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WASHINGTON UNIVERSITY

Department of East Asian Studies

CHANGE YOUR MIND:

NEUROPLASTICITY & BUDDHIST TRANSFORMATION

by

Laura Jean Vollmer

A thesis presented to the
Graduate School of Arts and Sciences
of Washington University in
partial fulfillment of the
requirements for the
degree of Master of Arts

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Dedication

To the beauty of novelties that invoke childlike wonder,

And to the mysterious depths of humankind's power.

To the meeting of dark cosmos and the illuminating mind,

And the music of Nature's song through time,

Resonating in that which Is, so it may be revealed and known.

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INTRODUCTION

Neuroplasticity and the Mind

In the last twenty years, revolutions in the field of neuroscience have raised many open questions for scientists and philosophers of mind alike, as primary assumptions in the field regarding the immutability of neural and mental states have proven to be incorrect. Previously, the field postulated that the adult brain was fixed in two respects: in that no new neurons are born and the functions of brain structures were thought to be determinate.¹ Recent studies have shown that both of these notions are mistaken, as will be discussed. Another overturned assumption in the field has been the discovery that the brain not only changes throughout one's life, rather than ceasing with childhood, but that in addition an individual can consciously participate in that change by cultivating various mental states.² The brain's potential for modification is referred to as neuroplasticity.³ The idea of

¹ The creation of new neurons is expressed by the term *neurogenesis*. The presence of neurogenesis in adults has also challenged the notion that the human brain is comparable to a sophisticated computer, as "it is difficult to accept the idea that new cells could come into a complicated circuit and become part of it in a way that would not only not be disruptive but might be beneficial," Fred Gage, a neuroscientist at the Salk Institute in La Jolla, California, remarked to the Dalai Lama at the twelfth Mind and Life conference. See Sharon Begley, *Train Your Mind, Change Your Brain: How a New Science Reveals Our Extraordinary Potential to Transform Ourselves* (New York: Random House, 2007), 52 and 6.

² *Ibid.*, xii.

³ Plasticity refers to "in an individual or population, the capacity for adaptation: a) through gene changes (genetic plasticity) or b) through internal physiological modifications in response to changes in environment (physiological plasticity)." See James N. Parker and Philip M. Parker, eds. *Brain: A Medical Dictionary, Bibliography, and Annotated Research Guide to Internet References* (Icon Group International Inc., 2004), 429. Brain systems are shaped by experience throughout life, although some brain systems are more plastic than others. See Begley, 75.

neuroplasticity is revolutionary; the fact that the mind can alter both the processes and the very structure of the brain calls into question the predominant physicalist interpretation of mind common in the field of neuroscience. Physicalism holds that the mind is reducible to a fixed brain and mental processes are nothing other than neural processes.⁴ However, such a reductionist view of mind is difficult to reconcile with current research and the workings of volitional neuroplasticity, leaving current models of mind in need of revision or outright rejection.

As research regarding the brain's capacity to change continues to grow, there has been increasing interest in the capabilities of meditation in altering the brain, as meditation offers a sort of demonstration for the loftier abilities of neuroplasticity.⁵ Experienced contemplatives in the Buddhist tradition find themselves increasingly in Western laboratories, where innovative research is being conducted to learn about the voluntary ability of using mental apparatus to change the functioning of the brain and the processes of the mind. Advanced contemplatives have demonstrated extreme malleability of mind and the production of physical manifestations of such mental practice, making them invaluable for study. Often scholars conveniently dismiss the possibility that religion and science could have any meaningful exchange, yet the research that will be discussed here illustrates

⁴ Physicalism actually refers to a much broader worldview and holds that the nature of reality is physical or supervenes on or is necessitated by the physical. See the Stanford Encyclopedia of Philosophy, <http://plato.stanford.edu>, under "Physicalism" at <http://plato.stanford.edu/entries/physicalism>. In some discussion on philosophy of mind, physicalism is used to refer to *identity theory*, suggesting mental states and properties are neurological states and properties. This is how the term will be used in this study. However, the physicalism argument predominant in the neurosciences comes to be modified, as will be discussed.

⁵ For a survey of scientific research on neuroplasticity and related research on meditation, see Begley.

how this dogma is quickly being moved to the pile of outmoded historical “givens” in intellectual thought. While Buddhism and neuroscience continue to converse in a variety of subfields, “of all the concepts in modern neuroscience, it is neuroplasticity that has the greatest potential for meaningful interaction with Buddhism,” Richard Davidson, the director of the Laboratory for Affective Neuroscience based at the University of Wisconsin-Madison, remarked to the Dalai Lama on one occasion.⁶

The production of meaningful exchange with Buddhism regarding neuroplasticity primarily occurs in one of two domains. One is in the scientific research itself, as experienced contemplatives act as the subjects of research involving such things as the role of attention for neuroplastic efficacy. The second domain is in philosophy of mind and the self. Contemporary western philosophy of mind has a number of theories regarding the nature of mentality that can be categorized under the more general divisions of monism, including physicalism mentioned above that argues there are no fundamental divisions between the mental and the physical, and dualism that asserts the existential independence of mind and matter.⁷ In regards to the philosophical implications of neuroplasticity, such as the ontological implication that mind exists, the metaphysical possibility of

⁶ Ibid., 11.

⁷ Dualism has referred to a variety of positions in the history of thought, however here dualism refers to the doctrine regarding philosophy of mind that contrasts mind and body. Dualist thinkers include Plato, Aristotle, René Descartes, and Karl Popper. Forms of dualism include psychophysical parallelism, occasionalism, and property dualism. See <http://plato.stanford.edu/entries/dualism>. Monism includes not only the identity theory as noted above, but also the theories of behaviorism, upheld by Ludwig Wittgenstein, and functionalism, developed by Hilary Putnam and Jerry Fodor. See <http://plato.stanford.edu/entries/behaviorism> and <http://plato.stanford.edu/entries/functionalism>. The most common form of monism in contemporary western philosophy is identity-theory physicalism. Important thinkers include John Smart and Ullin Place.

top-down causality (i.e. mind-to-body causality), and the epistemological consequences regarding observation/experience and knowledge of reality, these theories have a number of open questions that reduces their explanatory power, however pliancy of mind is a fundamental assumption in Buddhist philosophy, giving rise to the contemplative tradition.⁸ As such, Buddhists have long been utilizing mental potentiality through the development of many different techniques, generalized as meditation. Surrounding practice is a philosophy of mind or consciousness and the related philosophy of self that in many ways reflect current neuroscientific research and in doing so, provides a theoretical model of which to understand neuroplasticity and its implications, addressing a lacuna in Western theories of mind.⁹

According to the Buddhist perspective, the implications of neuroplasticity for philosophy of mind and the self are vast and answer a range of open questions in the West, including: What characterizes mentality? What is the self? What is the relationship between mind and body? How can experience be accounted for? What are the processes and mechanisms of mental states? And how can the mind be

⁸ Throughout this work, I refer variously to top-down causation, two-way causation, and mind-body causation. Some scientists use the term ‘top-down’ to refer to ‘higher’ biological processes affecting ‘lower’ processes. This is not how the term is used in this study, rather ‘top-down’ is one term that refers to ‘mind to body’ causation as it is commonly referred to in the sciences. All the above terms are used to convey mental and physical interaction or causation initiated from one or the other impacting the other or both.

⁹ It is important to be aware of the linguistic limitations. Just as in English, Buddhists also use many terms that refer to the mental including the Tibetan terms *sem* (*citta* in Sanskrit), translated as “mind;” *namshé* (*viññāna* in Sanskrit), “consciousness;” and *yi* (Sanskrit, *manas*), “mentality” or “mental states.” The Tibetan word *namshé*, referring to consciousness has much broader applicability than the English term, covering all conscious experiences in addition to what may be categorized as “unconscious” in Western psychological and psychoanalytic theories. Also, the Tibetan word for “mind,” *sem* refers to thought in addition to emotion. The term “mind” as used in this study refers to the whole range of mental events.

studied scientifically? These questions are the main object of this study and the answers, the contribution.

Method

In the past twenty years or so, the works of many amateurs, specialists from a variety of disciplines, and enthusiasts of all sorts have explored various aspects of Buddhism and Science. There are at least five common approaches. The first is the study of Buddhism and Science undertaken by those in the humanities and social sciences and includes the analysis of such scholars as Donald S. Lopez Jr., B. Alan Wallace, and David L. McMahan. The second approach is the scientific or medical study of Buddhist practice, such as meditation. Various scientists and doctors, including Stephen LaBerge, Richard Davidson, and Jon Kabat-Zinn, have undertaken research in this field. The third approach is a synthesis of Buddhism (variously defined) and scientific findings (variously enumerated) to produce scientific theories. Those who have taken this approach include the religious, the secular, and the scientific, in both popular and scholarly works with perspectives ranging from apologists to critics. One example from the many available is *The Quantum and the Lotus*, by Matthieu Ricard and Trinh Xuan Thuan, which explores parallels between physics and Buddhist thought. Some within this domain even produce cooperative works between contemplatives and scientists, such as the Mind and Life Institute publications.¹⁰ The fourth approach involves the works of modern Buddhists such as the Dalai Lama, who present Buddhism and Science in terms of their own

¹⁰ For a list of publications from the Mind and Life Institute, see http://mindandlife.org/books.pubs_section.html.

understanding of the evolving living tradition. While the Dalai Lama consciously reinterprets philosophy and practice to appropriate Buddhism to the modern context, other contemplatives and scholars have taken this approach as well, yet perhaps with little awareness of how they are contributing to the transformation of the tradition in question by re-presenting old ideas in novel ways in addition to deemphasizing or ignoring incommensurable religious elements.

The fifth approach is a synthesis of the other four, combining scholarly analysis of the emerging scientific theories of contemplatives along with the scientific study of Buddhist practice and the dialogue that these domains create. *Horizons in Buddhist Psychology: Practice, Research, & Theory*, edited by Maurits G.T. Kwee, Kenneth J. Gergen and Fusako Koshikawa, reflects this methodology. This approach involves granting the status of modern Buddhism as a tradition within its own right and analyzes Buddhism and Science in accordance with this living tradition. What modern Buddhism involves and what the referent 'Buddhism' of Buddhism and Science is will be discussed in the next section. This work primarily follows this fifth approach. In the spirit of modern Buddhism with its multifaceted nature, I will avoid essentializing the various perspectives, however my aim is also to convey the intellectual vigor of the dialogue between these various approaches and hence to outline the interpretations that have surrounded Buddhist involvement with neuroscience and to engage with the philosophical questions raised.

I would also like to contribute to the growth of a sixth approach, which involves the expansion of dialogue between Buddhist contemplatives and/or scholars of Buddhist philosophy and western philosophers of science. I undertook this research in part to add to the growing realization that a purely Eurocentric approach to broad philosophical questions is imposing needless limitations. I am certainly not qualified to assess the accuracy of the scientific research or adequately present the philosophies of science in entirety, I write as a scholar of modern Buddhist philosophy with an interest in the impact of science. However, philosophy of science is an important element for meaningful research within this domain. Neuroscience is interpreted almost exclusively by Western enlightenment philosophy and an undeniable bias in the field often results in the condemnation of Eastern philosophy before it is seriously considered. There are many open questions in philosophy of neuroscience and mind and Buddhism has many ideas that will be novel to western readers. I make no attempt to disguise my own partiality towards and admiration of Buddhist thought; yet I also wish to convey the importance of expanding dialogue between Buddhist contemplatives and western philosophers of science at this time. This research explores some particular Buddhist encounters with western science, yet it is not just a historical study of ideas, but I hope, a contribution to the expansion of the modern philosophical and intellectual imagination.

In view of the fact that this research is for a diverse audience of scholars, philosophers, both east and west, and scientists, many readers are likely to be unfamiliar with some aspect of this study. Therefore, I will present the reader with

many references and footnotes for clarification. Also included is a broad outline of the Buddhist tradition and various elements of belief and practice. The main target of this work though is the modern appropriation of Buddhism rather than the religion within the Asian context. While I avoid asserting Buddhism is somehow scientifically accurate, I do attempt to provide a theoretical model for interpreting the neuroscience and address the philosophical issues raised. The model cannot be found within any single Buddhist teaching; rather it is extrapolated from a variety of sources that have contributed to the development of modern Buddhist philosophy. Buddhist theory of neuroplasticity therefore is one presentation of how a modern Buddhist philosopher might interpret the material. While this may seem a tenuous compilation of variously identified 'Buddhist' elements, the analysis and presentation of Buddhist philosophy reflects modern Buddhists' own understanding of their tradition, as will be discussed in the next section.

When Buddhism was first introduced to the West it was often interpreted in terms of western expectations and assumptions. Presently, scholars have addressed such issues and have greatly expanded our knowledge of the living tradition in Asia. However, because the initial presentation of Buddhism to the West was often wrought with misunderstanding, a counter intellectual trend emerged with a marked tendency to almost exclusively analyze the modern tradition through a narrow definition of 'Buddhism,' stripped of the orientalist and essentialist notions that permeated earlier scholarship. Yet, every methodology has its limits and it is important to recognize that modern Buddhism demands a new paradigm that can account for a Buddhism outside the imposed boundaries applied to the religion by

this counter trend. The question 'How Buddhist is this Buddhism?' is often raised as an objection to Buddhist appropriation to the modern world as if this form of the tradition were somehow 'inauthentic.' While misunderstanding of the religion has certainly occurred, so have adaptation, evolution, and rebirth as the result of both consciously modernizing individuals and the adoption of the tradition by self-identified Buddhists, who may or may not be aware of their contribution. The novelties of this form of Buddhism are not indicative of inauthenticity, but rather the mark of a distinct tradition. In short, modern Buddhism should not be held up to some "traditional" standard or to a preconceived definition of the religion, rather as scholars and enthusiasts, we should embrace this form of Buddhism as part of the greater cultural, intellectual, and spiritual trends of modernity.

The next section is devoted to exploring the problematic terms of Buddhism and Science. Part of this counter intellectual trend is emphasis on the use of terms. Obviously clarity is always a concern, however the focus has been on resisting the generalization and simplification of Eastern traditions with the use of overarching words such as 'Buddhism,' 'tradition,' 'Eastern,' and 'Western.' While it is important to be aware of such issues which are vital to much scholarship, I, like Richard Dawkins in *The Blind Watchmaker*, take the stand that words are our servants, not our masters.¹¹ It is impossible to make any real progress if every term is problematized. Nonetheless, the terms 'Buddhism' and 'Science' need to be explored to define their usage by the modern Buddhist philosopher. Yet, once I have made known how these words are to be utilized, I will then use them freely within the

¹¹ See Dawkins, *The Blind Watchmaker* (New York: W. W. Norton & Company, 1996), 4.

context I have mapped out. Modern Buddhism in part illustrates how the uses of dichotomies such as 'East and West' and 'tradition and modernity' are becoming increasingly ineffective. However, perhaps due to my own lack of imagination, I see no way of completely avoiding their use. These terms are the finger pointing to the moon, not the moon itself, but I hope meaning will be conveyed nonetheless.

Modern Buddhism and the 'Buddhism' of Buddhism and Science

Traditionally, Buddhism has not concerned itself with science, however over one hundred years ago, the modern world began to influence Buddhism in a way that led to unprecedented developments, influencing the religion ever since. This engagement with the intellectual trends of modernity has led to the growth of a new form of Buddhism, one branch of the long tradition's evolution, referred to as modern Buddhism. According to David McMahan, 'modern Buddhism' is:

An actual new form of Buddhism that is the result of a process of modernization, westernization, reinterpretation, image-making, revitalization, and reform that has been taking place not only in the West but also in Asian countries for over a century.¹²

Western enthusiasts and modernizing Asians became the avenue of which the Buddhist community penetrated the modern world. Modern intellectual trends, such as scientific rationalism, were adopted and subsequently utilized as a means to expand Buddhist relevance and applicability in a variety of modern contexts.

¹² See David L. McMahan, *The Making of Buddhist Modernism* (New York: Oxford University Press, 2008), 5.

Disenchanted westerners became important contributors to the development of modern Buddhism as well. Modern individuals looked to eastern wisdom to address social problems of the age, including religious pluralism, the increasing clash between religion and science, modern warfare, and emerging environmental issues. The meeting of Buddhism and modernity has occurred on many cultural, intellectual, and historical fronts, the impact shaping how Buddhism would modernize through time. Although traditional elements remain in this form of Buddhism, many have been reinvented to mold to western inclinations, resulting in the purge of mythological elements and “superstitious” ritual from the religion. After such a fundamental transformation, Buddhism needed to emphasize other aspects of the tradition to maintain vitality in the Buddhist world and at the same time situate itself in the modern context. The consequences of such evolution have included new philosophical interpretations of cosmology and psychology, vast changes in ritual and other practice, with new speakers for the tradition, and an emphasis on the intellectual trends, social implications, and the language of modernity. ‘Modern Buddhism’ is not simply Buddhism in the modern period, but specifically refers to forms of Buddhism that have “emerged out of an engagement with the dominant cultural and intellectual forces of modernity.”¹³

Modern Buddhism has referred to multiple different forms of Buddhism that have arisen from the engagement with the intellectual trends of the European Enlightenment and their predecessors. The discourse on Buddhism and Science is no different, in that it too has manifested itself in many different ways. “Buddhism”

¹³ Ibid., 6.

has meant the Theravada tradition of Sri Lanka, the “esoteric Buddhism” of Theosophy, the Zen of D. T. Suzuki, and the tantric Buddhism of Tibet, to name a few. “Science” has referred to a range of things as well, including astronomy, physics, modern cosmology, and neurobiology. The contemporary phase of Buddhism and Science refers to that of Tibetan Buddhism and the cognitive sciences, including neuroscience and psychology.

Since the 1990s Tibetan Buddhism has engaged with science to a unparalleled degree in previous forms and phases of modern Buddhism and the Dalai Lama has become the representative champion of the movement, greatly contributing to the strengthening of relations. Since the development of the Mind and Life Conferences and the subsequent Mind and Life Institute, creating, expanding, and improving dialogue between Buddhism and Science, the Dalai Lama never fails to emphasize the compatibility of the two. At the first Mind and Life conference, where unprecedented dialogue between Buddhists and scientists was making history, the Dalai Lama said, “It is my view that generally Buddhism, and particularly Mahayana Buddhism, is very close to a scientific approach.”¹⁴ His Holiness goes on to assert that the authority in both Buddhism and science can be reduced to “reasoning” and “logic” and that the “basic Buddhist attitude” is “analysis

¹⁴ See Jeremy W. Hayward and Francisco J. Varela, eds. *Gentle Bridges: Conversations with the Dalai Lama on the Sciences of Mind* (Boston: Shambhala, 2001), 31.

and examination through reasoning.”¹⁵ Such sentiments are ubiquitous in the field of Buddhism and Science and are expressed at all the Mind and Life conferences.¹⁶

Unlike the vast majority of previous forms of modern Buddhism, this ‘scientific Tibetan Buddhism’ has mostly steered free of apologist claims and approaches its relationship with science in a whole new way. While previous advocates of Buddhism and Science, and some contemporary ones, make tenuous parallels between the popular science of the time and various schools of thought, scientific Tibetan Buddhism does not look to make claims, but rather to establish dialogue and produce meaningful exchange. Because of this, the works of such Buddhists, primarily the Dalai Lama and his colleagues, inform this study. The Dalai Lama’s intellectual integrity results in an impartial representation of the tradition at large, making note of any variance from school to school. Thus, the Buddhist perspective on neuroscientific issues explored in this study is extrapolated from Tibetan thinkers exchange with western scientists in addition to shared doctrine in Asian Buddhist thought, including that of India and Tibet.

As these thinkers are part of the modern Buddhist movement, there is less of a focus on sectarian differences and more emphasis on the complementariness between any given tenet of Buddhist thought and Science. One of the major characteristics of contemporary modern Buddhism is its nonsectarian and inclusive

¹⁵ Ibid., 32.

¹⁶ See <http://www.mindandLife.org/current.conf.html> for an overview of meetings, conferences, and events. Their vision as described on the institute’s website illustrates the equal standing of Buddhism and Science: “To establish mutually respectful working collaboration and research partnerships between modern science and Buddhism — two of the world’s most fruitful traditions for understanding the nature of reality and promoting human well-being.” See http://www.mindandLife.org/mission.org_section.html.

nature. As this study is subsumed within the field of modern Buddhism, the Buddhist perspective is accordingly and appropriately presented in a nonsectarian manner as the modern Buddhist would. That is, the 'Buddhist perspective' draws from all schools of thought, with specific tenets chosen for their relevance, compatibility (for both comparing and contrasting), consistency, and their complementariness with current science and the related philosophies. However, when referring to "Buddhism" and traditional thought regarding philosophy of mind and the self, I will be using it in the general sense of both ancient Indian and Tibetan thought, as the schools associated share many primary assumptions and much doctrine, yet major points of contention will of course be duly noted.

Naturally, there are many contradictions and complications that arise when drawing together two systems of thought like Buddhism and Science. Scholars and devotees alike have accounted for these inconsistencies in a number of ways including arguing Buddhism has always been modern or scientific, dismissing incompatibilities between Buddhist and scientific thought as irrelevant or at least not central to the argument at hand, and understanding the Buddhist utilization of science as a western-styled "skillful means."¹⁷ The emergence of all these different models for understanding "Buddhism and Science" illustrate the significant impact this dialogue has had, as both the scholar and devotee struggle with understanding science's place in the Buddhist world. Many scholars have addressed and attempted

¹⁷ Donald S. Lopez suggests just as Buddhism grew to include Vedic gods in India and kami in Japan, in order for Buddhism to be successful in the West, perhaps the religion has grown to include the god of Science in the pantheon as well. See Lopez, *Buddhism and Science: A Guide for the Perplexed* (New York: University for Chicago Press, 2008), 37.

to answer this question, some with an optimistic outlook,¹⁸ some with more doubtful inclinations.¹⁹ Yet, despite how Buddhism has been modified to situate itself in scientific dialogue, this is not indicative of meaninglessness. “Buddhism and Science” is an important historical movement that continues to produce valuable dialogue with many important implications.

After briefly discussing the Buddhist perspective on the mutability of mental and physical processes, I will turn to the scientific research on meditation and neuroplasticity. As the science will reveal the philosophical issues involved, I will then discuss the open questions at length and provide a modern Buddhist analysis and interpretation of neuroplasticity and its implications. I will conclude with a suggestion of how the scientific study of mind might proceed and the ethical implications of neuroplasticity from the Buddhist perspective. By focusing on such a narrow topic within the field of Buddhism and Science, I hope to convey the limitless possibilities for meaningful exchange.

The Buddhist Perspective: Mutability and Contemplative Techniques

The ultimate goal of the Buddhist tradition as presented by the Buddha in the Four Noble Truths is to end suffering or unsatisfactoriness and rebirth by fulfilling the human potential for enlightenment or *nirvana*. Living in accord with the Eight Fold

¹⁸ See B. Alan Wallace and Brian Hodel, *Contemplative Science: Where Buddhism and Neuroscience Converge* (New York: Columbia University Press, 2009). B. Alan Wallace is a known practitioner of Buddhism, the founder of the Santa Barbra Institute for Consciousness Studies, and an active scholar and supporter in the field of “Buddhism and Science.”

¹⁹ See Lopez. Lopez takes a tentative approach in viewing scientific study as accretion to the Buddhist canon. While he sees the accretion model explanation as somewhat accurate, he is also wary of this approach, as it reduces much of what we once understood to be “Buddhism.”

Path cultivates wisdom, morality, and meditation, resulting in the eventual transformation of body, speech, and mind and ultimately liberation. The Buddhist contemplative tradition is based on the fundamental belief in the mutable nature of human beings and implicit to this idea is a relationship between mind and body enabling transformation.

The Buddhist contemplative tradition holds that by using mental faculties, one improves the quality of the faculties, which pivots on the assumption put forth in the Eight Fold Path, that mind, body, and behavior can be transformed.²⁰ Crucial to transformation is first level training in *introspection*, aimed at developing *attention* and *equanimity*. Attention is the faculty that helps direct the mind (a deliberate intention) to a chosen object among the variety experienced. Attention is developed through (a) *mindfulness*—a faculty that keeps the mind tied to the object by maintaining meta-awareness of mental states and (b) *introspective vigilance*—a faculty to discern whether distraction occurs and whether the vividness of the mind’s focus has become lax. The second faculty crucial to introspection is equanimity—not excessively introspecting whereby the object becomes distorted and the mind is destabilized. Development of attention and equanimity will lead to mental pliancy, in that the mind is easily serviceable and can be directed freely to any object, known as the ‘tranquil abiding of the mind’ or *śamatha*, in Sanskrit.²¹

²⁰ The mind’s capacity for transformation is discussed in many Buddhist texts. Some of the earlier Mahayana works include the fourth century *The Sublime Continuum*, attributed to Maitreya and *Praise to the Ultimate Expanse*, attributed to Nagarjuna. Dharmakirti, an important Tibetan philosopher, also discusses transformation of mind.

²¹ Ibid., 153. *Śamatha* is known as *shi ne* in Tibetan.

Second level training is known as ‘insight’ (*vipaśyanā*) meditation, and works to discern investigation and analysis while in tranquil abiding.²² It begins with sharpness of inquiry and then maintaining focus on resultant insight as long as possible.

There are other techniques as well including structured analysis that has been developed to focus contemplative exploration and address the pitfalls to fantasy and delusion.²³ These faculties have been targeted by specific techniques in order to induce transformation of mind. Unfortunately, the scientific study of the causal power of mental states to modify brain condition was long neglected, for as the late biologist Francisco Varela commented, “It seems counterintuitive to Western assumptions.” However, he goes on to make the compelling statement, “but it is logically implicit in what science is saying today.”²⁴

²² *Vipaśyanā* is known as *lhak thong* in Tibetan. Both *śamatha* and *vipaśyanā* are practiced in Theravada and Mahayana traditions.

²³ *Ibid.*, 155. In *Stages of Meditation*, the 8th century Indian Buddhist master Kamalashila provides a detailed account of how both *śamatha* and *vipaśyanā* may be systematically cultivated. A translation and commentary of this work by the Dalai Lama is available. See *Stages of Meditation* (Snow Lion Publications: 2003).

²⁴ See Begley, 133. Varela was highly accomplished in the neuroscientific and cognitive scientific fields with over 150 publications. As a side note, the idea that the mind can be reduced to the brain began in the seventeenth century when Rene Descartes declared the dualism between mind and matter to be a scientific principle. Later, those known as the Oxford Circle, led by Thomas Willis, the father of modern neurology, conducted the first scientific exploration of the brain and the nervous system. With these studies began the trend of thinking about the mind in reductionist terms, in that all mental and emotional states came to be considered as manifestations of brain processes. As philosopher Colin McGinn put it “there is nothing more to a conscious state than its neural correlate” (quoted in *ibid.*, 135). By the 1990’s neuroscientists had identified what they called the explanatory gap in how brain properties add up to mentality. Some iconoclasts began to understand the mind as an emergent property of brain functions, so that the mind can affect the lower-order processes from which it came from, as will be discussed later. While the mainstream held that mental states could only affect mental states because they were in fact brain states, some important scientists, including Nobel Prize-winning neuroscientist Roger Sperry, stayed firm with the claim that the interaction

THE SCIENCE

Mental Faculties Conducive to Neuroplasticity

After two-way causation had been implicated by some initial research on neuroplasticity, scientists quickly took up the challenge to determine the causal power of mental states. In one study, Harvard's neurophysiologist Alvaro Pascual-Leone showed that thoughts of playing the piano altered the brain in the same way as those who actually practiced playing. Mental practice resulted in the same physical expansion of the motor cortex and resulted in similar reorganization of the brain.²⁵ This study shows that internal, mental stimuli, such as thoughts and concentration, can change the brain. As studies continued throughout the 1990's, it became increasingly apparent that the degree of attention was directly related to the magnitude of neuroplastic efficacy. In other words, attention was found to be vital and necessary if neuroplasticity is to come to fruition.²⁶ This reflects the Buddhist approach, as focused attention is the foundation for more advanced mental training. As Davidson notes, "attentional training is so important in Buddhism, and it

between the mental and physical was not unidirectional. As history was soon to tell, this seems to in fact be the case.

²⁵ Noted in *ibid.*, 152. See A. Pascual-Leone, A. Amedi, F. Fregni, and L. B. Merabet, "The Plastic Human Brain Cortex," *Annual Reviews of Neuroscience* 28 (2005): 380.

²⁶ For example, see G. H. Recanzone, C. E. Schreiner, and M. M. Merzenich, "Plasticity in the Frequency Representation of Primary Auditory Cortex Following Discrimination Training in Adult Owl Monkeys," *Journal of Neuroscience* 13 (1993): 87-103.

also is recognized to be very important by scientists. In many ways, attentional training can be thought of as the gateway to plasticity.”²⁷

Meditation and Neuroscience

Buddhism and neuroscience agree particular mental states, such as attention, enable the malleability or plasticity of the mind. However, attention alone will not produce change, rather specific meditative techniques are needed to achieve the desired effect. The selection of Buddhist meditation for the neuroscientific exploration of techniques for harnessing the power of neuroplasticity was not an arbitrary one. In the *Cambridge Handbook of Consciousness*, the reason for this choice is described as follows: “unlike many contemplative traditions, Buddhist traditions tend to offer extensive, precisely descriptive, and highly detailed theories about their practices in a manner that lends itself readily to appropriation into a neuroscientific context.”²⁸

²⁷ Begley, 160.

²⁸ See A. Lutz, J. D. Dunne, and R. J. Davidson, “Meditation and the Neuroscience of Consciousness: An Introduction” in *The Cambridge Handbook of Consciousness*. (Cambridge: Cambridge University Press, 2007), 503. This is not to say the ambiguity of the term is not a matter of concern for scientists. Much to the contrary, those involved in such study continue to look for meaningful ways of describing Buddhist practice. However, because the questions asked vary greatly from that of social scientists, the parameters for a definition of meditation are therefore quite different. What is defined is what can be observed objectively. So, while meditative techniques and the states induced are acceptable terms of defining meditation because of their measurable neural correlates, the meditative reflection on ultimate reality and other such philosophical components are separated as unverifiable. Davidson remarked, “The value of consulting a specific tradition is precisely that – through accident or expertise – the tradition may have gleaned some valuable knowledge or developed some practice that is not found elsewhere.” Focusing on a specific tradition allows scientists to explore the particular psychology and epistemology associated with it, in addition to the meditation techniques, and then from these tenets derive what contributions Buddhism can offer to the neurosciences in terms of understanding the cognitive and affective processes that are altered by mental training. There is another reason that neuroscientists see value in studying Buddhist techniques, it is simply that Buddhist understanding “is strongly consistent with our knowledge of the neurosciences.” See 499-502 for an excellent review of issues in the study of meditation and how the claims and descriptions resulting from such study are being sorted out by neuroscientists, making research increasingly sophisticated and meaningful.

While there have been over 1,000 empirical studies done on meditation, the neurophysiological processes involved and the effects of long-term mental training remain largely unknown.²⁹ Part of the problem with such studies has been the use of the term meditation, as it has referred to numerous types of practice. Today, however, cognitive scientists are much more aware of this problem and focus on specific types of Buddhist meditation in the hopes that it may reveal some clear effects of mental practice.³⁰

While the types of Buddhist meditation are numerous, those under rigorous and critical investigation can be categorized into three broad divisions: *śamatha*, also known as object meditation, cultivates tranquility and concentration; *vipaśyanā*, sometimes called mindfulness, provides insight and wisdom; and *maitrī*,

²⁹ Ibid., 499-500. For a complete survey of the empirical literature on meditation see J. H. Austin, *Zen and the Brain: Toward an Understanding of Meditation and Consciousness* (Cambridge: MIT Press, 1998); R. Cahn and J. Polich, "Meditation States and Traits: EEG, ERP, and Neuroimaging Studies," in *Psychological Bulletin* 132 (2006): 180-211; M. M. Delmonte, "Electrocortical Activity and Related Phenomena Associated with Meditation Practice: A Literature Review," in *International Journal of Neuroscience* 24 (1984): 217-231; Delmonte, "Biochemical Indices Associated with Meditation Practice: A Literature Review," in *Neuroscience & Biobehavioural Reviews* 9.4 (1985): 557-561; P. B. Fenwick, "Meditation and the EEG," in *The Psychology of Meditation*, edited by A. West (New York: Clarendon Press, 1987), 104-117; D. S. Holmes, "Meditation and Somatic Arousal Reduction: A Review of the Experimental Evidence" in *American Psychologist* 39 (1984), 1-10; and R. R. Pagano and S. Warrenburg, "Meditation: In Search of a Unique Effect" in *Consciousness and Self-Regulation* (Vol. 3), edited by R. J. Davidson, G. E. Schwartz, and D. Shapiro (New York: Plenum Press, 1983), 152-210. A theoretical model involving the neurophysiological processes involved in the transformation of mind brought about by meditation will be explored at a later point.

³⁰ Neuroscientists, of course, have very specific and sophisticated ways of defining meditation so that it may be objectively studied. Meditation is defined in four ways. First, a form of meditation is described according to the predictable and distinctive state associated with it, indicated by specific cognitive and/or physical phenomenon that can be observed and repeated. Second, the predictable and lasting traits and/or effects on both mind and body induced by repeated practice are used to distinguish one form from another. The third way meditation is understood is by the increasing levels of change from novice to adept, where improvement is observable by the acquisition of certain cognitive, emotional, and/or physical traits or by the occurrence of certain cognitive, emotional, or physical events. Fourth, is that the induction of meditative states must be something that can be learned, otherwise claims of a relationship between the production of meditative states and the development of certain traits becomes irrelevant. See Lutz, Dunne, and Davidson, 502-503 and 510-518 for a discussion on how meditation terminology is being used in scientific studies.

or compassion meditation, develops loving-kindness.³¹ The Buddhist scholar understands that these categories are vague and somewhat arbitrary, as *śamatha* and *vipaśyanā* describe two aspects of the same meditative state and are not so easily separated. Furthermore, when scientists study meditation techniques they often look at one type that falls under one of these three categories.³² For the sake of simplicity, the scientific research discussed has been divided into just the two categories of mindfulness meditation and compassion meditation.

Mindfulness Meditation and Neuroscience

Mindfulness meditation is increasingly being used in secular environments to treat a range of mental pathologies, including stress, depression, and obsessive-compulsive disorder (OCD). In a study conducted by neuropsychiatrist Jeffrey Schwartz and colleague Lewis Baxter, patients suffering from OCD who went through mindfulness-based therapy showed a dramatic decrease in activity in the orbital frontal cortex, the area activated by the disorder, compared to control subjects. As Schwartz noted:

[The study] offered strong evidence that willful, mindful effort can alter brain function, and that such self-directed brain changes—neuroplasticity—are a genuine

³¹ These are the Sanskrit terms. See Dakpo Tashi Namgyal, *Mahāmudrā: The Moonlight—Quintessence of Mind and Meditation* (Boston: Wisdom Publications, 2006) for a detailed description of different forms of meditation. *Maitrī* is also practiced in both Theravada and Mahayana Buddhism. In addition to these broad categories of meditation, Tibetan Buddhism also has thousands of tantric visualizations.

³² For example, “focused attention” meditation, *Tsé-cig Ting-ngé-dzin*, occurs in many forms of practice, but is generally understood as *śamatha*.

reality. Mental action can alter the brain chemistry of an OCD patient. The mind can change the brain.³³

In another example, psychologist Zindel Segal and Cambridge's John Teasdale and Mark Williams developed what they called mindfulness-based cognitive therapy for the treatment of depression. While patients under usual treatment served as the control group with 34 percent free of relapse, of those under mindfulness-based cognitive therapy, the rate increased to 66 percent. That comes out to be a 44 percent reduction in the relapse rate among those involved in mindfulness therapy, as reported in 2000.³⁴ In 2004, Teasdale, along with colleague Helen Ma, replicated the study, finding the same results of reduced relapse. By drawing awareness to their own mental states, patients suffering from depression were able to keep their negative thoughts from resulting in relapse.³⁵ These findings indicate top-down plasticity, because transformation originates in cognitive activity, that is, the mind initiates changes in the brain.

Mindfulness meditation has also found itself in the treatment of stress. In 1995, Jon Kabat-Zinn developed a program called the Center for Mindfulness in Medicine, Health Care, and Society as an outgrowth of the acclaimed Stress

³³ Begley, 141. Schwartz's studies of OCD and mindfulness-based therapy are discussed at length in J. M. Schwartz and S. Begley, *The Mind and the Brain: Neuroplasticity and the Power of Mental Force* (New York: Regan Books, 2002), chapter 2, "Brain Lock."

³⁴ See J. Scott, J. D. Teasdale, E. S. Paykel, A. L. Johnson, R. Abbott, H. Hayhurst, R. Moore, and A. Garland, "Effects of Cognitive Therapy on Psychological Symptoms and Social Functioning in Residual Depression," *British Journal of Psychiatry* 177 (2000): 440-46; and J. D. Teasdale, Z. V. Segal, J. M. Williams, V. A. Ridgeway, J. M. Soulsby, and M. A. Lau, "Prevention of Relapse/Recurrence in Major Depression by Mindfulness-Based Cognitive Therapy," *Journal of Consulting and Clinical Psychiatry* 68 (2000): 615-23.

³⁵ See S. H. Ma and J. D. Teasdale, "Mindfulness-Based Cognitive Therapy for Depression: Replication and Exploration of Differential Relapse Prevention Effects," *Journal of Consulting and Clinical Psychiatry* 72 (2004): 31-40.

Reduction Center, established in 1979 at the University of Massachusetts Medical School.³⁶ Mindfulness-based therapy has been found to produce alterations in patterns of prefrontal brain activity that has previously been found to accompany a positive affect.³⁷ Courses on Mindfulness-Based Stress Reduction now extend beyond the hospital setting for chronic patients and are applied to a wide array of individuals.³⁸ This method, with a primary basis in Buddhist practice, is now being used to treat chronic pain, anxiety disorders, general psychological well-being, psoriasis, and recurrent depression.³⁹ Recent studies have revealed that this type of therapy also produces changes in brain structure, showing again that meditation can induce neuroplasticity.⁴⁰

Compassion Meditation and Neuroscience

In the 1980's some initial studies on the plasticity of baseline emotions revealed a connection between attachment security and compassion.⁴¹ Attachment security is

³⁶ For more information, see <http://www.umassmed.edu>. Kabat-Zinn is also a founding Fellow of the Fetzer Institute that aims at the utilization of love, forgiveness, and compassion in transforming individuals and communities. See <http://www.fetzer.org>.

³⁷ See R. J. Davidson, J. Kabat-Zinn, J. Schumacher, M. Rosenkranz, M. Muller, D. Santorelli, S. F. Urbanowski, A. Harrington, K. Bonus, and J. F. Sheridan, "Alterations in Brain and Immune Function Produced by Mindfulness Meditation," *Psychosomatic Medicine* 65.4 (2003): 564-570.

³⁸ See J. Kabat-Zinn and A. Chapman-Waldrop, "Compliance with an Outpatient Stress Reduction Program: Rates and Predictors of Program Completion," *Journal of Behavioral Medicine*, 11.4 (1988): 333-353; and Kabat-Zinn, Lipworth, and Burney, "The Clinical Use of Mindfulness Meditation for the Self-Regulation of Chronic Pain," *Journal of Behavioral Medicine* 8.2 (1985): 163-90.

³⁹ See P. Grossman, L. Niemann, S. Schmidt, and H. Walach, "Mindfulness-Based Stress Reduction and Health Benefits: A Meta Analysis," *Journal of Psychosomatic Research* 57.1 (2004): 35-43.

⁴⁰ See S. Lazar, G. Bush, R. L. Gollub, G. L. Fricchione, G. Khalsa, and H. Benson, "Meditation Experience is Associated with Increased Cortical Thickness," *Neuroreport* 16.17 (2005): 1893-7.

⁴¹ Begley, 197-8.

the degree of which one feels secure in his/her own personal relationships and those who had a high degree of attachment security also had higher degrees of compassion. After a series of studies, Phillip Shaver and Mario Mikulincer of Bar Ilan University in Israel, found that the circuitry for attachment security is plastic and therefore can be increased along with compassion, thereby decreasing selfishness and ethnocentrism.⁴²

These findings launched further studies in developing positive mental states that would take advantage of the possibilities of neuroplasticity. Richard Davidson, who is familiar with Buddhist meditation and its implications for transforming emotions, undertook a study to examine the relationship between mental training and the generation of enduring happiness and other positive emotions. His hypothesis was that meditation has the ability to change the brain, through the workings of neuroplasticity, where patterns of neural activity or even the structure of neurons can be altered. Tibetan Buddhist monks traveled to the United States at the Dalai Lama's encouragement to act as subjects of research aimed at detecting change in patterns of prefrontal activation, the physical location correlated to positive emotions, through the process of mental training.⁴³ The monks followed the scientists' instructions in alternating neutral mental activity with six mental states, including compassion meditation. During compassion meditation, the left frontal

⁴² Mikulincer and Shaver describe their work in numerous publications. See Mikulincer, T. Dolev, and Shaver, "Attachment-Related Strategies during Thought Suppression: Ironic Rebounds and Vulnerable Self-Representations," *Journal of Personality and Social Psychology* 89 (Nov. 2005): 817-39, for an extensive overview.

⁴³ EEG is the acronym for electroencephalography and is a tool for measuring the electrical activity between neurons firing across the brain.

cortex, and the neural correlate for happiness, was higher than 99.7 percent of everyone ever measured.⁴⁴

After listening to a report of the findings, the Dalai Lama makes the compelling remark that happiness is something that can be cultivated deliberately.⁴⁵ Davidson makes a similar conclusion, stating happiness is not simply a state or a trait, but a skill, one that can be enhanced through mental training, just as Buddhism suggests. Davidson says:

There is a tremendous lacuna in our worldview, where training is seen as important for strength, for physical agility for athletic ability, for musical ability—for everything except emotions. The Buddhists say these are skills, too, and are trainable like any others.⁴⁶

Whereas emotions had been previously thought to be localized in certain areas of the brain, studies began to reveal that every area of brain dedicated to emotion is also devoted to some aspect of thought; both emotion and cognitive processing share the same neural circuits.⁴⁷ This neuroanatomy is consistent with the Buddhist notion that thoughts and emotions are inseparable parts of the same mental event and only further the hypothesis that cognition, with mental training,

⁴⁴ Begley, 229.

⁴⁵ Ibid. For more information regarding Buddhist and scientific understandings of emotions, see Paul Ekman, Richard J. Davidson, Matthieu Ricard, and B. Alan Wallace, "Buddhist and Psychological Perspectives on Emotions and Well-Being," in *Current Directions in Psychological Science* 14.2 (2005), 59-63.

⁴⁶ Begley, 231.

⁴⁷ Ibid., 232.

can alter the circuitry of emotions.⁴⁸ Davidson continued to investigate the possibilities of emotional plasticity. Using an fMRI to measure activity in the amygdala, the area of the brain associated with emotions such as distress, fear, anger, and anxiety, he found that simply by having the aspiration that a person in a photo be free of suffering, subjects, even without mental training, can alter activation in the brain.⁴⁹ Thought was altering emotion.

In another experiment, Davidson tested eight Buddhist adepts along with eight non-meditators as controls, to engage in loving-kindness meditation while their brain waves were measured by EEGs. The prominent presence of gamma waves was noticed at once, the signal continuing to rise over the meditation period. Gamma waves are believed to generally be associated with mental effort in addition to being the signature for activity between widespread brain circuitry and seem to be related to consciousness and perception. Even during neutral mental activity, the monks' increase in gamma waves was larger than had ever been recorded in previous neuroscience experimentation.⁵⁰ Furthermore, Davidson found a linear relationship between the number of years practiced and their baseline gamma signal, showing that the degree of mental training is related to the degree of change.⁵¹ The study was the first study on compassion meditation ever conducted

⁴⁸ Buddhist notions of cognitive-emotional processing, designated by the unit *vithi* in the Abhidharma, will be discussed at a later point.

⁴⁹ Ibid., 232-3.

⁵⁰ Ibid., 234.

⁵¹ Ibid., 236.

and was soon published in the prestigious science journal *Proceedings of the National Academy of Sciences*.⁵²

The results also showed that even when not meditating the adepts' brain signals were significantly different than non-meditators, illustrating that meditation or mental training can manifest as an enduring brain trait. Buddhists do not find this surprising, as it supports the claim that meditation has significant and lasting effects beyond the actual period of practice, influencing the person on a fundamental level that changes everyday life. Of even greater significance to Buddhists is the regions of the brain that were shown to be active during compassion meditation, as the physical correlates of the practice reflect what this type of meditation is meant to cultivate. During meditation, the brains of experienced meditators and the control subjects alike both showed activity in areas related to monitoring emotions, planning movements, and positive emotions such as happiness. For the adepts, however, there was increased activation in the right insula and caudate, the network associated with empathy and maternal love and that is exactly the desired effect of this type of meditation. The amount of hours spent in meditation was again informative of the degree of activation in these areas. And because of this increased activation in the area of the brain related to planned movement, it seemed as if the monks held the intent to act on this compassion. As Davidson noted at the twelfth

⁵² See A. Lutz, L. L. Greischar, N. B. Rawlings, M. Ricard, and R. J. Davidson, "Long-Term Meditators Self-Induce High-Amplitude Gamma Synchrony during Mental Practice," *Proceedings of the National Academy of Sciences* 101 (Nov. 16, 2004): 16369-73.

Mind and Life conference, these results seemed to give real meaning to the phrase 'moved by compassion.'⁵³

Another consistency between Buddhism and science revealed by such studies is that the meditating monks showed activation in networks associated with pain and, as Davidson notes, shows the notion of 'suffering with' someone makes real sense neurologically.⁵⁴ As part of compassion meditation involves the 'ingestion' of others' suffering, this makes sense to Buddhists as well.⁵⁵ Furthermore, regions that are involved in the understanding of what is "self" and what is "other" showed reduced activity, in adepts and novices alike.⁵⁶ The Buddhist scholar can immediately see how these studies are so compelling in the study of Buddhist philosophy. As all meditation is ultimately orientated toward realizing the wisdom of emptiness and no-self, physical evidence of meditation quieting the notion of "self" is quite compelling. The concept of no-self will be discussed at a later point. Such activity of the brain is notably higher in experienced meditators, suggesting again that the cultivation of these positive skills can be trained.

Of course, these results are of great interest to the neuroscientific community as well, for, as Davidson says:

⁵³ Begley, 238.

⁵⁴ Ibid., 238.

⁵⁵ In Tibetan this practice is called *tonglen* and involves sending out your happiness and compassion to all sentient beings with the exhalation of breath, preceded by the inhalation of all others' pain and suffering.

⁵⁶ Ibid., 237.

Because increased training in compassion meditation results in greater activation of areas linked to love and empathy, it suggests that emotions might be transformed by mental training. Science has long held that emotional regulation and emotional response are static abilities that don't much change once you reach adulthood. But our findings clearly indicate that meditation can change the function of the brain in an enduring way.⁵⁷

⁵⁷ Ibid., 238-9.

3

PHILOSOPHICAL IMPLICATIONS OF RESEARCH

As the research has revealed not only consistencies between Buddhism and neuroscience, but also some quite compelling possibilities, it seems the implications of the findings for philosophy of mind deserves some attention. Buddhism has long considered the potential of the plastic mind, which has been subject to intense analysis by serious contemplatives. The resultant Buddhist model of mind is an alternate vision that has not been fully considered by western philosophers, one that addresses the difficulties and pitfalls associated with current, predominantly accepted models in the field, including physicalism and dualism.⁵⁸

The Middle Way between Physicalism and Dualism

Regarding the structure of reality, Buddhism rejects both physicalism and dualism, instead taking the middle way between the two. Buddhism suggests there are three fundamental aspects of the mundane world of conditioned things, the world of conventional experience: (1) matter—physical objects; (2) mind—subjective experience; and (3) abstract composites—mental formations. Science deals primarily with that which is physical, observable, and objectifiable and often maintains the metaphysical assumption that all reality is ultimately reducible to such, including the mind. Many philosophers of neuroscience maintain similar

⁵⁸ This is a vast oversimplification of the sophisticated arguments put forth by many important thinkers. Yet, reducing the philosophical viewpoints to this dichotomy will help illustrate the Buddhist understanding by comparison. For a comprehensive overview of past and present contributions in philosophy of mind, see David J. Chalmers, ed., *Philosophy of Mind: Classical and Contemporary Readings* (New York: Oxford University Press, 2002)

views. According to the Buddhist perspective, the mental realm *is* heavily contingent upon physical bases, however it is also considered separate from the material world. In other words, the mental cannot be reduced to the physical, although it may depend upon the physical to function.⁵⁹ At first glance this may appear to be dualistic, however this in fact is not the case, as will be discussed shortly. The third realm of abstract composites cannot be characterized as physical or mental because it is not composed of material constituents nor does it exist only in subjective experience. These include features of reality that are integral to our understanding of the world, including time, concepts, and logical principles that are essentially constructs of our mind but distinct from the typology of mental phenomena. All phenomena within this realm are contingent upon either the physical or mental realms but have characteristics distinct from the two.⁶⁰

Buddhist philosophy further divides the mental realm into a six-fold typology of mental phenomena: the experiences of sight, hearing, smell, taste, touch, and the mental states.⁶¹ Mental phenomena corresponding to the five senses are considered

⁵⁹ With the exception of one materialist school in India, most ancient Indian and Tibetan philosophical schools agree that the mental cannot be reducible to the physical. See His Holiness the Fourteenth Dalai Lama [Tenzin Gyatso], *The Universe in a Single Atom: The Convergence of Science and Spirituality* (New York: Broadway Books, 2005), 126.

⁶⁰ This is similar to philosopher of science Karl Popper's vision of reality. See "Three Worlds," the Tanner Lecture on Human Values delivered at the University of Michigan, April 7th, 1978. Accessible at <http://www.tannerlectures.utah.edu/lectures/documents/popper80.pdf>.

⁶¹ One division of the Yogacara school posits an eightfold typology. In addition to the six discussed, they argue for the existence of a 'basic mind' that retains throughout the lifetime of an individual and is best understood as 'foundational consciousness.' Inextricable from this foundational consciousness is the consciousness of selfhood, asserting "I am." This is understood as a distinct stream of consciousness. The Middle Way school, generally upheld by Tibetan thinkers, rejects this typology because of the potential implications of foundational consciousness regarding the nature of self. See the Dalai Lama (2005), 123-124.

contingent upon the sensory faculties that are understood as material (i.e. physical). The experience of mental states on the other hand, have greater independence from their physical bases as faculties such as imagination illustrate. There are two primary characteristics that define these various states as mental: luminosity and knowing.⁶² Luminosity or clarity refers to the ability of mental states to reveal or reflect. Knowing or cognizance refers to mental state's faculty to perceive or apprehend what appears. All phenomena having these qualities are regarded as mental. The Dalai Lama provides further elucidation:

Just as in light there is no categorical distinction between the illumination and that which illuminates, so in consciousness [i.e. mental states] there is no real difference between the process of knowing or cognition and that which cognizes. In consciousness, as in light, there is a quality of illumination.⁶³

Mentality is not considered to be distinct from these mental processes; rather the mind is characterized as such.

As physicalism holds that mental processes are nothing other than physical processes, categorizing the mind as mental processes may seem to suggest the mental is simply physical, evidenced by neural correlates of mental events. However, the primary characteristic of mind is its subjective nature and nothing purely objective can fully account for subjectivity. It is by nature different than the physical, objective world. Because the nature of the mental and physical are necessarily different one cannot be the substantial cause of the other. This is

⁶² Young Tibetan Buddhists' first lesson in epistemology is, "The definition of the mental is that which is luminous and knowing." Ibid., 124.

⁶³ Ibid., 125.

because according to Buddhist theory of causation there are two principle categories of causes: (1) the substantial cause, the substance that turns in to a particular effect (for example, clay is the substantial cause of a pot); and (2) contributory or complementary causes, that is all other factors that make the effect possible (continuing the previous example, this would include such things as the potter and kiln).⁶⁴ According to Buddhist theory of consciousness, consciousness and matter can and do contribute toward the origination of each other, but one can never be the substantial cause of the other.⁶⁵ Furthermore, if this is the line of demarcation between the mental and the physical than subjective experience having neural correlates does not refute the claim that one's mind, one's subjective experience can alter the physical. In fact, the neural correlates can be interpreted as supporting such a theory, as they provide the mechanism of which the mental can act on the physical.

Dualism suggests there are two independent substances, mind and matter. This is not the Buddhist view. Instead, reality as experienced by ordinary perception is the world of conditioned things. The nature of reality contains two truths, the conventional and the ultimate. They are distinct and neither is more "true" than the other. On the ultimate level, nothing has inherent existence and is known as "empty," rather everything is *dependently originated*, that is everything originates according to causes and conditions and is therefore subject to change. All things

⁶⁴ It is perhaps worth noting the substantial and contributory causes are comparable to Aristotle's material and efficient causes.

⁶⁵ Ibid., 131. Buddhist theory of causation has been explored by thinkers such as Dharmakirti (ca. 7th cent.). His philosophy is generally upheld by Tibetan thinkers and is part of the monastic curriculum.

experienced in the conditioned world go through the three phases of arising, remaining, and ceasing. The mind, like all conditioned phenomena, arises from many contributing factors and is dependent on and relational to many components. Mind and body are distinct, but not wholly separate, related, but not equivalent.

Both physicalism and dualism have difficulty accounting for two-way causation implicated by neuroplasticity. The philosophy of physicalism is complicated by recent research showing the production of physical change through attention and other volitional mental states (such as equanimity), which would be impossible according to the prevalent view in neuroscience that rejects mental causation. Two-way causality is a problem for dualism in that if mind and matter are completely existentially independent from each other, how could any kind of causal relationship between the two be accounted for? Just as it is difficult to accept that mind and matter are reducibly equivalent, positing the mental and the physical are wholly independent is equally unsatisfactory. Rather, the middle way between the two, positing distinction, but not total separation between mind and body seems to be consistent with the neuroscientific research and the implications of neuroplasticity.⁶⁶

The Neuroplastic Mind, Two-Way Causation, and the Problem of Self

⁶⁶ B. Alan Wallace has also acknowledged the Buddhist view as the “Middle Path between Dualism and Materialism.” See Houshmand, et al., 34-37.

Buddhists see neuroplasticity as an expression of the fluidity and impermanence of mental states in the ever-changing processes that characterize consciousness.⁶⁷ This idea is of fundamental importance to Buddhism, in that neuroplasticity can be equated to mental transience and attaining understanding of the nature of mind is the foundation of the Buddhist notion of no-self, to be discussed shortly.

Neuroplasticity suggests the mind is not, in fact, some automated, mechanical process emerging from the physical, but is distinct and enjoys some independence from the brain, reflecting Buddhist understanding.⁶⁸ Even though the mind is considered to be distinct from the brain, this is not seen as establishing any kind of permanent or inherent existence. Rather, the mind is characterized by the transitory processes of consciousness or neuroplastic potential and, therefore, has no permanent attributes that could account for inherent existence. The Madhyamika or Centrist view of Tibetan Buddhism rejects the inherent existence of all things. However, things *do* exist in relation to each other, including the mental and the physical related through sensation, perception, and conception. This school of thought rejects both the philosophies of dualism and physicalism as noted above. Phenomena do not exist in themselves, but do exist as dependently related events.

⁶⁷ His Holiness the Dalai Lama explicitly expresses this view. See the Dalai Lama (2005), 150. There are many varieties of awareness and degrees and qualities of consciousness falling along a spectrum from the very gross to the very subtle. Those that are of a grosser nature are entirely dependent on the physical body as discussed earlier, however subtle levels of consciousness are related to conceptual awareness (as oppose to sensory awareness). For a brief discussion on the spectrum on consciousness between His Holiness and western scientists, see Zara Houshmand, Robert B. Livingston, and B. Alan Wallace, eds. *Consciousness at the Crossroads: Conversations with the Dalai Lama on Brain Science and Buddhism*. Ithaca: Snow Lion Publications, 1999, 37-55.

⁶⁸ Buddhism concedes that the brain or the body is the basis for certain kinds of awareness, but the brain is not understood as apprehending anything at all. The awareness apprehends, not the physical body. See Daniel Goleman, ed. *Healing Emotions: Conversations with the Dalai Lama on Mindfulness, Emotions, and Health*. Boston: Shambhala, 1997, 232.

Dependence is threefold: (1) things arise in dependence on preceding causal influences, (2) phenomena exist in dependence on their own attributes, and (3) they are dependent on humankind's verbal and conceptual designation of them.⁶⁹ The mind too, exists as a causal nexus, part of which is shared with the body, allowing for two-way causation.⁷⁰

In light of the implications of neuroplasticity regarding mind-body causality, both physicalists and dualists need to modify some of their claims about the mind-body relationship. While this is still a major problem that needs to be addressed in dualism, advocates of physicalism have put forth a revised argument, positing the mind is an 'emergent property' of the brain, which has become the predominant theory in neuroscience. The idea that the mind is a property of the brain is a philosophically tricky explanation that finds a way to recognize the mind and dismiss it at the same time and attempts to support the two contradictory notions that mind has existence but is without subsistence. This explanation allows for the continuation of the reductionist, physicalist view by denying the mind any categorical distinction from the brain. Buddhists and neuroscientists agree that consciousness is a process; however, if the mind is a process it necessitates a cause

⁶⁹ See Houshmand, et al., 35.

⁷⁰ Some philosophers of science argue for an etiological understanding of explanations, that is explanation should describe cause and effect in terms of a shared causal nexus between supporting component parts, rather than a constitutive explanation of component parts that understands cause and effect in reductionist terms. For example, see Wesley C. Salmon, *Causality and Explanation* (New York: Oxford University Press, 1998), which brings together this important thinker's contributions over the course of his career. Buddhist understanding of dependent origination can be compared to the etiological explanation position, in that cause and effect do not occur solely as the mechanical/physical reaction of component parts, but also occur as a causal nexus. A good explanation therefore, will account for causal relations. Following this line of reasoning, an adequate explanation of mind should describe the mind not in terms of reducibly physical component parts, but rather account for a nexus between mind and body.

and the spontaneous emergence of mind from brain seems to suggest an initial point of which there is no cause. Logically a causeless initial cause is inconsistent and difficult to accept.⁷¹ This theory creates a situation of which the mind can still be understood as some definable, determinable, physically observable phenomenon, giving it the illusion of subsistence and providing a haven for its existence to reside in. In other words, the theory allows for top-down causality without top-down causes, allows for mind-to-brain causality without granting mental causes.⁷²

Such problems arise in part due to attachment to the notion of permanent selfhood pervading western thinking. Western philosophy too often conflates the terms mind and self. For example, any given book on philosophy of mind will devote some time to the notion of free will. The relevance of free will to mind lies in the idea that the mind holds the autonomy and independence of the self. While previously the predominant view was that selfhood persisted in such forms as a soul, as religious thought became less relevant after the European enlightenment, selfhood was relocated to the mental realm, which to many was reducibly physical. The impermanence of the body was granted, however the permanence or inherent existence of some attributes constituting the self was assumed nonetheless.

⁷¹ At the third Mind and Life conference, the Dalai Lama and western scientists touched on this subject of categorizing the mind as an emergent property of the brain. The Dalai Lama commented: "There are many degrees of subtlety of consciousness, and science has looked only at the ordinary levels. So, science has merely not found the more subtle ones...and merely not finding is not enough to controvert...because of the human body, there is a certain consciousness that entirely depends on the human organism. Obviously, we call that grosser level of mind the human mind. In that sense, you could virtually speak of the human mind as being an emergent property of the body." However, in regards to subtler levels of consciousness, the substantial cause for the mental must be mental. See Goleman (1997), 227-228.

⁷² For a discussion regarding philosophical issues raised in interpreting top-down causality in terms of interlevel causation, rather than intralevel causation, see Carl F. Craver and William Bechtel, "Top-Down Causality without Top-Down Causes," in *Biology and Philosophy* (2007) 22:547-563.

This assumption has led western philosophers of mind to focus on explaining what permanent attributes could account for selfhood and often ignoring the possibility that there is no self.⁷³ Even the “emergent mind” hypothesis, which attempts at dismissing a mind that is categorically distinct from the brain reflects such problems. If there were no self to consider along with no mind to deny, there would be no need to establish the mind as existentially dependent on, but causally distinct from the changing, neuroplastic brain. As research on neuroplasticity revealed the brain is rather dynamic, it could no longer serve as the seat of selfhood. Selfhood, then must reside in the mental realm, existing by way of memory or some other continuity. In order to make such notions of selfhood consistent with physicalist or naturalistic philosophies, the mental came to be regarded as an emergent property of the brain. In this way, the mental realm is granted some independence, but not granted categorical distinction from the brain, allowing selfhood to persist outside of the impermanent, transient body while simultaneously maintaining a mind that is reducibly physical. The simpler explanation to account for mind-brain causality would be to conclude the mind is subject to causes, conditions, and change and is no more stable or enduring than the brain, both lack permanence and exist only in dependence on particular causal networks, although they are distinct. Neuroscientific findings regarding neuroplasticity clearly indicate the impermanence of brain structure *and* mental states. The implicit objection to

⁷³ For example, see Robert R. Llinas, *I of the Vortex: From Neurons to Self* (Cambridge: MIT Press, 2002), which examines selfhood from the perspective of cellular physiology.

such a model of mind is if the mind, like the brain, is impermanent, what is left to identify the self with?⁷⁴

The Self

Neuroplasticity reveals that human beings are not some fixed, monolithic entity, rather both the mental and the physical aspects of the individual are plastic and are even characterized by impermanent and varying processes. Knowing that change is the nature of our being, the question of self has never been greater.⁷⁵ If both mind and body are constantly changing and therefore lack permanent attributes, what accounts for selfhood? From the Buddhist perspective, perhaps the most significant implications of neuroplasticity are those regarding conceptions of the self.

According to Buddhism, just as the mind is subject to particular causes and conditions, undergoing constant change and therefore impermanent and lacking inherent existence, so too for the self. When Buddhists assert that there is no self, what is being suggested is that there is no permanent entity of which to identify with the self and the experience of self as an enduring being is an illusion. Rather, the

⁷⁴ Some scientists in the field of biology and cognitive science are aware of the problem of self when thinking of the mind as an emergent property of the brain. For example, neuroscientist Francisco Varela notes that the Buddhist notion of no-self or empty self follows the model of “virtual self” being developed in his field. Following this view, the self can be seen as the emergent property of the mind, but like the mind, the self has no inherent existence and is something like an optical illusion of the mind. Individuals reify the self and attribute permanence and solidity to something that is illusory. However, even this notion of virtual self seems to maintain attachment to the notion of a permanent self, despite the implications of such a theory. While it is noted that the self cannot be located anywhere in the body, the self is described as “produced by an underlying network of biological and cognitive systems.” However, following the logical conclusion of “virtual self” there should be nothing that could be identified as “produced,” except perhaps when speaking of the conventional experience of self, but that is not how it is used. See Daniel Goleman, ed., *Destructive Emotions: A Scientific Dialogue with the Dalai Lama* (New York: Bantam, 2004), 93.

⁷⁵ Naturally, many thinkers have explored the question of self. For a contemporary and influential work, see Douglas R. Hofstadter and Daniel Dennett, *The Mind's I: Fantasies and Reflections on Self & Soul* (New York: Basic Books, 2001), which contains Dennett's well-known essay, “Where Am I?”.

self is designated as a transiently existent phenomenon, meaning the self is both existent and illusory.

No-self can be examined as follows. When thinking of 'I,' there arises a conception of something independent of the body, mind, or a continuum of such elements, as if these things were irrelevant to and separate from 'I.' Then one may question if this 'I' is one with the elements or different from them. Buddhists understand mental and physical aggregates as having different types and sources, lacking the unity of 'I.' Because these aggregates are of many kinds, there would be many types of 'I' if the self could be equated to these elements. Furthermore, if these aggregates were eliminated or destroyed, 'I' would be also. It is impossible, therefore, that 'I' and the aggregates could be one in the same.

However, if the 'I' and the aggregates were completely independent of each other, they could not relate to each other. Then, when the body is sick, it would mean the 'I' is not sick, when the body suffers, 'I' do not suffer, but this is not supported by experience. Therefore, the self and mental and physical aggregates cannot be unrelated.

Yet, for the self to have existence it must have subsistence (something that categorizes it as existent and as existentially distinct from other existent entities) and what characterizes it should either be the same or different from the aggregates. Because neither one is the case, one must conclude that there is nothing inherently existent to the 'I.' The 'I' does not exist, but this is also counter to experience, so one must conclude that it is not totally non-existent. Conventionally, there is a self, but it

is a nominal 'I' of imputed existence.⁷⁶ The self is not inherently existent, it is not totally non-existent, it is not both of these, and it is not either of these.⁷⁷ The self must be understood both on the conventional and ultimate levels. As mentioned, a fundamental Buddhist philosophical belief is the 'two truths:' the two levels of reality. As the Dalai Lama states:

One level is the empirical, phenomenal and relative level that appears to us, where functions such as causes and conditions, names and labels, and so on can be validly understood. The other is a deeper level of existence beyond that, which Buddhist philosophers describe as the fundamental, or ultimate, nature of reality, and which is often technically referred to as 'emptiness.'⁷⁸

So while the self does not exist at the ultimate level, it can continue to be validly understood in terms of the relative level of ordinary experience.

A major objection to such a view is if the 'I' has imputed existence, who is doing the imputing? In other words, there must be self to establish self. However, this objection assumes a nihilistic interpretation of the Buddhist view and is not in agreement with what is being suggested. Buddhists are denying the inherent

⁷⁶ The logic used in analyzing the self is extrapolated from the Dalai Lama's presentation of the argument. See H. H. the Dalai Lama, *The Buddhism of Tibet and the Key to the Middle Way* (Delhi: Vikas Publishing House, 1975), 42-45.

⁷⁷ In the discussion on the nature of self, the Dalai Lama quotes Nagarjuna here, from the *Fundamental Text Called 'Wisdom'* (XV.10): "Existence' is holding to permanence, 'Non-existence' is a view of nihilism. Not existent, not non-existent, not both and not something that is not both." Quoted in *ibid.*, 44.

⁷⁸ See Dalai Lama, Herbert Benson, Robert A. F. Thurman, Daniel Goleman, and Howard Gardner, et al., *MindScience: An East-West Dialogue*, proceedings of the symposium sponsored by the Mind/Body Medical Institute of Harvard Medical School & New England Deaconess Hospital, and Tibet House New York, edited by Daniel Goleman and Robert A. F. Thurman (Boston: Wisdom Publications, 1991), 14.

existence of self as a phenomenon independent of other phenomena. Thus, inherent existence is the object of negation. The idea that the self is completely non-existent is not the Buddhist view. Rather, the self is a dependently originated phenomenon and is constantly undergoing change, however as a result of conditioning, phenomena appear to inherently exist. Attachment to the idea of permanence invariably leads to dissatisfaction, or suffering as noted in the Four Noble Truths. From the Buddhist perspective, all mental afflictions arise from misunderstanding the nature of things, namely the nature of self.⁷⁹

The Mind-Body Problem

While dependent origination, discussed earlier, explains the ontological status of mind and matter and confirms both as subject to change and therefore without inherent existence, the theory does not explain how the physical and mental interact. Known as the mind-body problem in western philosophy of mind, the question is how can something nonphysical (the mind) act on the physical (the body)? What is the mechanism? According to Buddhism, the causal networks of mind and body are intertwined, yet they are not identical, nor are they subject to all the same laws, as mental states independence from physical sensory information

⁷⁹ For an interesting comparison between Buddhism and science regarding afflictions relating to identity, see William S. Waldron, "Common Ground, Common Cause: Buddhism and Science on the Afflictions of Identity," in *Buddhism and Science: Breaking New Ground*, edited by Alan Wallace (New York: Columbia University Press, 2003), 145-191.

illustrates.⁸⁰ Therefore, when the physical and mental realms interact, the occurrences are within a particular causal network.

When the nose as physical sensory organ comes in contact with the scent of a flower, there occurs a mental correlate to physical occurrence. That mental correlate or sensation is mediated by perception and translated into the realm of subjectivity as a concept. The phenomenon goes from a transition to physical (for example, a rose), then exists as both physical and mental phenomena (smelling the rose), then enjoys independence within the mental realm (smell of the rose). The *Abidharma kosa sastra* (*Abhidhamma* in Pali), one of the three parts of the Pali canon known as the *Tripitaka* (Pali: *Tipitaka*), regards consciousness as acting without an actor, but not without cause, and conscious cognition is therefore understood in terms of the dynamics of input and output.⁸¹ The input data are the objects of consciousness. When the objects of consciousness arise from the physical senses they are known as *rupa*, translated as body or matter. Other input comes from consciousness itself, independent from the physical senses, called *nama*, translated as mind. According to the *Abidharma*, the mind is regarded as the sixth sense, as

⁸⁰ That is not to say there are no laws. One important Buddhist thinker who explored psychological laws was Dharmakirti (ca. 7th cent.).

⁸¹ The *Abidharma* is a compilation of canonical Theravada Buddhist texts and one of three sets of volumes known collectively as the Tipitaka or “Three Baskets.” The texts are in Pali, compiled around 500 B.C.E. to 250 B.C.E. and deal with phenomenological psychology as obtained through the effects of meditation or trained introspection. See Henk Barendregt, “The Abhidhamma Model of Consciousness and Its Consequences,” in *Horizons in Buddhist Psychology*, (Taos Institute Publications: Chagrin Falls, 2006), 331-349 for a sketch of the *Abidharma* model and an interpretation of that model regarding various psychological notions like neurosis, psychosis, and coping mechanisms. The effects of mindfulness meditation are considered in light of psychotherapeutic explanations. Not all volumes of the *Abidharma* have been translated into English, including five volumes of the *Patthana*.

noted earlier when discussing the typology of mental phenomena. Yet, this does not refer to anything supernatural as 'sixth sense' implies in the West, but refers to the ability of consciousness to supply its own input. When *rupa* is the object, it is immediately copied to consciousness with a corresponding *nama*, as in the above example of smelling the rose.⁸² *Nama* then becomes output in terms of mental states and body movements and speech.⁸³

Some suggest the *Abidharma* is not solving the mind-body problem, nor even addressing it.⁸⁴ However, that is because in Buddhist philosophy there is no mind-body problem. The question 'how can the mind act on the body?' would only have relevance if the mind were completely independent from the physical world, because then there would be no causal networks between the two to account for interaction. However, since the mind does in fact affect and influence the body, as the body does the mind, they are necessarily related and must be subject to some of the same causes and conditions. As stated earlier, Buddhism does not assume duality between mind and body, rather they give rise to the origination of each other and therefore must share some of the same causal networks. Two-way causation is the logical product of such conditioned phenomena. It is exactly because the mind and body are conditioned phenomena that the mind is able to act on the body and

⁸² Part of *rupa* does not come from the physical sense, but from the mind. Organizing information into composite parts is an example. Another example is the immediate judgments of visible objects being edible or having sexual quality. See *ibid.*, 332.

⁸³ *Ibid.*, 333.

⁸⁴ *Ibid.*, 332.

the body on the mind. If they existed completely independently of each other, causality would be an impossibility.

Understandably, this explanation would seem somewhat insufficient for those in the field of science. The main component that seems to be missing is that mind cannot be localized in spatio-temporal terms. In other words, how is one to objectively identify something that exists outside the laws of the physical world, how could it possibly be accounted for? While the answers to such questions will be explored more fully in the conclusion, it seems appropriate here to address the relationship between the mental world and physical reality. Empiricism is based on observation and experience in the hopes of identifying an objective world independent of mental subjectivity. However, empiricism, and the validity of objective accounts, is based on the fundamental assumption that reality exists as we experience it, or at least that there is some correlation between the two. If there were none, all sensory evidence would be irrelevant. Yet, the empirical tool used for science is after all the mind and if scientists do not understand how the mind is related to physical reality, how can they ever expect empirical adequacy?⁸⁵ As mentioned, Buddhists regard the mental as one of the fundamental aspects of reality. The following thought experiment will hopefully elucidate why and illustrate where and how mentality resides in reality.

⁸⁵ B. Alan Wallace comments, "The primary instrument that all scientists have used to make every type of observation is the human mind [...] This is tantamount to using an instrument for three hundred years before subjecting it to scientific scrutiny." See Wallace and Hodel, 56.

A classic thought experiment asks, “If a tree were to fall in the forest and no one were around to hear it, would it make a sound?” If sound is understood as the physical waves that occur, then yes, the tree makes a sound. However, if sound is understood in terms of vibrations within the ear resulting in hearing, then no, sound did not occur. Yet, assume that the world is made up of all deaf beings. If scientists of sound were to confine their research to sound waves alone, without any reports of a hearing experience, they would not understand much about sound. Indeed, they would have no reason based on sound waves alone to conclude they are correlated to hearing at all. Now, remove all reference to sensory information. In this universe, there is little reason to determine anything regarding correlations between the mental realm and the physical world. Rather, this universe is silent, dark, and empty. Furthermore, it would be completely meaningless to ask questions about this abysmal world beyond our observations.⁸⁶

There can be no knowledge without knowing and no knowing without luminosity. The mind is what casts the light on this universe resulting in the explosion of sensations, perceptions, and conceptions. It is nothing other than this illumination and knowing. When we try to find the mind, we need only look at the brilliance of reality surrounding us. Without mind, matter would be impenetrably dark, and without matter, mind would be blinding light. Between the two arises the world of conditioned things and quite literally, reality as we experience it.

Reality as We Experience It: Perception

⁸⁶ For a fascinating and controversial thesis on the emergence of consciousness, see Julian Jaynes, *The Origin of Consciousness in the Breakdown of the Bicameral Mind* (Boston: Mariner Books, 2000).

According to Buddhist epistemology, our ability to ascertain objects has inherent limitations. One limitation is temporal, in that the ordinary untrained mind can only ascertain an event that occurs over a certain period of time, traditionally thought to be about a span of a finger snap. While one may perceive the event, it is not subject to conscious recollection.⁸⁷ The second limitation on human ascertainment is the inclination to regard objects or events according to their composite nature. For example, if I were to look at a coffee mug, I would not see the individual molecules or the space between them, rather I would see the composite object that is made-up of such. Moments are similarly conflated into one continuum, when in fact any given moment is composed of numberless temporal sequences.⁸⁸

How perceptions arise is a major point of interest in Indian and Tibetan Buddhist epistemology and continues to be debated. There are three main schools of thought. One suggests that when looking at a multicolored object, for example, there is a multiplicity of perceptions that occur with the visual experience. Accordingly, any given perception is made up of endless amounts of minute perceptions. A second school upholds the view that perception and the object perceived are identical and the event is split into objective and subjective halves. The third position is that traditionally accepted in Tibetan schools, and argues despite the myriad facets of a chosen object, perceptual experience occurs as a single unitary

⁸⁷ Buddhist epistemology distinguishes between ascertainment and perception, with the former referring to 'wholly registering the object/event,' subject to recollection. Perceptions are a component of ascertainment, however the nature of perception is much more complicated and will be discussed below.

⁸⁸ See Dalai Lama (2005), 172. His Holiness explains the nature of temporal conflation by using the example of perceiving a movie as one fluid motion even though it is in fact made up of a series of individual pictures.

event.⁸⁹ How we experience reality is not in fact mirroring ‘what is out there,’ but is a complex process of organization that makes potentially infinite amounts of information manageable to the human mind.

Another long-standing question in Western philosophy of mind is how can experience be accounted for? How can neurons give rise to experience, how can neurons be *about* something? These questions arise due to the need for a theory of cognitive representation consistent with a physicalist or naturalist ontology. Yet, according to the traditional interpretation of Tibetan schools, because the nature of perception prevents the mind from mirroring reality, this view does not need to answer the question how neurons can be about something, that something *is* the perception, not a reality or entity. Perceptual experience cannot be equated to reality, although they are correlated. Even though perception cannot reflect ultimate reality under ordinary circumstances, it maintains conventional truth. For all practical purposes, ascertaining ultimate reality is irrelevant for determining the truth of conventional experience and conventional reality is reality as we experience it. So, while perception does not reflect ultimate reality, it retains truth-value in understanding our world of convention.⁹⁰

Consciousness, Neurophysiology, and Mind-Body Causation

Neuroscientific research regarding meditation has shown mental practice and the development of certain mental states is conducive to neuroplasticity. The

⁸⁹ Ibid., 172-3.

⁹⁰ Another point of interest in Buddhist epistemology is the analysis of true and false perceptions. See *ibid.*, 173.

implications of such research from the Buddhist perspective, provides evidence for the transformative nature of mind, the existential distinction between mind and body, the ability of the mental and physical to influence each other, and as evidence for the distinction between perception and reality. Buddhist phenomenology of mind may also provide a means of which to understand top-down causation in terms of the associated neurophysiological happenings. A further examination of the *Abidharma* model of consciousness may provide a theoretical explanation of why some meditation-based therapy is successful.

The *Abidharma* suggests consciousness is not continuous; rather consciousness is made up of minute sequences called *cetas*. A *ceta* has three phases of arising, existing, and disappearing, all in a short duration of time. Each *ceta* is directed toward some object of cognition and will determine proceeding *cetas*, known as the *karmic* (Pali: *kammic*) *effect* of the *ceta*. There are many different types of *cetas* that could be associated with any given object. For example, a visual object may incite greed, lust, or compassion. Both the type and the object of the *ceta* influence future *cetas*. Such influence results in *accumulated karma*, which is transferred and augmented to proceeding *cetas*. Accumulated karma, can influence present *cetas* or future *cetas* in a number of ways. When a *ceta* has a direct effect on the following *ceta* it is known as *producing karma*. Producing karma is subdivided into *unwholesome*, leading to attachment and suffering, and *wholesome* karma, giving rise to freedom and decreased suffering. When collaborated with other *cetas* to produce an effect it is known as *supporting karma*. When the karma force of a *ceta*

or cetas resist the effects of other cetas it is called *obstructing karma*. Some effects of cetas can be wholly prevented by other cetas, called *destructive karma*.

Cetas are composed of what are known as *cetasikas*, meaning “born together with a ceta,” and can be thought of as mental “elementary particles.”⁹¹ Cetasikas occur simultaneously with cetas and share the same object. Most cetas are determined by their cetasikas of which there are three main groups: unwholesome, neutral, and beautiful. Cetasikas are also distinguished according to temporality, either universal or occasional. According to the Tibetan view, there are five factors universal to all mental events: feeling (value judgment, emotion), recognition (rudimentary distinctions, perception), engagement (volition, motivation), attention (choosing input), and contact (obtaining input) with the object.⁹² There can be additional factors. Mental factors are not considered separate entities, but rather as different aspects or processes of the same mental event, distinguished by their functions.⁹³ *Vithis* consist of a serial collaboration of cetas and have to do with cognitive-emotional processing.

In “The Abhidhamma Model of Consciousness,” Henk Barendregt shows how the *Abidharma* model is possibly implemented in the brain in terms of current neurophysiological understanding. Barendregt states, “It is well-known from

⁹¹ See Barendregt, 335.

⁹² The *Abidharma* posits seven universal neutral cetasikas: contact (obtaining input), feeling (value judgment), volition (motivation), perception (rudimentary distinctions), attention (choosing input), cooperation (synchronization), and one-pointedness (focus). *Ibid.*, 336. For the Tibetan system, see Dalai Lama (2005), 176. There are many systems of enumeration, however the standard version traditionally upheld by Tibetan thinkers follows that of the fourth-century thinker Asanga.

⁹³ See Dalai Lama (2005), 176.

neuropsychological experiments that consciousness has parallel and serial aspects,” and that is exactly what the *Abidharma* model emphasizes.⁹⁴ Cetas show consciousness has a strong serial component and collaborating cetasikas suggest parallel processing. Serial discrete series of cetas perhaps occur as the firing of one group of neurons, as this firing indeed happens in discrete units. Also, just as the ceta has three phases of arising, existing, and ceasing, the action potential for each neuron clearly exhibits such a life cycle. Furthermore, the four types of karma (producing, supporting, obstructing, and destroying) are consistent with the well established collaborating, excitatory, and inhibitory types of neurons. Finally, accumulated karma may occur as new synapses between neurons.

As Barendregt discusses, the *Abidharma* can provide insight into the nature of such mental afflictions as neuroses, psychoses, and other pathologies such as depression. For example, Freud discusses neuroses in terms of conflict between the *super-ego*, at the level of cognition, and the *id*'s underlying drives. The *Abidharma* explains how this occurs. All cetas contain a cetasika of feeling, however vithis, as a chain of cetas, constitute cognitive-emotional processing. Emotions/feelings associated with particular cetas can and often do conflict with thoughts in the vithis. The *Abidharma* model shows the organization of consciousness in terms of not only the cognitive level of our mind, but the neurotic core as well. As Barendregt notes, psychotherapists often work at the cognitive level of mind and attempt at modifying

⁹⁴ See Barendregt, 346.

one's thinking (i.e. one's vitis). However, working directly with the cetas and cetasikas may be a powerful treatment as well.⁹⁵

The *Abidharma* model illustrates how consciousness might occur at the neurophysiological level. Such modeling suggests a theoretical explanation as to why some meditation therapy has been successful, evidenced by the Mindfulness Based Stress Reduction treatment developed by Kabat-Zinn and Mindfulness Based Cognitive Therapy developed by Segal discussed earlier. What the *Abidharma* model of consciousness illustrates is how such top-down causation may possibly occur. Purification of mental afflictions through mindfulness involves the prevention of unwholesome cetas, resulting in no new accumulation of negative karma. There is a coherent physiological explanation for the experience of advanced meditators: with the reduction of the firing of neurons associated with mental afflictions, the brain circuitry falls into disuse, while the networks responsible for positive emotions become ever stronger.⁹⁶ This notion is consistent with the seventh-century philosopher and monk Dharmakirti's psychological law of impermanence regarding the transformability of consciousness. The law posits one mental state cannot be developed without undermining the integrity of opposing mental states. This means, for example, that the cultivation of compassion will necessarily result in the diminishment of hate and ethnocentrism.⁹⁷ Neuroplasticity has shown that changes in the mind and brain are possible, neurophysiology provides a means of physical

⁹⁵ Ibid., 339-340.

⁹⁶This argument was put forth at the twelfth Mind and Life conference. See Begley, 242.

⁹⁷ See Dalai Lama (2005), 147.

manifestation, and the *Abidharma* notion of consciousness provides a theoretical model for the transformation of associated mental and physical states.

4

CONCLUSION

Neuroplasticity is the means by which meditation can bring about enduring physical, mental, and emotional changes. Scientists now know that the brain undergoes constant change, even through adulthood, and that understanding and controlling neuroplasticity is vital for adapting to changing conditions, learning new things, and developing new skills. Neuroscientist Michael Merzenich at the University of California, San Francisco believes that in the future, our understanding of neuroplasticity will bring in an age of “brain-fitness” based on the notion that just as one needs to exercise the body, the brain needs to be worked as well to promote health and well-being and Buddhists could not agree more.⁹⁸ Yet, before this can be realized, some advances in the scientific study of mind are needed.

Scientific Study of the Mind

Although the mind permeates our experiences, science generally excludes the subjective from the natural world and attributes causality only to physical, objective phenomena. This is because empiricism and scientific materialism are often conflated, resulting in the dogma within the scientific field that the individual, private, and subjective are not part of the metaphysical composition of the cosmos. The assumption is that the objective world somehow lies beyond the subjective realm including all our sensory and mental information, which is not granted the

⁹⁸ Begley, 248.

same status of 'existence' as the physical, but rather consigned the status of epiphenomenon or illusion.

Scientists furthermore put great emphasis on reductionism, analyzing reality according to its constituent parts. Although reductionism has served the scientific tradition well, it is not always the appropriate approach. Just as examining phenomena at the subatomic level will not reveal the global processes occurring in diverse regions of the brain, so a solely objective account of the brain cannot account for subjective mental events or any mind-brain correlates. Such an objective reductionist account by itself cannot reveal *any* type of evidence for the existence of consciousness or subjective experience at all, just as sound waves alone cannot explain the experience of hearing as noted earlier. Neural events could not even have meaning outside of first-person accounts of mind. Such a commitment to ontological reductionism undermines the fundamental ideal of consilience found in the sciences. Once free from the dogmas of materialism and reductionism, scientific inquiry of consciousness can be greatly strengthened by Buddhist thought and that of other contemplative traditions.⁹⁹

Buddhism, like science, presents itself as a body of systematic knowledge about the natural world and posits a range of testable hypothesis and theories regarding the nature of mind and its relationship to the physical environment. These theories have been tested and experientially confirmed numerous times over the

⁹⁹ B. Alan Wallace makes such an argument in "Introduction: Buddhism and Science—Breaking Down the Barriers." See *Buddhism and Science: Breaking New Ground*, edited by B. Alan Wallace (Columbia University Press: New York, 2003), 1-29.

past twenty-five hundred years, by way of duplicable meditative techniques.

Although scientific knowledge is collective and public and contemplative insights are private, not being demonstrable is not equivalent to being unobservable. Any competent researcher with sufficient training can replicate the results.

Yet, the mind is a unique case of inquiry, in that the object of study is mental, the instrument of study is mental, and the medium by which the study is undertaken is mental. The research instruments of science are designed to measure physical phenomena and therefore contemporary neuroscience involves analysis of such physical measurements. Buddhist contemplatives reject this methodology out of hand. A brief digression will illustrate the point. At the Dalai Lama's urging several Tibetan contemplatives residing in the hills of Dharamsala agreed to meet with a group of western scientists to study the effects of mental training. Each monk, after being briefed on the project and the intended research, made similar comments regarding the scientists' proposed methodology: 'if you want to understand the mind, you should examine the mind.' Often the encounters turned into long debates regarding the validity of scientific analysis for the study consciousness. In the end, resistance to scientific analysis was so severe that no usable data was gained from the scientists' time spent in Dharamsala.¹⁰⁰

Such complications arise due to Buddhist understanding of mentality, characterized by its subjective nature. All of subjective experience has two components, the physical components such as brain chemistry and behavior of an

¹⁰⁰ See Begley, 215-219.

individual and the phenomenological experience of the mental events themselves, including cognitive, emotional, and psychological states. In order for the scientific study of mind to be complete, a paradigm shift in methodology is needed to account for not only the neurological and other biological happenings, but also the subjective experience itself. In order to accomplish such a task, use of both the third-person *and* the first-person approach is necessary. As the Dalai Lama notes, it is for the phenomenology of mind that the application of a first-person method is essential.¹⁰¹ First-person methodology is vital in advancing understanding of the qualia of consciousness, something science has yet to address sufficiently. No objective account of neurons and brain functions can convey the subjective experience itself. Modern Buddhists urge scientists to utilize the first-person investigative analysis of the nature and functions of the mind, by training the mind to focus on its own internal states. Referred to as *gom* in Tibetan, this mental training carries the connotation of familiarization and implies rigorous, focused and disciplined use of introspection, mindfulness, and insight to make empirical observations. This is perhaps the most scientific aspect of Buddhism. As the Dalai Lama has argued, and I

¹⁰¹ Ibid., 145. Some philosophers of science have argued for the third-person approach as well. For example, see Gualtiero Piccinini, "Data from Introspective Reports: Upgrading from Commonsense to Science," *Journal of Consciousness Studies* 10.9-10 (2003), 141-156. Piccinini argues scientists can and should analyze introspective reports and provides a methodology based on public evidence and assumptions in assessing the validity of third-person accounts. Also see, Alvin Goldman, "Epistemology and the Evidential Status of Introspective Reports: Trust, Warrant, and Evidential Sources," *Journal of Consciousness Studies* 11.7-8 (2004), 1-16, for similar views. Ludwig Wittgenstein, in *Philosophical Investigations*, put forth a famous objection called the "beetle in the box" that argues the mind is treated as an entity, however that entity is unobservable and therefore any conclusions of commonality between minds is grounded on the belief in something we cannot be certain exists. Wittgenstein's beetle has been applied to a variety of philosophical investigations. See David G. Stem, "The Uses of Wittgenstein's Beetle: Philosophical Investigations [section] 293 and its Interpreters," in *Wittgenstein and His Interpreters: Essays in Memory of Gordon Baker*, edited by Guy Kahane, Edward Kanterian, and Oskari Kuusela (Oxford: Blackwell Publishing, 2007), 248-268.

agree, “the combination of the first-person method with the third-person method offers the promise of real advance in the scientific study of consciousness.”¹⁰²

Science and the Ethical Goals of Buddhism

Ethics is fundamental to Buddhist philosophy; anything with philosophical implications also has ethical implications.¹⁰³ Compassion, the primary ethic of Mahayana, is understood as built into the Four Noble Truths, where a wish to be free of suffering is extended to include all sentient beings. However, freedom from suffering cannot be bestowed, it is accomplished only by internalizing the truth. The goal of the Mahayana Buddhist practitioner then, is to first know and embody the truth oneself and then teach it to others.¹⁰⁴

Buddhism has established five fields of knowledge in regards to caring for others: medicine, technology, logic, the science of sound, and inner knowledge/spiritual practice.¹⁰⁵ In this ethical context, science becomes a mode of disseminating knowledge on appropriate practice, revealing the truth and efficacy of Buddhist teaching. One of the broader goals outlined in such organizations as the Mind and Life Institute is the collaboration between Buddhists and scientists in alleviating suffering and increasing the overall well being of humankind, illustrating

¹⁰² The Dalai Lama (2005), 142.

¹⁰³ Ethics is considered to be the basis of all other practice and the support for attaining wisdom and therefore, ethical conduct is primary. See Dalai Lama (1975), 45.

¹⁰⁴ Ibid., 46-47. Buddha said the only way beings can be free is through the truth of the nature of things. The Dalai Lama goes on to explain how the goal of the Buddhist is to spread the teachings, arguing people need to be taught what should be adopted and what should be discarded in practice.

¹⁰⁵ See Goleman (1997), 245.

the role of science as an ally in following the Buddhist ethic.¹⁰⁶ Science actually has little to no affect on Tibetan nationals' practice and belief, but this was never its intended role in Buddhism.¹⁰⁷ Rather, science is a teaching aid in the modern context and can be completely separate from the achievement of wisdom and the practice of the Buddhist tradition at large, even for modern Buddhists.¹⁰⁸

Just as with any philosophical topics within Buddhism, neuroplasticity is interpreted in part according to its ethical implications. Neuroplasticity has called into question what critics call neurogenetic determinism, the belief, propelled by modern genetics and pharmacology, that genes and chemical composition are the ultimate and inescapable determinants of behavior and mental health.¹⁰⁹ This view is not argued for exactly, rather it is implicit in medical research aimed at identifying genes that account for various pathologies and the pharmacological attempts to find medicinal cures for psychological and behavioral disorders. Determinism often produces a nihilistic attitude towards personal responsibility, as one cannot be accountable for his/her natural composition, making ethics irrelevant. However, neuroplasticity reveals the power of mind over matter, making individual moral responsibility relevant once again in the modern and scientific West. Sharon Begley,

¹⁰⁶ The Dalai Lama reiterates these goals at every Mind and Life conference.

¹⁰⁷ The Dalai Lama introduced scientific discourse as part of the monastic curriculum and today, more and more Buddhist students from monastic universities engage in some systematic study of science. Nonetheless, Tibetan nationals lack the same engagement with science that is occurring in the West. See Begley, 23 and 50.

¹⁰⁸ The Dalai Lama's repeated description of science as "ammo" for spreading the Dharma illustrates how science is used as a tool for grander Buddhist goals. For example, see Goleman (1997), 248, "You scientists are giving me more ammunition now!"

¹⁰⁹ *Ibid.*, 252.

Newsweek science writer and author of *Train Your Mind Change Your Brain*, following the proceedings of the twelfth Mind and Life conference, states, “Perhaps one of the most provocative implications of neuroplasticity and the power of mental training to alter the circuits of the brain is that it undermines neurogenetic determinism.”¹¹⁰ Rather than a deterministic scenario, this study has revealed a dynamic one, in terms of the nature of mind and body *and* ethical orientation. From the Buddhist perspective, neuroplasticity vindicates the role of ethics.

In the realm of philosophy, the relationship between Buddhism and Science becomes quite a bit more complex. Where fact ends and theory begins we see a different kind of relationship emerge between the two, not of ethical allies, but philosophical competitors, vying for interpretative superiority. The emergence of a Buddhist theory of neuroplasticity illustrates the creative tension between the two traditions. This process is not antagonistic, but constructive and reveals a lot about the relationship between Buddhism and Science and the potential for future growth.

Neuroplasticity is an area of study that has and continues to produce particularly meaningful exchange with Buddhism. The interpretation and analysis of neuroplasticity from the Buddhist perspective serves as a contribution to western philosophy of science, answering many open questions about the mind and the mind-body relationship. Furthermore, the Buddhist interpretation illustrates the wide applicability of Buddhist ideas to modern western ones; neuroplasticity is just one area of study within the realm of Buddhism and Science, yet the implications

¹¹⁰ *Ibid.*, 253.

and applications are numerous and of vital importance. What this study hopefully elucidates is the validity and value of continuing dialogue and including Buddhist philosophy in western philosophy of science discourse. I do not think it is an exaggeration to state the mind is *the* scientific question of the twenty-first century, yet contemporary western philosophy cannot adequately explain neuroplasticity and mind-body causality. Buddhism can. The nature of our being is change, harnessing that change becomes cultivation, and cultivation induces transformation. Imagine a world of mental fitness, nurturing the skills of happiness and compassion and decreasing suffering and hate, an era of limitless human potential.

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