information that will be the crux not only of regulation but also the general opinion of the enhancement enterprise.

6.1 Accelerated Research Programs

Accelerated research programs must be conducted to assess CE drug safety and efficacy in the cognitively intact. Safety and efficacy studies are urgently needed in order to understand the effect these drugs have in “normal” individuals. Ideally, the results will be advantageous in maximizing the benefits of these drugs and minimizing their risks. Conversely, if studies find CE drugs marginally beneficial or new adverse events are observed, further investigation would be needed to determine if CE drugs are appropriate in the cognitively intact. An evidence-based approach to evaluation of the risks and benefits of CE, with special attention paid to long-term effects and the possibility of new adverse effects unique to enhancement, is an ideal study. In order for such studies to occur, substantial funding is necessary, particularly because large, accelerated studies are highly costly. Pharmaceutical companies are likely to fund studies, as a new indication for their medications is profitable; however, the NIH should also be involved. The NIH can provide large-scale oversight and additional necessary funding.

The current studies of CE abuse are concentrated on undergraduate abuse. It is necessary to study populations beyond college students, as recent findings show that high school students, professors, and suburban mothers have begun abusing these drugs. College students are a young demographic; therefore, it is necessary to investigate other age demographics to determine if age produces diverse responses. Additionally, the potential for abuse must be studied. Thorough research into CE in the cognitively intact is necessary immediately, as this will provide otherwise unknown insight. CE use is increasing and it is imperative that its safety is well understood, not only to protect those who choose to enhance but also in the creation of subsequent regulatory policies.

6.2 Cohort Studies

Cohort studies, although not as exhaustive as the randomized trials recommended in 6.1, are greatly valuable and should be used to identify efficacy and tolerability in specific populations, particularly adverse events. These longitudinal studies will analyze risk factors and outcomes of CE drugs in the healthy population. A cohort study involves a cohort, meaning a sample of individuals who share a common characteristic within a defined period, for example exposure to alcohol *in utero* or living in the same town. The Framingham Heart Study, a cohort study, is one of the most influential studies of the 20th century. This study discovered much of what is now “common knowledge” regarding cardiovascular health, such as the effects of diet and exercise on the heart. The study began in 1948 with over 5,000 adult subjects from Framingham, Massachusetts and is currently in its third generation of subjects. This study was immensely successful and is indicative of the power of cohort studies. Cohort studies are markedly less expensive than randomized trials, making these a good tool to investigate CE in distinct populations. The studies would track and monitor subjects’ short-term and long-term exposure to CE drugs and investigate the subjects’ medical histories in order to determine risk factors for adverse events. Potential cohorts to study might include the following:

1. Illicit Undergraduate CE Use by the Cognitively Intact
2. CE Use to Achieve Academic Goals by the Cognitively Intact
3. CE Use by Cognitively Intact Faculty Over the Age of 35
4. Prescription Stimulant Use in ADHD Treatment for Over Ten Years
5. CE Use by Cognitively Intact Faculty of All Ages

These studies would be immensely beneficial, as the majority of studies focus on the use of CE as a medical intervention for ADHD or the illicit use of prescription stimulants by undergraduates. Investigating a broader sample through numerous cohort studies will generate information that will not only provide insight into patterns of use in the cognitively

intact but also may identify pre-existing conditions or risk factors that make one more vulnerable to adverse reactions.

6.3 Education

As hundreds of thousands of undergraduates currently abuse CE drugs, it is essential that steps be taken to protect undergraduates from the dangers of these medications.

Although prevalence statistics are unavailable, faculty members must also be protected from the dangers of CE medication. Educating the general public and members of the academic community about the risks and benefits of CE will raise public awareness, safeguard those who choose to enhance, and disseminate general knowledge. The public should be educated on the basic concepts of CE as well as the risks, benefits, and alternatives to CE. CE information should be easily accessible and could be modeled after anti-smoking campaigns.

It is imperative that members of the academic community and related health service providers are knowledgeable about CE, as this population is known to engage in psychopharmacological CE. Academic health services should broadly educate students about the risks of CE, similar to what they do with alcohol, to ensure that students and faculty comprehend the risks associated with these medications. Health services can provide students and faculty with resources such as checking for drug interactions in order to prevent the combination of medications that could produce adverse events. Polydrug use is a significant problem with illicit users. Students' health will be monitored because elevated blood pressure or heart rate may be indicative of CE use. If the provider suspects this, the provider will speak with the patient about CE drug use so the patient understands associated risks. Student health facilities, on-campus hospitals, and hospitals located near campuses should be briefed on the prevalence of CE drug abuse in order to be consciousness of this

and best treat patients who are hospitalized from these medications. Although it is unlikely to be a heavily used service, a program should be implemented to protect and provide immunity to students and faculty who must go to the hospital as a result of CE use. It is crucial, just as with alcohol poisoning, that members of the academic community do not fear repercussions nor, as a consequence, avoid necessary care.

6.4 Reframing the Debate

The current debate between the critics and proponents of CE is a fierce dialogue engrossed in refuting arguments instead of debating to better understand the dilemma. Socrates adeptly identified dialectic dialogue and elenchus dialogue, two opposing forms of inquiry. In dialectic debate, there are two opposing views, but each side is invested in a dialogue to discover truth through the exchange of perspectives. This debate must evolve to a dialectic dialogue in order to benefit society, let alone influence regulation. The debate should be reframed as a fact-finding mission in which numerous stakeholders (e.g., physicians, educators, regulators, and ethicists) engage in interdisciplinary discussion and leverage the randomized trial and cohort study data. It is essential that an effective framework is developed to address CE. As medical innovation continues, it is certain that similar ethical issues will arise. A previously established framework will be immensely beneficial in guiding future discussion and decision-making.

VII. Concluding Remarks

Cognitive enhancement by elective psychopharmacological intervention in academia is a promising topic of inquiry that should be pursued. Moreover, CE in academia should be welcomed with exuberance and gratitude as this technology has the potential to greatly

benefit individuals and society as a whole. Cognitive enhancement is pervasive, demonstrated by literacy, computers, and schooling. All of which show the benefits of enhancing cognitive ability. The current knowledge, research, and ethical discourse on psychopharmacological CE substantiate a *pro tanto* suggestion in favor of pursuing CE in academia. CE in academia should be pursued because the benefits of responsible use of CE drugs are immense, ethics validate their use, and CE use may be the defining discovery of the 21st century.

The responsible use of CE drugs is ethically permissible and is the sole appropriate response to society's growing demand for enhancement. A transition from the current state of CE, in which the public is ignorant of the risks of use, and safety and tolerability in the cognitively intact is not understood, to a state of responsible use would minimize risks and maximize the benefits of CE. The responsible use of CE drugs requires following the recommendations previously outlined, particularly accelerated research programs and cohort studies in order to assess safety and tolerability in the cognitively intact. Upon completion of these studies, risks will be better understood and safeguards can be implemented to protect users. CE drugs will be evaluated individually and, consequentially, be recommended or cautioned against for enhancement. Furthermore, "responsible use" intrinsically indicates that use must be sensible and conscientious, meaning those who choose to enhance legally obtain medication, monitor adverse effects, and use the power of enhanced cognition for academic purposes. The proper societal response to the demand for CE in academia is responsible use and the management of risks.

CE is subject to intense ethical scrutiny, which is unsurprising as it is a novel and provocative subject in neuroscience and ethics. The ethical debate, complete with brazen

critics and steadfast proponents, is based on philosophical, societal, and safety arguments. Critics do not provide cogent or convincing arguments against enhancement, primarily because their philosophical arguments are heavily dependent upon invalid assumptions and outdated folk psychology concepts of the brain. The current objections are easily refuted and dismissed. The debate is ongoing. Consequently, it would be advisable for critics to regroup and construct new arguments founded less on abstract notions of the mind and more on scientific evidence. Moreover, upon systematic analysis, CE in academia is robustly supported by sound philosophical, societal, and safety arguments and, consequently, is ethically permissible.

It is illogical to oppose CE, as humans have embraced numerous similar enhancements. One must remember that enhancement is not the pursuit of perfection but the pursuit of improvement, which is a noble endeavor. Humans have long favored innovation and technological revolutions that encourage the improvement of individuals and society. The current revolution in neuroscience and neuroimaging technologies, of which CE is an integral part, may be the defining event of this century. Humans' ability to alter their own brain function might shape history as powerfully as the development of metallurgy in the Iron Age, mechanization in the Industrial revolution, or genetics in the second half of the 20th century.^{cxxxvi} It would be a momentous error to impede psychopharmacological discovery and development in order to avoid potential CE abuse. To embrace CE in academia is to recognize the legitimacy of elective psychopharmacological enhancement as but one cognitively enhancing technology among numerous other enhancing advancements. Since the enhancement of normal cognitive function by psychopharmacological intervention is already a fact of life for many, it would, therefore, be naïve to ignore enhancement and

ignorant to dismiss CE's potential. CE in academia should be pursued in a responsible manner because it is not just ethically validated but also ethically mandated. CE may substantially benefit society and the greater good.

TABLE 1 **COMPARISON OF SIDE-EFFECT PROFILES OF SLEEP DEPRIVATION AND OF MODAFINIL**

<i>Sleep deprivation</i>	<i>Modafinil</i>
Increase in blood pressure (Tochikubo et al. 1996)	Nervousness (at high doses) (Broughton et al. 1997)
Increased sympathetic tone (Meerlo et al. 2008)	Nausea (at high doses) (Broughton et al. 1997)
Decreased insulin sensitivity (Gonzalez-Ortiz et al. 2000)	Dermatological reactions (very rare) (Kumar 2008)
Increased inflammatory markers (Irwin et al. 2008)	
Altered satiety signals (Spiegel et al. 2004)	
Increased thyroid stimulating hormone (Gary et al. 1996)	
Decreased mood (Rose, Manser, and Ware 2008)	
Anxiety (Rose, Manser, and Ware 2008)	
Fatigue (Rose, Manser, and Ware 2008)	
Impaired memory (Mogras et al. 2009)	
Slowed reaction time (Saxena and George 2005)	
Reduced vigilance (Saxena and George 2005)	
Loss of dexterity (Taffinder et al. 1998)	
Increased risk of auto accidents (Powell et al. 2001)	
Increased risk of medical errors (Gander et al. 2007)	

Side effects of sleep deprivation are from both acute and long-term deprivation studies, and those of modafinil have been determined to have greater incidence compared to placebo.

Table 1 from Webb, et al., “Contemplating Cognitive Enhancement in Medical Students and Residents,” *Perspectives in Biology and Medicine* 53 (2010): 201.

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