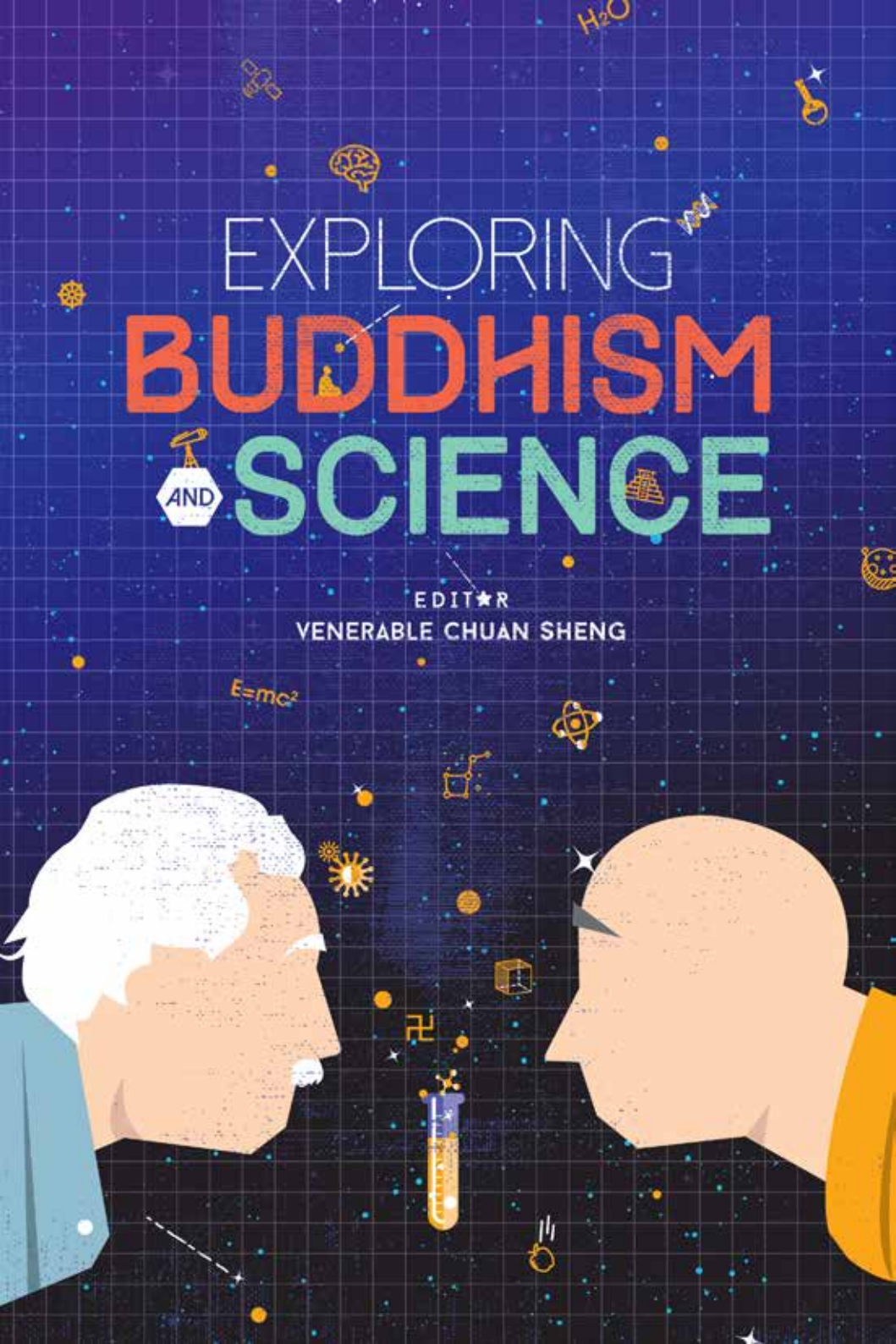
EXPLORING
BUDDHISM
AND
SCIENCE
EDITOR
VENERABLE CHUAN SHENG
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EXPLORING BUDDHISM AND SCIENCE

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May the merit accrued from this undertaking be dedicated to all beings. May all beings be well and happy. May all beings attain the bliss of Nirvāṇa.

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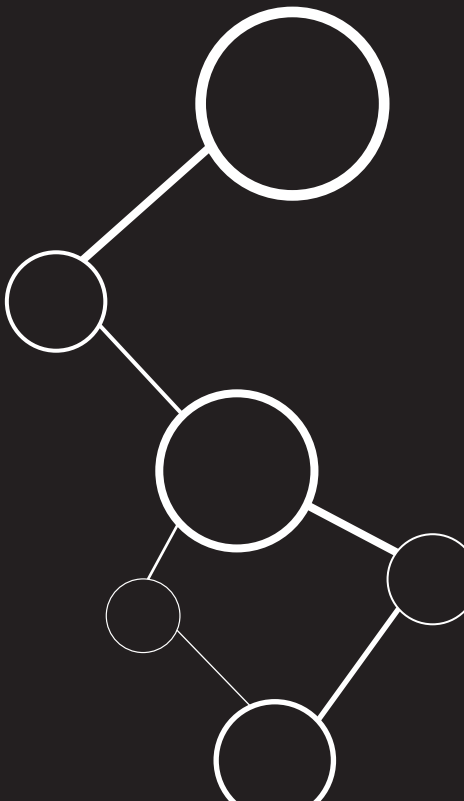

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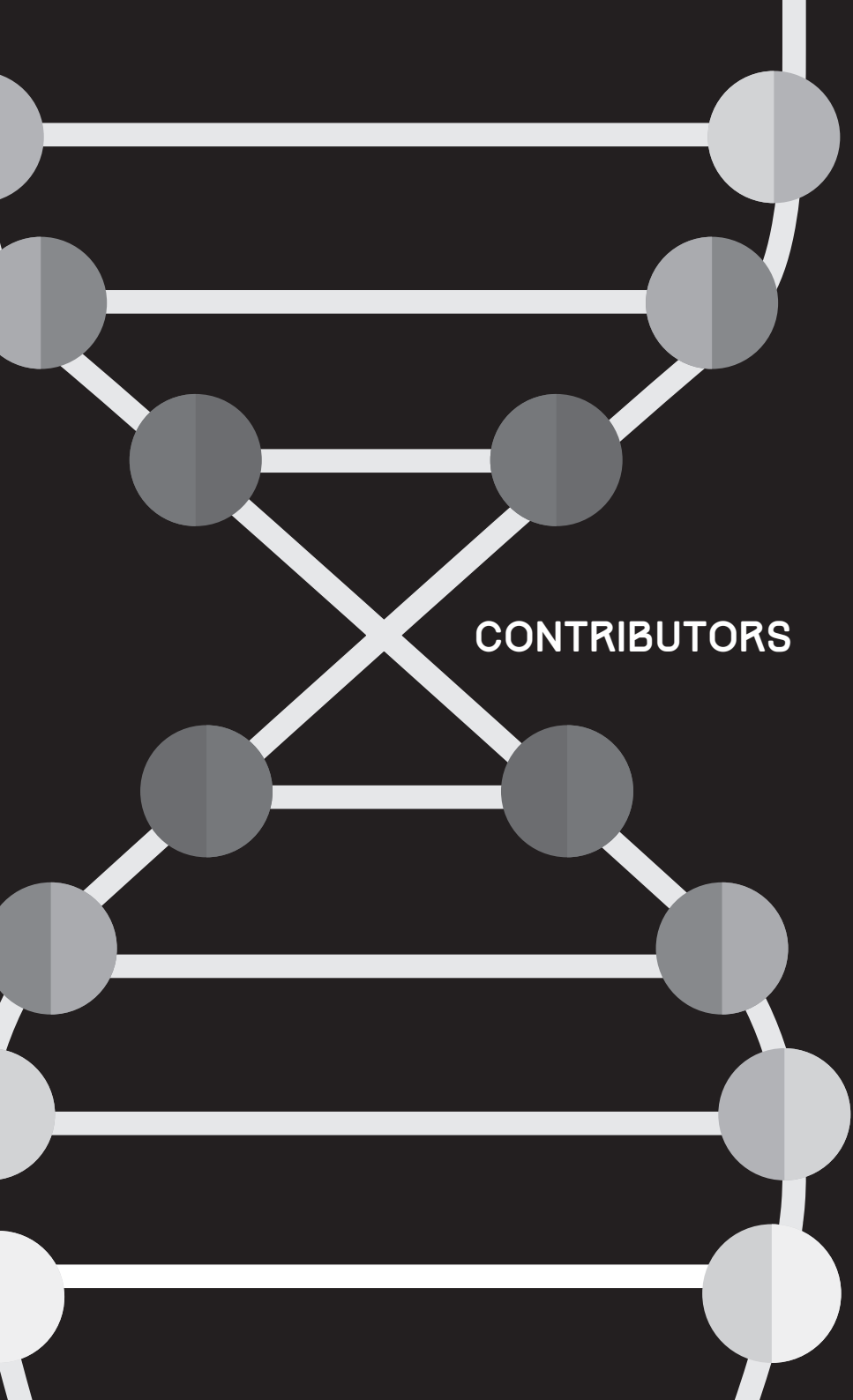

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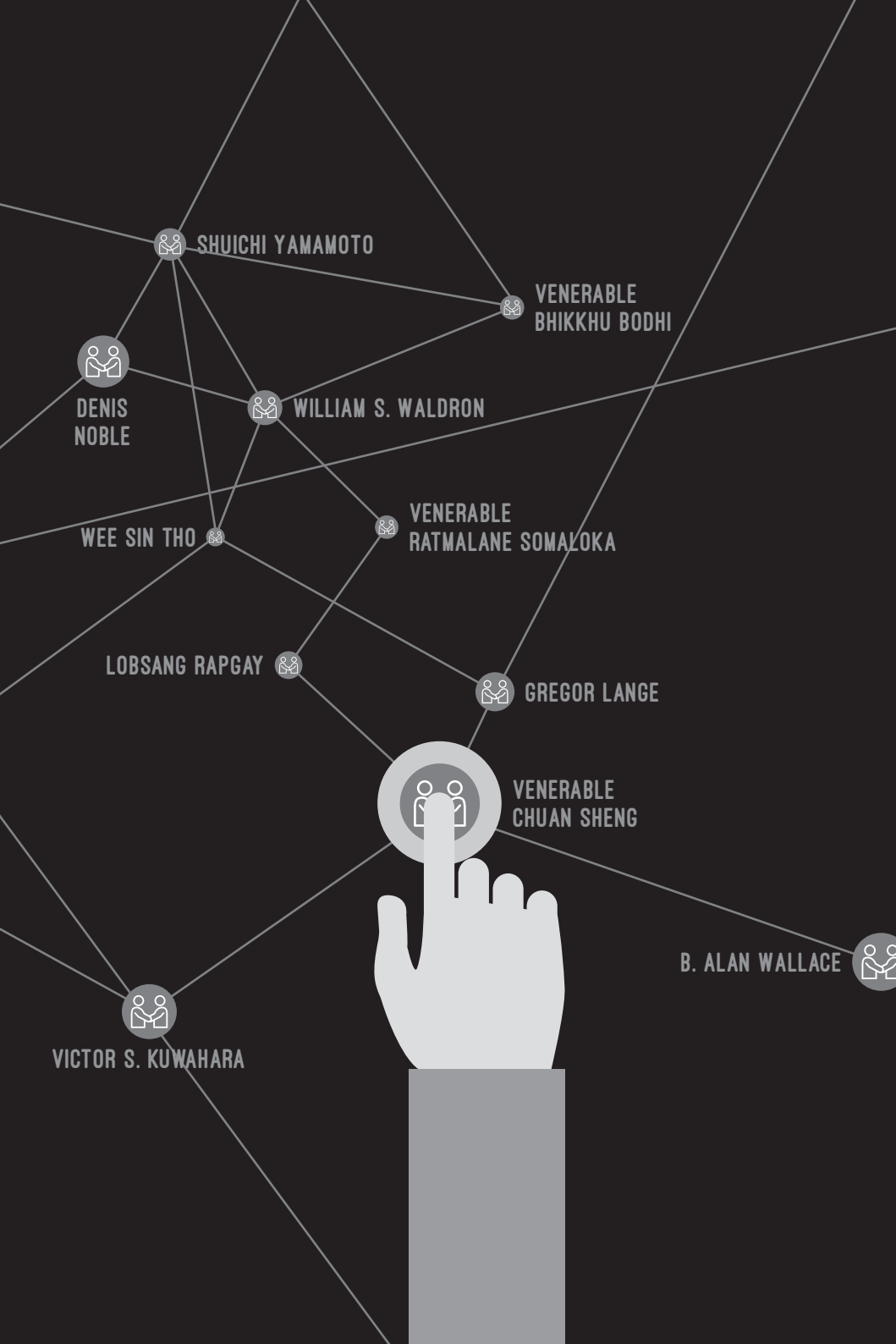
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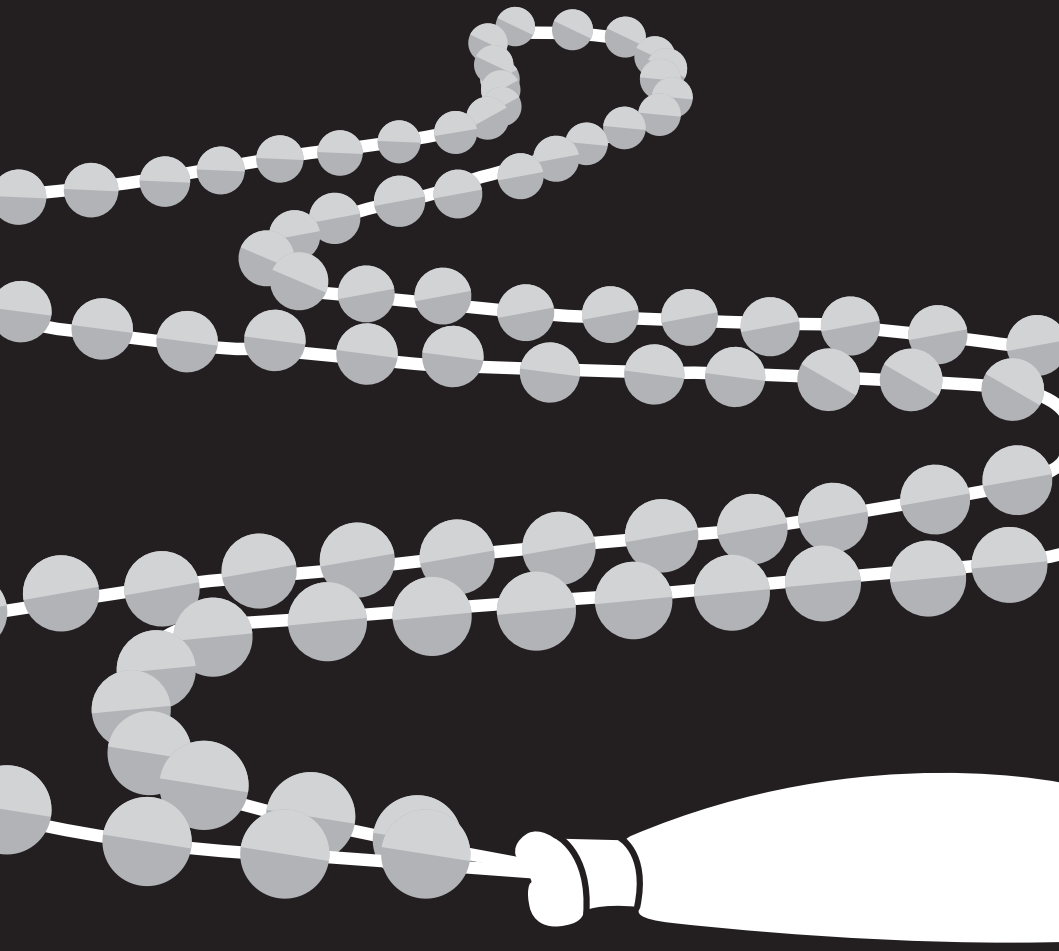

INTRODUCTION

From the Scientific Revolution to the "Mindful Revolution"

Venerable Chuan Sheng

> *In general, what is a gain to science is a loss to religion... But Buddhism benefits by the discoveries of science. The more science progresses, the clearer Buddhism becomes, for Buddhism explains the truth concerning the universe... Science helps us to understand Buddhism by offering suitable analogies.*
>
> ”

So commented Venerable Master Taixu 太虛 (1897-1947) in 1933 (cited in Pittman 2001, 167). A prominent Chinese Buddhist reformer whose legacy is seen in the practices of modern Chinese Buddhism today, Taixu regarded Buddhism as "the only religion which does not contradict science," and considered this as one of the three aspects that characterized his "Buddhism for human life" (*Rensheng Fojiao* 人生佛教) (Pittman 2001, 165, 169).

Taixu's view captured one facet of the so-called "compatible" relationship between Buddhism and science in the early twentieth century, a compatibility that emerged in the nineteenth century and seen to continue to present times. Throughout this period, Buddhism has been associated with such science as "the mechanistic universe, the theory of evolution, the theory of relativity, the Big Bang, ... the microscope, the telescope, the spectrometer, and now the

MRI...." (Lopez 2012, 14). From classical physics, quantum physics and cosmology to Darwinian and neo-Darwinian theories of evolution, recent discussion on the compatibility between Buddhism and science has moved on to focus on the various types of meditation, especially mindfulness meditation, and their relations to neuroscience and psychotherapy, so much so that the 3 February 2014 issue of *Time* magazine had "The Mindful Revolution" as its cover story. This chapter will explore the encounters of Buddhism and science from the Scientific Revolution to the "Mindful Revolution," beginning with a brief historical account, followed by an overview of how the encounters have been interpreted and categorized, to provide the context to introduce the essays of this book.

Exploring the Encounters between Buddhism and Science

The encounters between Buddhism and science could be traced to the sixteenth century, amid the politics and strife of Western imperialism and colonialism. Originating about 2,500 years ago, Buddhism had first spread from India to the rest of Asia, where it became a major religion in many countries in South Asia, East Asia, and Southeast Asia. Although references to Buddhism had also been made in the West in early times, its presence there had been insignificant. With the onset of the Age of Exploration and the Scientific Revolution from the sixteenth century onward, encounters between religion and science gradually developed. As Christian missionaries traveled around the world, they allied themselves with science and presented Christianity as the modern religion of advanced Western civilization, superior to other religions; Buddhism was deemed idolatrous, superstitious, ritualistic, pessimistic,

and nihilistic (Lopez 2012, 10-11, 16-17, 21-23; McMahan 2008, 94).

With the scientific mode of inquiry rising in prominence, empiricism and rationalism were increasingly emphasized in intellectual pursuits. Aided by the science of philology, Western orientalist scholars started mining Buddhist texts, in particular, the Pali Canon (Lopez 2012, 38-41). This, together with the prevailing "Victorian crisis of faith" that resulted from the dominance of scientific modes of thought, wariness toward heightened evangelism, and openness to religious pluralism, provided the contexts for the emerging discourse of "scientific Buddhism" (McMahan 2008, 89-113). From the 1860s Buddhism and science came to be seen as compatible, leading one intellectual, Paul Carus, in 1896, to portray the Buddha as "the first positivist, the first humanitarian, and the first prophet of the Religion of Science." Buddhist leaders from the late-nineteenth to early twentieth centuries took note, and stressed this compatibility in their anti-imperialist struggles and efforts to revitalize Buddhism (Lopez 2012, 7-11; Lopez 2008, 1-24).

The close association between Buddhism and science has continued since then, leading Lopez to term this phenomenon as the "Scientific Buddha," "a Buddha to whom all manner of scientific insights would be ascribed, from the mechanisms of the universe to the structure of the atom, from a natural law of morality to the deepest workings of the mind" (Lopez 2012, 41). The stress on Theravāda traditions in the late-nineteenth and early twentieth centuries expanded to encompass Mahāyāna discourses, especially Zen, in the latter half of the twentieth century, and Vajrayāna thought in recent decades due to the prominent role played by the Dalai Lama (Lopez

2008, 25-35). This close association is evident in the numerous books written on the subject throughout this period. They include works by scholars of different Buddhist traditions and scientific expertise, such as Wang Chi Biu (1946), Egerton C. Baptist (1955), K. N. Jayatilleke, Robert F. Spencer, and Wu Shu (1958), D. T. Suzuki, Erich Fromm, and Richard De Martino (1960), Fritjof Capra (1975), W. R. Kloetzli (1983), Buddhadasa P. Kirthisinghe (1984), P. A. Payutto (1995), B. Alan Wallace (1996), James H. Austin (1998), J. K. P. Ariyaratne (2001), the Dalai Lama (2005), Chi-Sing Lam (2008), Rick Hanson (2009), Phra Dharmakosajarn (2010), and Ratmalane Somaloka (2012).

B. Alan Wallace notes that such scholars as Thupten Jinpa and José Ignacio Cabezón have analyzed Buddhism-science encounters and categorized them in three main ways. First, Jinpa's notion of "rival philosophy" and Cabezón's concept of "conflict/ambivalence" stress the perception of science as a field of knowledge that differs fundamentally from Buddhism. Such a view corresponds to scholars who see religion and science as "autonomous (nonoverlapping magisteria)" realms of knowledge that hold little promise for mutual conversations; Wallace highlights that post-modernist scholars have likewise considered Buddhism and science to be "fundamentally incomparable" since they interpret these two disciplines to be "culturally specific" (Wallace 2003, 1-4, 20-25, 69; Jinpa 2003, 79-80; Cabezón 2003, 41-43).

Second, in Jinpa's characterization of "ally philosophy" and Cabezón's categorization of "compatibility/identity," Buddhism and science are seen to have important similarities, leading advocates to cite scientific data to buttress Buddhism, claim that Buddhism and science are identical, or see Buddhism as

a higher form of knowledge (Wallace 2003, 69; Jinpa 2003, 80; Cabezón 2003, 43-48).

Third, in Jinpa's interpretation of "equal partner" and Cabezón's understanding of "complementarity," a constructive engagement of Buddhism and science that can expand the frontiers of human knowledge is emphasized; here, the similarities and differences in methodologies and concerns of the two disciplines are seen to be mutually enriching. For instance, Cabezón sees Buddhism and science as "complete systems that resist dichotomizing: systems that can both support and challenge each other at a variety of different levels...." For Jinpa, Buddhism is an appropriate partner of science because of "[Buddhism's] suspicion of any absolutes, its insistence on belief based on understanding, its empiricist philosophical orientation, its minute analysis of the nature of mind and its various modalities, and its overwhelming emphasis on knowledge gained through personal experience." Wallace considers the Buddhism-science discourse a worthwhile "cross-cultural and interdisciplinary pursuit of understanding" since it can "shed a fresh light on our own subjectivity, our own language, and our own categories, for example, of religion, science, and philosophy" (Wallace 2003, 27, 69-70; Jinpa 2003, 81-83; Cabezón 2003, 49-61).

The essays in this volume hope to further this cross-cultural and interdisciplinary pursuit of understanding. Ranging from short reflective pieces to longer works with detailed documentation, they include published work as well as work written or revised for this publication. Reflecting views that correspond to the compatibility and complementarity categories, the essays provide thoughtful insights on relationships between Buddhism and science in the fields

of neuroscience and psychotherapy, and the physical and biological sciences.

Following this essay in the Introduction section, Venerable Bhikkhu Bodhi, in "Two Paths to Knowledge," highlights the main similarities and differences in the aims and orientations of the Buddhist and scientific pursuits. William S. Waldron then suggests in "An End-run 'round Entities" how scientific analogies can be applied in teaching core Buddhist ideas, using terms like river, tree, frog, and human, to explain such concepts as dependent arising and non-self.

The six essays in Part 1 explore the relationships between Buddhism and neuroscience and psychotherapy. In "Grow More Brain," Piya Tan presents evidence from neuroscience to highlight the health benefits of three types of Buddhist meditation: focused-attention, mindfulness or open-monitoring, and the cultivation of loving-kindness. Rick Hanson follows up with "Mind Changing Brain Changing Mind: The Dharma and Neuroscience," covering such topics as how the mind and brain co-arise co-dependently, the intricate workings of the brain, how meditation benefits brain and body, the brain in relation to dependent origination and equanimity, and why the self is like a unicorn.

The next four essays examine the various dimensions of Buddhism and psychotherapy, beginning with Gregor Lange's overview of the multitude of mindfulness-based interventions, such as Mindfulness-Based Stress Reduction (MBSR), Dialectical Behavior Therapy (DBT), Mindfulness-Based Cognitive Therapy (MBCT), Acceptance and Commitment Therapy (ACT), Mindfulness-Based Relapse Prevention (MBRP), Mindfulness-Based Eating Awareness Training (MB-EAT),

Mindfulness-Based Childbirth and Parenting (MBCP), and Mindfulness-Based Mind Fitness Training (MMFT). Venerable Ratmalane Somaloka then compares such mindfulness psychotherapy with the main tenets of Buddhist psychology and psychotherapy, including mental disorders, awareness of mind and matter (*nāma-rūpa*), the mechanism of mindfulness, and compassion as the therapeutic element in mindfulness.

Specific case studies follow: Lobsang Rapgay evaluates how effective MBSR has been in treating anxiety disorders, and how MBSR can be integrated with the practice of the Four Foundations of Mindfulness; Piya Tan explains how the key concepts of ACT can enhance understanding of Buddhist psychology, counselling and meditation, and he stresses the mutually beneficial relationship between Buddhism and modern psychology. Adding a much-welcomed "taste" of "practice" to the discussion on mindfulness, Wee Sin Tho, in the Appendix, introduces such mindfulness techniques as body scan, breath sensations, and recalling an emotional episode to show how mindfulness practice can be applied in daily life.

In the final essay of Part I, David Paul Boaz Dechen Wangdu reviews the mind-body problem that has captivated cognitive scientists, neuroscientists, and philosophers of mind. He argues that "[w]e need hard neuroscience to explicate the hardware of brain, and a soft, contemplative science of consciousness to penetrate the software of mind," and he sees in the emerging new science of consciousness, an "urgent juncture in the integration, then unification of Science and Spirit, and the emergence of a truly integral noetic science of mind, nature, ethics and spirituality."

The relationships between Buddhism and the physical and biological sciences is the theme of the six essays in Part 2. In his two essays, Ankua Barua examines developments in modern physics, especially the theories of Einstein, in relation to Theravāda Buddhist interpretations of the physical world: the first essay compares Einstein's quantum theory, notion of escape velocity and black holes and views on energy for expanding universe, with the Buddhist concepts of matter, dynamic flux, and double truth drawn from the Abhidhamma; the second essay analyzes dependent origination, relativity and modern cosmology using a psychological concept of time, the "Śūnyatā" or "Emptiness" view of space, and the notion of the co-existence of multiple solar systems. Shuichi Yamamoto and Victor Kuwahara then expand on such key issues as the inflationary Big Bang theory, steady-state cosmology, problems of modern cosmology, cosmological and anthropic principles, and Buddhist cosmology based on a text widely used in Mahāyāna Buddhism, Vasubandhu's *Abhidharmakośa-bhāṣya*.

In his two essays, B. Alan Wallace adds to the discourse by exploring similar topics, but from the perspectives of "energy dynamics" and "vacuum states of space and consciousness," making reference to the teachings of Vajrayāna Buddhism, and highlighting that, "Like focusing two eyes on the same reality, the integration of Buddhism and western science may discover a deeper vision than either tradition has achieved on its own." Agreeing with Wallace, Boaz highlights "varieties of Buddhist experience and quantum emptiness" — materialism / realism / essentialism, objective idealism, and centrist Middle Way — and advocates "noetic contemplative research methodologies that utilize both quantitative objective third person data sets, and the qualitative, though still objective data sets of

personal, subjective, introspective, even contemplative first person reports."

This section closes with Denis Noble's essay that discusses the relationship between Buddhism and the biological sciences from a "systems biological interpretation of the concept of No-Self (*anātman*)": it emphasizes "processes" instead of "molecular biological components," organisms to be seen as "variable open systems" instead of "determinate closed systems," and elucidates "the relation between the microscopic and macroscopic views of the world."

The Conclusion section begins with Waldron's essay on how Buddhism can fruitfully engage with the sciences, using the examples of causality and non-essentialism, and self-identity and suffering, to demonstrate its ongoing relevance in the fast-changing developments of the modern world. In "Better Than A Hundred Years," Venerable Bhikkhu Bodhi shares his thoughts on the kind of world that may take shape in a century from now, including the possible roles played by Buddhism and science and technology, and stresses the need for a "dimension of transcendence." Venerable Chuan Sheng closes this section and the book by recapitulating the main themes of the essays and presenting some recent scientific advances that have a bearing on Buddhism.

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Two Paths to Knowledge[1]

Venerable Bhikkhu Bodhi

Many of the formidable social and cultural problems we face today are rooted in the sharp schism that has divided Western civilization between science and religion, where science claims invincible knowledge based on the empirical investigation of the natural world, while religion can do little more than call for faith in supernatural creeds and obedience to codes of ethics that require restraint, self-discipline, and self-sacrifice. Since religion, as traditionally understood, often rests on little more than blithe promises and pompous threats, its appeals to our allegiance seldom win assent, while the ethical ideals it advocates stand hardly a fighting chance against the constant injunction — thrust upon us by TV, radio, and signboard — to enjoy life to the hilt while we can. As a result, a vast portion

[1] This essay was published in Buddhist Publication Society (BPS) Newsletter cover essay no. 42 (2nd mailing, 1999); it was last revised on 16 June 2011 for *Access to Insight (Legacy Edition)*, 16 June 2011, http://www.accesstoinsight.org/lib/authors/bodhi/bps-essay_42.html . We thank BPS for granting permission to reproduce it.

of humankind today has become alienated from religion as a meaningful guide to life, left with no alternative but to plunge headlong into the secular religion of consumerism and hedonism. Too often, those in the religious camp, sensing the threat secularism poses to their own security, feel driven toward an aggressive fundamentalism in a desperate bid to salvage traditional loyalties.

The quest to establish a sound basis for conduct in today's world has been made particularly difficult because one consequence of the dominance of the scientific worldview has been the banishment of values from the domain of the real. While many scientists, in their personal lives, are staunch advocates of such ideals as world peace, political justice, and greater economic equality, the worldview promulgated by modern science grants to values no objective grounding in the grand scheme of things. From this perspective, their root and basis is purely subjective, and thus they bring along all the qualities the notion of subjectivity suggests: being personal, private, relative, even arbitrary. The overall effect of this scission, despite the best intentions of many responsible scientists, has been to give a green light to lifestyles founded on the quest for personal gratification and a power drive aimed at the exploitation of others.

In contrast to the classical Western antithesis of religion and science, Buddhism shares with science a common commitment to uncover the truth about the world. Both Buddhism and science draw a sharp distinction between the way things appear, and the way they really are, and both offer to open our minds to insights into the real nature of things normally hidden from us by false ideas based on sense perception and "common sense." Nevertheless, despite this affinity, it is also necessary to recognize the great differences

in aim and orientation that separate Buddhism and science. While both may share certain conceptions about the nature of reality, science is essentially a project designed to provide us with objective, factual knowledge, with information pertaining to the public domain, while Buddhism is a spiritual path intended to promote inner transformation and the realization of the highest good, called enlightenment, liberation, or Nibbāna. In Buddhism, the quest for knowledge is important not as an end in itself, but because the main cause of our bondage and suffering is ignorance, not understanding things as they really are, and thus the antidote needed to heal ourselves is knowledge or insight.

Again, the knowledge to be acquired by the practice of Dhamma differs significantly from that sought by science in several major respects. Most importantly, the knowledge sought is not simply the acquisition of objective information about the constitution and operations of the physical world, but a deep personal insight into the real nature of one's personal existence. The aim is not to understand reality from the outside, but from the inside, from the perspective of one's own, living experience. One seeks not factual knowledge, but insight or wisdom, a personal knowledge, inescapably subjective, whose whole value lies in its transformative impact on one's life. Concern with the outer world, as an object of knowledge, arises only insofar as the outer world is inextricably implicated in experience. As the Buddha says: “It is in this body, with its perception and thought, that I declare is the world, the origin of the world, the cessation of the world, and the way to the cessation of the world.”

Because Buddhism takes personal experience as its starting point, without aiming to use experience as a springboard to an impersonal, objective type of knowledge, it includes

within its domain the entire spectrum of qualities disclosed by personal experience. This means that Buddhism gives prime consideration to values. But even more, values for Buddhism are not merely projections of subjective judgments which we fashion according to our personal whims, social needs, or cultural conditioning; to the contrary, they are written into the texture of reality just as firmly as the laws of motion and thermodynamics. Hence, values can be evaluated: rated in terms of truth and falsity, ranked as valid and invalid, and part of our task in giving meaning to our lives is to unearth the true scheme of values. To determine the true gradation of values, we must turn our attention inward and use subjective criteria of investigation; but what we find, far from being private or arbitrary, is an integral part of the objective order, permeated by the same lawfulness as that which governs the movement of the planets and the stars.

Affirmation of the objective reality of value implies another major distinction between Buddhism and science. In order for the liberating knowledge of enlightenment to arise, the investigator must undergo a profound personal transformation guided by inner perception of the genuine values. While natural science can be undertaken as a purely intellectual discipline, the Buddhist quest in its entirety is an *existential* discipline which can only be implemented by regulating one's conduct, purifying one's mind, and refining one's capacity for attention to one's own bodily and mental processes. This training requires compliance with ethics all the way through, and thus ethical guidelines support and pervade the entire training from its starting point in right action to its culmination in the highest liberation of the mind.

What is especially noteworthy is that the ethical thrust of the Buddhist training and its cognitive thrust converge on

the same point, the realization of the truth of selflessness (anattā). It is just here that contemporary science approaches Buddhism in its discovery of the process nature of actuality, implying the lack of an ultimate substance concealed behind the sequence of events. But this correspondence again points to a fundamental difference. In Buddhism the impermanent and substanceless nature of reality is not simply a factual truth apprehended by objective knowledge. It is above all an existential truth, a transformative principle offering the key to right understanding and right liberation. To use this key to open the door to spiritual freedom, its sole purpose, we must govern our conduct on the premise that the idea of a substantial self is a delusion. It is insufficient merely to give intellectual assent to the idea of selflessness and turn it into a plaything of thought. The principle must be penetrated by training ourselves to discover the absence of selfhood in its subtlest hiding place, the deep recesses of our own minds.

It is to be hoped that Buddhist thinkers and open-minded scientists, by sharing their insights and reflections, can show us an effective way to heal the rift between objective knowledge and spiritual wisdom and thus bring about a reconciliation between science and spirituality. In this way spiritual practice will become an integral part of the discipline aimed at knowledge, and spiritual practice and knowledge in combination will become the tools for achieving the highest good, enlightenment and spiritual freedom. This has always been the position of Buddhism, as evidenced by the most ancient texts themselves. We must remember that the Buddha, the Enlightened One, is not only, like the scientist, a *lokavidū*, "a knower of the world" but also, above all, a *vijjācaraṇasampanno*, "one complete in both knowledge and conduct."

An End-run 'round Entities: Using Scientific Analogies to Teach Basic Buddhist Concepts[1]

William S. Waldron

Students bring with them to the classroom assorted sets of assumptions, however implicit or inchoate they may be, about the world, about causal relations, about personal identity, linguistic reference, and so on. Since so many aspects of the early Buddhist view radically differ from commonly held assumptions, students are often perplexed in their initial encounter with Buddhist thought. This reaction is exacerbated, I think, by the standard presentation of the Buddhist catechism with its time-honored stock formulas — the Four Noble Truths and the Three Marks, etc. I have therefore tried to introduce key Buddhist perspectives without using Buddhist jargon. Instead, I have found it expedient to initially present Buddhist concepts in terms of current scientific explanations

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[1] This essay was published in V. S. Hori, R. P. Hayes, J. M. Shields (eds.), *Teaching Buddhism in the West: From the Wheel to the Web* (RoutledgeCurzon, 2002), pp. 84-91. We thank the publisher for granting permission to reproduce it.

rather than in those inherited by, for example, traditional Western religion or philosophy. This paper will outline the purpose of using scientific analogies to present basic Buddhist concepts and briefly describe some practical procedures.

Purpose

Because so many of our persisting modes of thinking and expression are derived from substantialist Greek philosophy or from theistic religion, it is often difficult to extricate ourselves from terms of substance, essence, souls, and identity, and to find skillful ways to express the Buddhist worldview. There is a disjunction between the aims and assumptions of the Buddhist worldview and the means of expression most readily available to present and explain that worldview. In other words, our working vocabulary for discussing religion and philosophy is so imbued with substantialist assumptions that the vocabulary itself obstructs rather than edifies the very worldview we are attempting to explain. Hence, if we are to adequately convey the radically different perspective provided by the Buddhist worldview, we need a different vocabulary, a different set of categories based upon a different set of assumptions.

Fortunately, such terms, categories and assumptions are already available in some of the overlapping worldviews comprising our modern age, particularly in the general principles of various scientific disciplines. It is possible to exploit these pre-existing scientific notions of interdependent causality, drawn from a variety of fields and used in a variety of applications, as an effective means of breaking down the a priori assumptions students typically bring with them regarding the reality of entities, essences and active agents—

the very assumptions that typically prevent students from understanding the Buddhist notions of interdependence and selflessness. Scientific analogies therefore provide explanations, a working vocabulary and a useful set of categories, that are more commensurate with the Buddhist worldview than those derived from cultural traditions which are so irrevocably at odds with that worldview. By providing a bridge to Buddhist concepts that is based upon familiar conceptual frameworks and is couched in commonly understood terms and categories, scientific analogies can provide an "endrun" around the entities and essences assumed in traditional Western worldviews. (Needless to say, this process neither attempts any comprehensive comparison of Buddhist and scientific worldviews, nor aims to accrue the credibility of one field onto another; it is used strictly heuristically.)

Practice

Although quantum physics may be the most obvious area for analogies with Buddhist thinking — with the wave/particle nature analogized to the non-duality of Emptiness and Form perhaps the most famous — nevertheless, I think the Indian Buddhist worldview is much better served by analogies derived from biology, as the vegetative metaphors and similes used in Buddhist texts would readily suggest: trunks and roots, seeds, fields and fruits, etc. Hence, I have found it useful to initially engage in modes of inquiry that draw upon students' (my students at least) pervasive concern with environmentalism and basic understanding of biology, evolution and ecology.

Because my purpose is to use general scientific principles primarily as heuristic devices rather than to suggest

potentially specious point-by-point analogues, I use a Socratic method of bringing out certain foreseeable conclusions through classroom participation. I begin by inquiring into the constitutive conditions of an inanimate object, usually a river, and then proceed with the same deconstructive method to animate objects, a tree, a frog and finally, to humans (severely straining the forbearance of those for whom this is their first chance to develop *anutpattika-dharma-kṣanti*)

Dependent Arising

I ask the students to describe as the constitutive conditions of a river: how it came to be, how it persists, and what exactly the term "river" refers to. Students generally enjoy demonstrating their environmental and ecological literacy (as, I suppose, do I) and we hastily make headway toward a variety of "Buddhistic" conclusions:

- That because the term "river" refers to the continuous flow of water bound by the river bed and riverbanks, and fed by tributaries that were themselves fed by rainfall that was in turn produced by evaporation from the oceans into which the rivers themselves ultimately fed (i.e. the widely understood "water cycle,") we readily reach the classic Buddhist position that the term "river" is merely a useful designation for a selected part of a complex set of processes that come about through a long history of interaction and that persist only as long as the conditions that enable it also persist (with the important corollary that the processes that brought about the river were themselves products of complex conditions).

- That because it was the flow of the water itself through gravity and friction (i.e. erosion) that initially carved out the river bed that thereafter directed the subsequent flow of water, which in turn carved out a deeper bed, and so on, it is easily understood that the river current and the river bed mutually shaped and influenced each other, building upon the formations carved out by their own previous interaction; that structures or patterns arise through a history of interaction of distinct yet inseparable processes is clearly and almost viscerally understood.

- That because our understanding of the persisting interaction of gravity, friction, the water cycle, etc. is sufficient to account for the origins of the river, without reference to any controlling or directing force external to the relations between these nor inherent within any single factor among them, we readily come to the conclusion that it is nonsensical (given a naturalistic frame of reference) to ask the question: "Who made the river?" This point is so obvious, students usually laugh when I ask it.

It takes but a few minutes to extend this line of questioning to plant life, using a tree as an example. This complicates the process considerably of course, because of the necessary antecedent condition of seeds, the metabolic processes of organic growth and development, the complex chemical processes of photosynthesis, etc. This line of inquiry necessarily engages evolution as well. But the complexity here strengthens rather than weakens the aforementioned conclusions, especially the point that the patterns of natural

phenomenon come about without any external or internal agent or force. So we have now painlessly reached, through biology alone, three strong points indispensable to the Buddhist worldview, all without referring to anything outside of the student's previous range of knowledge:

1. That complex processes come about through long histories of interaction and persist only as long as the conditions that enable them also persist.

2. That interaction and mutually reinforcing feedback mechanisms create and build upon structures that fabricated by their own previous interaction; more on this later.

3. That natural phenomenon come about without any external creator, nor by means of any internal agent or force. Who *makes* the cells photosynthesize? Who *makes* cells reproduce, absorb and process nutriments, etc.? In fact, who *grows* the tree? Does it *grow* itself, as an active agent? If so, which exact part of it grows itself?

Their now pleasantly puzzled faces indicates they find these questions predictably absurd and silly. They have reached that quintessentially Buddhist sentiment expressed in the *Zenrin kushū*: "the grass grows by itself."

This exercise skillfully sidesteps the implicit and widespread assumption that entities are fixed "things" somehow isolated from their surrounding environment, knowable without reference to their own developmental histories, and singular or unitary despite any internal differentiation. By simply avoiding

such assumptions, scientific analogies are actually *more* useful than traditional (i.e. cultural) language in conveying the sense of many Buddhist concepts — for the very reason that they break down, rather than reinforce, the sense of the world as comprised of isolated entities bumping up against each other in billiard ball Newtonian universes. That "things" arise conditioned by their systemic relations with a complex of other factors is an underlying assumption of virtually every modern scientific discipline, and the students implicitly know this. We, the students, are already firmly in the groundless realm of dependent arising.

Designation

The concept of "designation" was also alluded to in the above passages, for in the analysis of a river or tree students readily understood that these terms focused on only certain parts of a much larger complex of related processes, a focus that is somewhat arbitrary depending upon one's interests. A tree can be but an insignificant part of a forest to an ecologist, a total environment to an entomologist, a natural resource to a businessman, or a source of inspiration to a mystic or poet.

This point then can be extrapolated from the designation of objects to a critique of theoretical discourses by asking a simple question. Which discipline is the really correct way of understanding human life: anthropology, psychology, sociology, biology, religion, etc.? This will be greeted with a laugh and a shrug, so commonsensical is the Mahāyāna idea of conventional truth, that technical discourses as skillful means designed to meet specific, contingent needs. The acknowledgment that each field has its own models that might not map into one another undermines claims to an exclusively

valid discourse and hence relativizes discursive thinking altogether, a point that Nāgārjuna would find congenial, I think. How one cuts up the pie, then, is determined by a collective agreement based upon the specific pragmatic purposes it is designed to serve, not by some incorrigible correspondence with Reality. Again, I have found the scientific analogies for this critique linguistic reference far more accessible to students than similar formulations found in traditional Western thinking. At the very least, they serve as an efficient way to prime them for deeper reflections.

Non-self

We are all familiar with the difference between technical scientific discourses and the well-nigh necessity of speaking colloquially in terms of entities, essences, egos and agency. We anthropomorphize weather and so-called "computer memory"; we use allegories, similes, synecdoches, to express complex patterns of interaction that are otherwise difficult to grasp. There is thus a radical disjunction between most scientific explanations based on complex multicausality and our everyday language which either refers to or implies the existences of entities and agents. This disjunction is brought out most clearly by extending the kind of deconstructive analysis previously applied to rivers and trees even closer to home — to us.

Extrapolating from the analysis of trees and their seeds, we now analyze how animals with rudimentary nervous systems, like frogs, came to be and to "do." Like the river and the tree, animals are also the result of countless transformations that were, in each and every step, built upon structures already created by their own previous developmental history. The

mutually reinforcing feedback mechanisms called evolution (again, assuming a naturalistic worldview) operates without any external creator nor internal, directing force. Once again we ask, who *grew* the frog? Does it actively *grow* itself? These questions are similarly ill-formed.

Even the frog's behavior, such as abruptly capturing a fly with its sticky tongue, can also be understood as a natural and "automatic" functioning of its primitive nervous system, whose structures and capacities came about through complex evolutionary developments, and which operates, like the metabolic processes of photosynthesis, without the need for any central controlling agent. Who, after all, *makes* the neuron respond the way that it does? If the chemical processes in plants operate "by themselves," then so do neurons in the nervous systems, which engage only the stimuli they have evolved to engage. There is no need to impute higher cortical functions of conscious intention to each and every cell, nor, perhaps, to anything at this stage of life. Like the river, the tree, and its individual neurons, can't the frog's simple activities also be thought to "just happen"? Assenting students have unwittingly crossed a conceptual Rubicon.

We are now but a short step from some cold, slimy frog, whose nervous system "functions by itself" without any central controlling agency, to our warm cuddly neonate whose potentially complex nervous system is still too undeveloped to speak unequivocally of agency or intention: when a baby is hungry it cries, when it is happy it coos. The language of agency, identity or intentionality is still premature. In the growth and maturation from the neonate to an adult, however, a personality, a personal identity, is forged through the complex and countless interactions between nervous system,

environment, experience, memory, etc. But we must analyze the construction of personality in the same fashion as before. Who made the personality? Who is in charge of its growth? Who, in short, made us who we are?

Propelled by the inertia of the previous analyses of the river, the tree and the frog, we are forced to conclude that the personality is the end result of the development of neural and cognitive structures created through previous actions and experience, an endless interaction between one's internal, physical and social worlds, all of which came about without an external or internal controlling agent. So *who* experiences moment to moment? *Who* desires, gets hungry, passes water, etc.? Like the Zen grass, like the river, the tree, the frog's nervous system, whatever we "are" came about, matured and continues to operate "by itself."

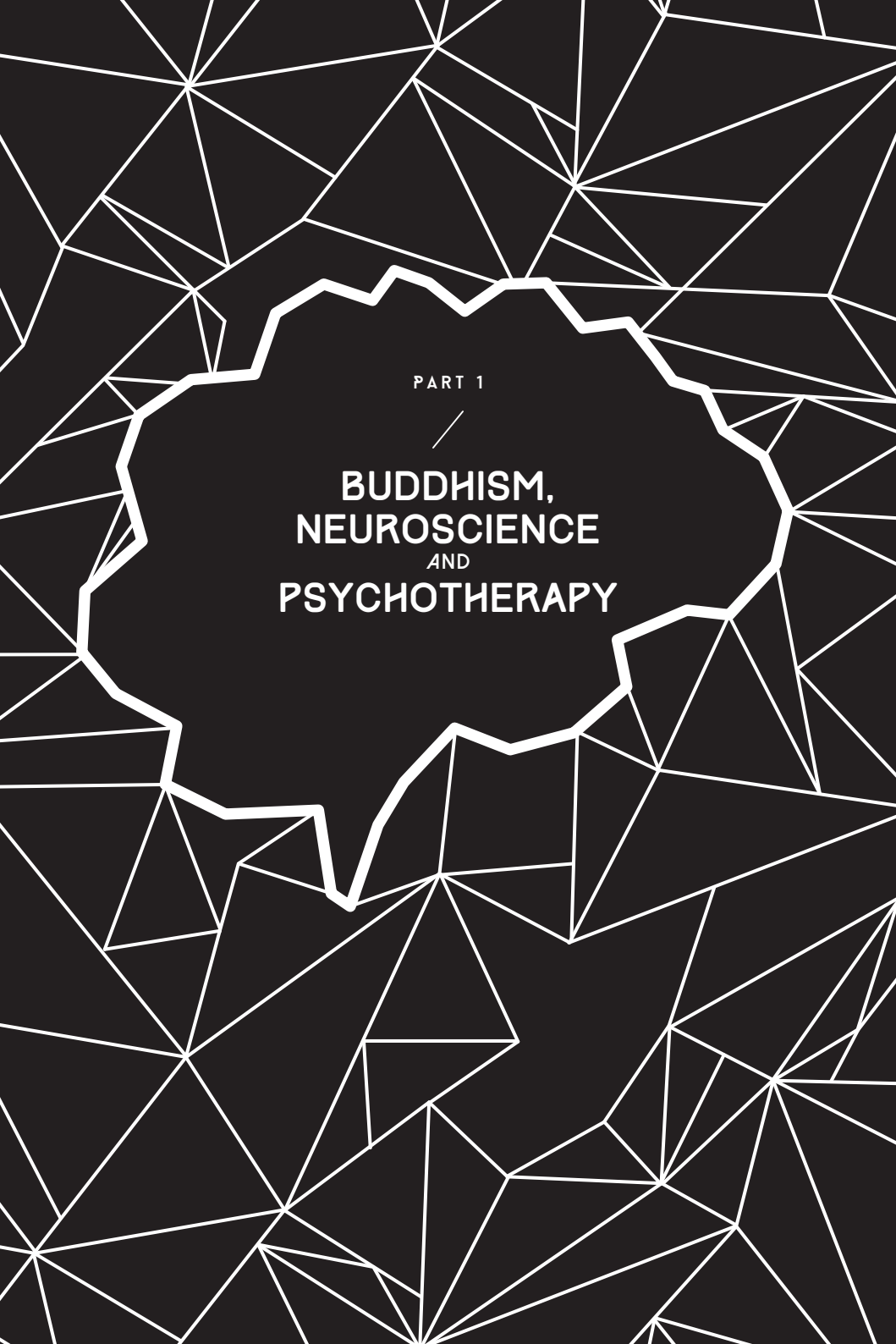
We have no *explanatory* need for an internal director in charge of it all, a hidden puppetmaster pulling all the strings, in order to account for either the genesis of personality or the moment-to-moment processes of body and mind. A naturalistic account of who we are requires no real "we" behind it all, only a conventional designation. Whatever the sense of self may be or refer to, it clearly seems added on to the basic metabolic and cognitive processes of human life, and its adventitious nature is painfully but inescapably demonstrated.

Students' smiles have given way to gasps of inchoate objections as they viscerally register the implications of this basic Buddhist perspective. We know that they have come to understand the concept of attachment to self by that fact that they react to this last round of deconstructive analysis — demonstrating the basic Buddhist idea of non-self — not with

the élan and elation elicited at the outset but with despair and deflation of the denouement at the end, a typical response to a cogent presentation of non-self.

Once contextualized in this fashion, the presumed primacy of narrative agents, of beings in charge of their own story, is irredeemably challenged; it loses its status as self-evident or revealed truth. Narrative agents may now be seen as a kind of myth-making, with no myth claiming as strong a hold on our imagination as that of a self within, our homunculus watching the movie at home. Some judicious reference to the congruent conclusions of cognitive scientists at this point may stir the pot even more.

This short exercise in scientific analysis and analogy has altogether bypassed the detours of essentialist and substantialist thinking and taken students to the threshold of Buddhist thought. Where you go from there is up to you.



PART 1

BUDDHISM, NEUROSCIENCE AND PSYCHOTHERAPY

Grow More Brain[1]

Piya Tan

Proven benefits of meditation

Over the last two decades, scientific researchers from various universities have noted how meditation brings about structural changes in brain tissue. An important discovery they made is that, those experienced in Buddhist meditation had more brain tissue in the prefrontal cortex. These regions play a role in processing attention, sensory information and internal bodily sensations. Newer studies further confirm these vital discoveries.[2]

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[1] This essay was published in R373 Revisioning Buddhism 107 [an occasional re-look at the Buddha's Example and Teachings], http://dharmafarer.org . Copyright by Piya Tan ©2014. This reflection is inspired by M Ricard, A Lutz & R J Davidson, "Mind of the meditator," *Scientific American*, November 2014: http://www.investigatinghealthyminds.org/ScientificPublications/2014/RicardMindSciAm.pdf.

[2] Sara W Lazar, Catherine E Kerr & Bruce Fischl, "Meditation experience is associated with increased crotical thickness," *Neuroreport* 16,17. 28 Nov 2006:1893-1897, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1361002/.

One of the great benefits of meditation, neuroscientists are discovering, is that the adult brain can still be deeply transformed through experience. Whenever we learn something new, like playing a musical instrument or learning a new language, the brain changes through a process called neuroplasticity.[3] That part of the brain controlling our finger movements or remembering words grows progressively larger with the mastery of the instrument or language.

A similar process happens with meditation. Although nothing may change in the world outside, the meditator works with an inner enrichment that improves his mind and the brain's structure. Scientific researches repeatedly show how meditation can rewire brain circuits to produce benefits not just on the brain and the mind, but on the entire body.

What is meditation?

Meditation has roots in the contemplative practices of nearly every major religion, the most ancient and best known of which is Indian Buddhism. Essentially, Buddhist meditation refers to the cultivation of basic human qualities, such as a more stable and clear mind, emotional balance, a sense of caring mindfulness, even love and compassion. All this contribute to a more serene, flexible, even creative, being.

In practice, meditation is quite simple and can be done anywhere. No special tool or dress is needed. We begin by sitting comfortably, with a desire for self-betterment, for others' well-being and the alleviation of their difficulties.

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[3] A simple explanation by Sentis: http://www.youtube.com/watch?v=ELpfYCZa87g. E Chudler, "Brain plasticity: What is it? Learning and memory," 2013: https://faculty.washington.edu/chudler/plast.html.

In due time, we must stabilize the mind, which is too often disorderly and tugged in all directions by a stream of inner chatter. Mastering the mind requires us to free it from automatic reactivity, mental conditioning and inner confusion.

Three well-known meditation methods developed through Buddhism are now practiced in non-religious programmes in hospitals and schools worldwide. The first one, focused-attention meditation, aims to tame and anchor our mind in the present moment while we train to be vigilant against distractions.

The second, mindfulness or open-monitoring meditation, trains us to be less reactive toward thoughts, feelings and emotions, as they arise, to prevent them from spiraling out of control and creating mental distress. In this practice, we remain attentive, moment by moment, to any experience without focusing on anything specific.

The third is the cultivation of lovingkindness to foster an unconditional perspective of self and others. This is a healing meditation that teaches us to begin by accepting ourselves just as we are, by accepting others just as they are, and working on a vision of a better self and other, empowered by a sense of all-embracing spacious joy.

Focused attention

During focused attention practice, such as breath meditation, we would initially notice that our mind wanders away from an object, and we simply recognize this and restore our attention to the gradual rhythm of in-breathing and out-breathing. We would progressively notice four aspects or phases of this

meditation: (1) a period of the mind wandering, (2) a moment of becoming aware of the distraction, (3) a re-asserting of attention, and (4) continuing our focused attention.

Neuroscientists now know that each of the four aspects or phases involves particular brain networks. The first part, when a distraction occurs, increases activity in the wide-ranging default-mode network (DMN) (that seems to relate to daydreaming and non-focused thought). This network includes areas of the medial prefrontal cortex, the posterior cingulate cortex, the precuneus, the inferior parietal lobe and the lateral temporal cortex.[4]

The DMN is activated when the mind wanders and generally builds and reinforces our own models of the world conditioned by long-term memories about the self or others.[5] Experienced meditators generally have less DMN activity, implying that the mind wanders less during meditation. With more training, we can develop a new type of "default mode," a greater ability to control thought and emotion, and to stay focused on the present.

The second phase, becoming aware of a distraction, occurs in other brain areas such as the anterior insula and the anterior cingulate cortex, regions of what is called the salience[6] network. This network regulates subjective feelings, which might, for instance, distract us from a task. Scientists think that the salience network plays a key role in detecting

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[4] For brain-parts, see http://serendip.brynmawr.edu/bb/kinser/Structure1.html. For more details, see http://en.wikipedia.org/wiki/List_of_regions_in_the_human_brain.

[5] Susan L Smalley, "Mind-wandering and mindfulness" 31 Jan 2012: http://www.psychologytoday.com/blog/look-around-and-look-within/201201/mind-wandering-and-mindfulness.

[6] On salience, see http://en.wikipedia.org/wiki/Salience_(neuroscience).

changes (such as that caused by a noise we hear or a strong emotion), shifting away from the default-mode network.[7]

The third phase engages additional areas — such as the dorsolateral prefrontal cortex and the lateral inferior parietal lobe — that retrieve our attention by detaching it from any distracting stimulus.

In the fourth and last phase, the dorsolateral prefrontal cortex continues to retain a high level of activity, as our attention remains directed toward an object, such as the breath.[8]

Mindfulness

In mindfulness or open-monitoring meditation, or non-directive mindfulness, we note every sight, sound, bodily feeling, or inner talk. We stay aware of what is happening without becoming overly preoccupied with any one of them, returning to this detached focus each time the mind strays. As awareness of our surroundings grows, daily disruptive events — an angry co-worker, a worried call from home — become less disruptive, and we develop a sense of mental well-being.[9]

Studies have documented the benefits of non-directive mindfulness on symptoms of anxiety and depression, and its

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[7] More on "salience network": Jennifer Ouellette, "Inside a brain circuit, the will to press on," *Quanta Magazine*, 5 Dec 2013. http://www.quantamagazine.org/20131205-inside-a-brain-circuit-the-will-to-press-on/.

[8] On the breath meditation, see **Ānāpāna,sati Sutta** (M 118), SD 7.13: link.

[9] Jian Xu et al, "Nondirective meditation activates default mode network and areas associated with memory retrieval and emotional processing," *Frontiers in Human Neuroscience* 8,86, 26 Feb 2014: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3935386/.

ability to improve sleep patterns. By deliberately observing and monitoring our thoughts and emotions when we feel sad or worried, we can use meditation to manage them as they arise and so lessen rumination and alleviate depression.[10]

Lovingkindness

This meditation cultivates attitudes and feelings of unconditional acceptance and kindness toward others, whether they are close relatives, friends, or strangers, even enemies. Here, we become aware of someone else's needs and then experiencing a sincere, compassionate desire to help that person or to alleviate his suffering by shielding him from self-destructive behavior.

To be lovingkind, we sometimes need, as it were, to feel what another person is feeling. This is only a start. We must also be driven by an unselfish desire to help someone who is suffering. This form of meditation on love and compassion has proven to be more than just a religious exercise. It has shown potential to benefit healthcare workers, teachers and others who run the risk of emotional burnout linked to the distress experienced from a deeply empathetic reaction to others' needs and troubles.

We begin by showing an unconditional feeling of benevolence and love first for ourself, silently repeating: "May I be well. May I be happy. I accept myself fully just as I am." Then, we direct this lovingkindness to others, with such thoughts (or rather

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[10] D M Davies & J A Hayes, "What are the benefits of mindfulness?" *American Psychological Assn*, Jul-Aug 2012: http://www.apa.org/monitor/2012/07-08/ce-corner.aspx. Mindfulness meditation course: www.marc.ucla.edu.

feelings) as, "May all beings be happy. May the suffering be suffering-free."

This meditation produces more activity in areas such as the temporoparietal junction, the medial prefrontal cortex and the superior temporal sulcus, all typically activated when we put ourselves in the place of another. This practice also helps to reduce negative emotions, and increase positive ones, which are accompanied by corresponding changes in the areas of several brain networks associated with compassion, positive emotions and maternal love, including the orbitofrontal cortex, the ventral striatum and the anterior cingulate cortex. Researchers have also shown a week of training in lovingkindness increased prosocial behavior in a virtual game specially developed to measure the capacity to help others.[11]

A door to consciousness

In a broader perspective, meditation has finally provided mind scientists with the tool for studying one of the last frontiers of science, human consciousness. With the scientists themselves meditating, they become their own experiments with first-person experiences of their research. As more scientists compare and corroborate their findings, our scientific understanding of the human mind will help improve our mental health and general wellbeing.

For practitioners of Buddhist meditation, all this may be exciting discoveries and affirmation of what the Buddha

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[11] Emma Seppala, "18 science-based reasons to try loving-kindness meditation," *Huffington Post*, 12 Nov 2014: http://www.huffingtonpost.com/emma-seppala-phd/18-sciencebased-reasons-t_b_5823952.html.

teaches and a contemplative tradition of over 2,500 years. The scientific approach to Buddhist meditation clearly promises a more open understanding of humanity itself, one that cuts across all races, cultures and religions, and that sees the human race as one rooted in similar mental processes and their related issues.

All this in no way makes Buddhist meditation outmoded or obsolete (unless we have been trying to change or modernize Buddhism to suit our whims or to keep up with the world). Early Buddhist meditation is a tool for mental cultivation that must be solidly based on the cultivation of moral virtue, the wholesomeness of our body and speech. With a healthy mind in a healthy body, it is easier for us to cultivate insight wisdom that frees us from our dark and negative emotions to enjoy the free space of a joyful mind. The scientists are today helping to show that the Buddha's meditation methods work, and in a very significant way for humankind.

Mind Changing Brain Changing Mind: The Dharma and Neuroscience[1]

Rick Hanson

The knowledge of neuroscience has doubled in the last twenty years. It will probably double again in the next twenty years. I think that neuropsychology is, broadly, about where biology was a hundred years after the invention of the microscope: around 1725.

In contrast, Buddhism is a twenty-five hundred-year-old tradition. You don't need an EEG or MRI to sit and observe your own mind, to open your heart and practice with sincerity. I don't think of neuropsychology as a replacement for traditional methods, but simply as a very useful way to understand why traditional methods work. This is helpful in our culture, since arguably the secular religion of the West is

[1] This essay was published in *Insight Journal* (Barre Center for Buddhist Studies), Vol. 32, Summer 2009, pp. 9-15. It is based on a course the author taught at Barre Center for Buddhist Studies in April 2009. We thank the publisher for granting permission to reproduce it.

science. If you understand why something works in your own mind, that promotes conviction (*saddhā*, trust in the Buddha's teachings). Understanding a little neuropsychology also helps you to emphasize or individualize those particular aspects of traditional practices that best suit your own brain; natural differences in the brain are a fundamental kind of diversity, and if teachers and meditation centers want to respond to the needs of their existing members and to reach out to new ones, they will have to take into account normal variations in the brain.

Breakthroughs in brain science create opportunities to develop new or refined methods of practice. As Buddhism spread through Tibet, China, and Japan, it learnt from the cultures in those lands and developed new methods. Similarly, as Buddhism has come to the West and encountered what is arguably its dominant cultural force — science — it is beginning to draw on science for ways it, too, might be of use on the path of awakening. Not in any way to change the aims of practice — as the Buddha said, I teach one thing: suffering and its end — but to increase the skillful means to that end.

Immaterial experience leaves material, enduring traces behind. In the saying from the work of the psychologist, Donald Hebb: "Neurons that fire together, wire together." This is a neurologically informed way to appreciate why your experience really matters, and how important it is to have a kind of mental hygiene, to really appreciate what we allow in our minds.

Perhaps your mind is running themes of threat, grievance, and loss. Or alternately, perhaps it is running heartfeltness, generosity, kindness to self and others, awakening. Whichever

movie we're running, those neurons are firing and wiring together. So learning how to use your mind to shape the wiring of your brain is a profound way to support yourself on the path of awakening.

The mind & brain co-arise co-dependently

There's been a lot of research and clarification over the last several decades about how the brain makes the mind, and how the mind makes the brain, in a co-dependent, circular kind of way.

Let's begin with some clarifications:

- By "mind" I mean the flow of information through the nervous system, most of which is forever unconscious. We privilege what's in the field of awareness because that's what we're conscious of. But cultivating beneficial factors down in the basement of the brain, outside of conscious awareness, is actually more influential in the long run.

- Further, the brain is embedded in larger systems, including the nervous system as a whole, other bodily systems, and then biology, culture, and evolution. It is shaped by those systems, and also shaped by the mind itself. For simplicity I'll just refer to the brain, but really we are talking about a vast network of interdependent causes. Much as the Buddha taught.

- There may well be transcendental factors required for the mind to exist, to operate: call those factors God, Buddhanature, the Ground, or by no name at all. Since by definition, we cannot prove the existence or non-existence of such transcendental factors either way, it

is consistent with the tenets of science to acknowledge transcendental factors as a possibility. That said, and with a deep bow in their direction, we will stay within the frame of Western science.

- Within that framework, the brain is the necessary and proximally sufficient condition for the mind. (It's only proximally sufficient because the brain is nested in a great network of causes, without which the brain could not exist.) This view, generally shared within Western science, is that every mental state is correlated with a necessary and proximally sufficient brain state.

This integration of mind and brain has three important implications. First, as your brain changes, your mind changes. Second, as your mind changes, your brain changes. Many of those changes are fleeting, as your brain changes moment to moment to support the movement of information. But many are lasting, as neurons wire together: structure builds in the brain. Mental activity is like a spring shower, leaving little traces of neural structure behind. Over time, the little tracks in the hillside draw in more water down, deepening their course. A kind of circular self-organizing dynamic gradually develops, and then the mind tends to move more and more down that channel, and soon enough you've got a gully.

For example, if you are using neural circuits a lot, they actually become more sensitive to stimulation, for better or worse. Over time if a region is increasingly active, it gets more blood flow, more glucose, more oxygen and so forth. Existing synapses get stronger and new synapses form. Cortical layers actually get thicker as neural structures build; for example, the thickening in the part of the brain called the insula — which senses the

internal state of your body—that is due to meditation, is on the order of a two-hundredth of an inch, which may not sound like much, but that's lots and lots of new synapses.

Remarkably, synapses began forming in your brain before you were born, and your brain will keep changing up to the point of your last breath. Since neural activity continues in an increasingly disorganized way for a few minutes after the last breath, synapses may still be forming as the lights in the great mansion of the mind slowly go out.

The third implication is the practical one, and that's where we'll focus: you can use your mind to change your brain to benefit your whole being—and every other being whose life you touch.

Your complex, dynamic, interdependent brain

Your brain has about a hundred billion neurons in it (see the footnote for more basic, amazing facts about your brain).[2]

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[2] Your brain weighs about three pounds, with the consistency of soft tofu. It is made of about 1.1 trillion cells. About a hundred billion of these cells are neurons; the others are the support structure of the brain, the white matter, the glial cells, predominantly, that help build myelination around the long axonal fibers of the neurons, which accelerate neurotransmission.

Each of those neurons on average has about five thousand connections with other neurons. That creates about five hundred trillion connections, called synapses. These are tiny little junctions between neuron "A" and neuron "B" where they communicate. In most neurons, each time a neuron fires, neurochemicals move across the synapse (a small fraction of your neurons make direct, electrical connections).

Each neuron is always either firing, or not. Each firing is a signal, like "green light/red light"; it tells the downstream neuron to fire or not. So each neuronal firing is like a bit of information in a computer, a zero or a one. Most of the neurons in your brain are firing five to fifty times a second. They are very, very busy.

As a result, this little organ, two percent of body weight, uses twenty to twenty-five percent of the body's metabolic supplies. Even in the deepest sleep, even in a coma, the brain is busy. It's like a refrigerator; it's always on. The brain keeps going so that if you're suddenly attacked in the wild or you've got to deal with something in your cave, kaboom, you're ready to go.

We can recognize maybe four thoughts per second, if we're pretty aware. If we get really quiet, we might be able to see eight to ten, at the most. Working memory circuits, which are a key neural substrate of conscious awareness, seem to update about six times a second. So that's roughly how tight the granularity is of discrete thoughts. That is really slow, as far as the brain's concerned. So what we think of as thought—this slow, congealed, turgid stuff—is just the tip of the iceberg of mental activity.

In principle, the number of possible states of the brain is the number of possible combinations of a hundred billion neurons either firing or not ("on or off"). That number is really big: ten to the millionth power, which is one followed by a million zeros. To put this in perspective, the number of particles in the known universe is about ten to the eightieth power — one followed by eighty zeros versus a million zeros. The brain — your brain, right now — is the most complex object known to science. It's more complex than an exploding star, or climate change.

The brain functions through a mixture of specialization and lots and lots of teamwork. Parts of the brain do specialized things, like the speech centers in the left temporal and frontal lobes. On the other hand, if you map the communications pathways among the regions and specialized tissues of the brain, you see that it's highly interconnected. It's a little bit like tracking roadways from space or information on the Internet: a very dense network. So when people talk about specialization and function in just one place, like "The amygdala is the fear part of the brain," or "The left hemisphere is bad and the right hemisphere is good," it's an inaccurate simplification.

Within the networks of the brain, there are lots of circular loops. To simplify, there is the "A" neuron connected to the "B" neuron, connected to the "C" neuron, connected to the "D" neuron, and then back to the "A" neuron. These possibilities of recursion, as a computer programmer would call it, give you the capacity — among other things — to become aware of awareness.

Neurons also share each other. To simplify again, let's say you activate the "C" neuron in our A-B-C-D-A loop, and the "C"

neuron is shared with another loop. So there you are, irritated because the faucet's dripping in the middle of the night, and suddenly you think about the smell of your grandmother's cookies. Why? For some reason, there was shared circuitry in the coalitions of synapses that momentarily formed. The discursive stream of consciousness is so complex that as a system it exhibits some chaotic qualities. Understanding the chaotic and sometimes frankly wacky flux of all that neural activity can allow you to take it less seriously.

Neurons often fire in harmony with each other, five to fifty times a second — maybe even eighty or a hundred times in some parts of the brain. They're synchronizing with each other, and that's what produces the rhythmic waves of electrical activity — "brainwaves" — that are picked up with EEGs. Types of brainwaves are grouped together based on how fast they are; for example, brainwaves that happen 30 — 80 times a second are called gamma waves. In one study, when experienced Tibetan practitioners meditated, there was a spreading and strengthening pattern of gamma wave activity in the brain: billions of neurons firing in harmony with each other, 30-80 times a second. Synchronizing microscopic neurons spread across broad regions of your brain is like everybody between Barre and Boston clapping in unison let's say thirty times a second. Wow! And these effects of synchronization and integration are seen outside of formal meditation: in the same study, those Tibetan monks — who have done 30,000 to 50,000 hours of meditation in their lifetimes — have resting state gamma activity that's greater than people who don't have so much practice. This suggests that, as we practice more and more, there's more integration and coherence in the brain — which corresponds to a growing stability and spaciousness, equanimity in other words, in the mind.

Brain and body benefits of meditation

The anterior cingulate cortex (ACC) is a brain region that is ground zero for a lot of very important functions. For one, it's the part of the brain that manages what's called "effortful attention," which is basically paying attention in a deliberate way. That sounds like meditation. The ACC is the part of the brain we use for mindfulness in all four postures, not just seated, but walking, lying, and standing. It's also the main source of the focused attention we use for talking, and doing other activities that call for deliberate focus. Your cingulate cortex tends to get thicker to the degree you meditate.

For many people, it's easy to feel when they feel, or think when they think, but to bring mental clarity into being upset, or to warm up cold cognition with heartfelt emotion, is hard. The capacity to do that is centered in the anterior cingulate cortex. So, for example, doing things like compassion meditation, particularly mingling thoughts and feelings of compassion together, stimulates the ACC and therefore strengthens it; you're firing those neurons and therefore you're wiring those neurons.

Another region that gets thicker with meditation is called the insula. If you strengthen a part of the brain through meditation, you get to reap those rewards for other uses. For example, the insula is crucial for one of the three main aspects of empathy: visceral resonance with the feelings of another person (the other two aspects are simulating inside yourself the actions ["mirror systems"] and the thoughts/wishes/psychodynamics ["theory of mind"] of others). To the extent that we're in touch with own inner being, including our gut feelings — and this degree of in-touchness correlates with the activity of the insula — we become more able to be empathic with others.

True compassion, true loving kindness, requires empathy. I've known people who are sort of generically compassionate, and generically kind, but aren't actually moved by the inner state of the other person. That's not the real deal. So it's foundational to strengthen your empathy. I can tell you from twenty-seven years of marriage, empathy's a good thing! (And there are of course lots of important places for empathy outside of marriage.) Also, if you understand how to be empathic yourself, you understand better how to ask for it from others.

Meditation is probably the most researched mental activity in terms of neural impact. We know, for example, that meditators have less cortical thinning with aging. As I see more gray hairs on my head every year I appreciate the fact that one of the great ways to promote mental faculties well into old age is through contemplative practice. One exploratory study has shown a correlation of about a fifteen per cent reduction in Alzheimer's symptoms if a person has a religious background (there was only one Buddhist in the sample, and any kind of religious activity counted, but the study is still suggestive). That reduction of fifteen percent is about as much as the best current medication can do for Alzheimer's.

In another example, Richard Davidson did a very interesting study with people in a high tech company. He had some of them do daily meditation. After just six weeks, the people who meditated had stronger immune systems. They fought off a flu virus more effectively than people who hadn't meditated.

So meditation benefits us through multiple pathways. Parasympathetic activation ("rest-and-digest") — relaxation, in other words — is very supportive of immune system functioning, whereas sympathetic activation ("fight-or-flight") suppresses

immune function. Chronic stress exposes us to illness to a marked degree. Sleepy meditating is better than no meditation in terms of parasympathetic activation, or dampening sympathetic arousal (wakeful meditation is usually best of all). We can get attached to and even righteous about one specific method, whereas actually meditation has a lot of important general effects not specific to any particular method.

Another major Richard Davidson finding is that people become increasingly happy as they meditate — positive emotions become more prevalent, broadly defined. There's a greater asymmetry of activation, left front to right frontal. To illustrate this with stroke patients, people with a stroke in the right frontal region tend to become kind of mellow. Maybe they can't walk well, but they're often relatively serene about it. But if they have a stroke in the left frontal region, they're a lot more likely to be grouchy and grumpy.

Why is that? Because the left frontal region is involved in dampening, inhibiting negative emotional activity, whereas the right frontal region tends to promote negative emotional activity. In the wild, there's a lot of survival value to negative emotional activity; right hemisphere activation — which tracks the spatial environment from which most threats originate in the wild — primes you for dealing with threats: in other words, primes you for aversion, for what are called avoidance behaviors, namely fight, flight, freeze, appease. Maybe sometimes those behaviors are useful; in our evolutionary history, they certainly promoted survival and passing on genes. But today, in different settings and with different aims (like spiritual practice), it's great to have relatively strong left frontal activation.

Dependent Origination, brain, & equanimity

The feeling tone is a good example of where the Dharma maps well to neuropsychology. In the Dharma, there's this notion of the chain of Dependent Origination. One part of that chain that contains great opportunities to reduce or eliminate suffering is the sequence of contact > feeling tone > craving > clinging > suffering.

Contact is the meeting of three things: an object, the sense organ that apprehends that particular kind of object, and the consciousness that goes with that particular sense organ. Following contact, the brain produces a feeling tone that is pleasant, unpleasant, or neutral to help you know what to do: approach the pleasant, avoid the unpleasant, and move on from the neutral. This mechanism is a very effective way to promote survival in the wild and the passing on of genes. Feeling tones are important in evolution and they are a central theme in the Dharma: for example, they are one of the Five Aggregates, and also one of the Four Foundations of Mindfulness.

Say the phone rings. Depending on whether you're waiting for a call from a dear friend, or doing something really important and don't want interruptions, you'll get a different feeling tone: pleasant, unpleasant or neutral. In the brain, the amygdala and hippocampus register pleasant/unpleasant and then broadcast a signal widely.

In Dependent Origination, what follows feeling tone is craving. We crave the pleasant, and the ending of the unpleasant. Either way, it's a kind of craving. After craving comes clinging, a sort of a more congealed, substantiated, enacted, "you're in it" form of craving. And then, what follows clinging? Suffering.

Equanimity can break the chain right between feeling tone and craving, like a big, jumbo scissors. You let the feeling tone be. It gets into the "mud room" of your mind — that outer room where the muddy boots and wet jackets get left — but it doesn't enter the central "living room" of your mind. Equanimity increasingly allows us to just be present with the pleasant, the unpleasant and the neutral, alike, without getting reactivated around them.

Equanimity is a very deep matter in Buddhism. It is one of the Seven Factors Of Awakening, and one of the hallmark characteristics of the *jhānas* (states of concentration). Notice, for example, the difference between calm and equanimity. Calm is when you don't have reactions. You're chilled out. But with equanimity, you're not reacting to your reactions; they stay in the mud room. It's as if the reactions are surrounded with a lot of spaciousness. You prefer the pleasant to continue and the unpleasant to end — that's OK. But you don't even react to not getting that preference. You just surround it with space, and that's where freedom is. I think that's how people like the Dalai Lama can be sorrowful about what's happening in Tibet, and yet simultaneously have enormous equanimity around it.

Calm is based on conditions, and thus not that reliable. But equanimity is based on insight, wisdom, and is thus much more dependable. For example, disenchantment is a key factor of equanimity. We start to realize, "Won't get fooled again." Ice cream tastes like ice cream, orgasms are orgasms, being angry is being angry. Winning an argument, being right and showing them the error of their ways is just that. After a while you go, "so what?" Wisdom allows you to let go of the lesser

pleasure, chasing the pleasant or resisting the unpleasant, for the greater pleasure of equanimity.

What happens in the brain when people become equanimous? In a sense, equanimity is unnatural, since we evolved to get really good at reacting to the feeling tone. Our ancestors that were all blissed out, and not driven to find food and mates, and not driven to avoid predators and other hazards... CHOMP, did not pass on their genes. The ancestors who lived were extremely easy to activate into states of "greed" and "hatred"; realizing this helps bring self-compassion to a path of practice that involves, in part, moving upstream against evolutionary currents. And it is important to remember that when we are not activated, our natural resting state is characterized by the Five C's: Conscious, Calm, Contented, Caring, and Creative. It's just that we are very vulnerable to signals of opportunity and threat — and especially to signals of threat, since in evolution it is more important to dodge sticks than to get carrots: if you miss out on a carrot today you'll probably get another chance at them tomorrow, but if you fail to duck the stick today — POW — you won't have any chance for carrots tomorrow. I think this is the evolutionary reason for the Buddha's emphasis on dealing with aversion, since aversion to threats is so central to human existence.

In your brain, equanimity entails insights and intentions centered in the prefrontal cortex as well as prefrontal buffering of the feeling tone signals pulsed by the amygdala. It also entails the stable spaciousness of mind characterized by increased gamma wave activity of the brain. These neural developments are the fruits of sustained practice.

Seeing the origins of mental activity

One of the possibilities of meditation, or practice broadly, is to get us closer to the bare processing of "this moment, this moment, this moment." The brain takes the noisy, fertile chaos of billions of neurons networked together in intricate and transient circuits, and then it forms assemblies which may last a few tenths of a second, or a few seconds at most. When you observe your mind you can see the outer signs of this neural activity by watching your thoughts merge into solidity and then crumble and disperse.

Just before a new neural assembly forms, there's a space of fertile emptiness, where structure hasn't yet congealed. Once a representation becomes fully established — an image, an emotion, a view, a thought — it is no longer free. You can have freedom around it, but whatever it is, that representation is set until it disperses.

So abiding increasingly in that fertile, generative space, in which neural assemblies take form, is a central process along the path of awakening. I think the people who are really far along in the practice are increasingly abiding in that territory. Thought is occurring, but they're living more in that space of fertile freedom.

Self is like a unicorn

Components and functions of the apparent self — *Me! My Precious! I want! How'm I doin'?* — are widely distributed in the brain. Take just three kinds of self-related activities. One is recognizing yourself, distinct from other people, or noticing an "x" on your forehead someone put there without you realizing it. Only a few animals can do that, including humans,

other "great apes" such as monkeys and gorillas, whales and dolphins, and elephants. Another aspect is personal history, your memories. The third aspect is making decisions; I want chocolate, not vanilla, for example. Studies have shown that those self-related activities are spread out throughout your brain. There's no homunculus looking out from your eyes. Self in the brain is just like the Buddha says in the Dharma: compounded (made of many parts), variable and transient, and interdependently arising. It has no inherent, underlying self-arising on its own; therefore it's empty of absolute existence.

Much of the time there's not much selfing present; there is presence and mental activity without much activation of "I" or "mine." You shift your body in your seat because it's gotten tight somewhere: probably there's not a lot of self present. But suddenly someone says something to you, or you notice, hum, their chair is crowding into mine: *Hey, don't you respect my space?!* Then the self really activates. There is a process of varying self-related activities; self is not a noun but a verb: there is selfing. Selfing developed in evolution to help us survive, and so it shows up particularly under three conditions: pursuing opportunities (often associated with "greed"), avoiding threats (often associated with "hatred"), and interactions with others (since we evolved to be the most social animal of all).

Aspects of self arise as impermanent but existent patterns of mental and therefore neural activity. These patterns exist in the sense that the patterns which correspond to a thought of a butterfly or the knowledge that 2+2=4 exist. Patterns exist, but they're impermanent and dependently arisen: they're empty. Mental/neural patterns related to self are just more patterns in the mind and brain, not categorically different

from other mental/neural patterns. The problem is that we privilege those particular patterns above all others. They are the ones we most identify with, and the trickiest ones to disidentify with as we proceed along the path of practice. The mental/neural activity of selfing is designed by evolution to continually claim ownership of experiences, claim agency of actions, and claim identification with both internal states and external objects (like political groups or sports teams we like): it's very powerful! Watch your mind: a strong reaction will arise, let's say, and for the first second or two there is not much self entwined with it, but quickly self jumps on the bandwagon and then claims the reaction as its own. Self does give rise to desire, but much of the time, it is desire that gives rise to self.

But actually, much of the time self is truly superfluous to functioning well in the world, and feeling good inside. Without much if any selfing present, there can be executive functions at work, such as organizing and planning or the will. There can be wholesome desire, *chanda*, present — which is distinct from *tanhā*, thirst or craving, which the Buddha said caused suffering. Walk across the room: does there need to be self present? Lift the cup to your lips: is self needed?

The patterns of selfing in the mind and brain are real; they exist in the way that memory or an emotion exists. Their existence is transient and empty, to be sure, and thus not worth clinging to. But even more to the point: does what they point to, what they represent, actually exist? In other words, is there actually a coherent, unified, stable, enduring being somewhere, somehow, in the brain? Actually, no such being exists. Whatever of self there is in the brain, it is compounded and distributed, not coherent and unified; it is variable and transient, not stable and enduring. In other words, the conventional notion

of self is a mythical creature. Representations of a horse in the mind/brain are real representations of a real thing. But representations of the self in the brain are like representations of a unicorn: real representations of an unreal thing.

In sum, when you appreciate that the representations of self in the brain are empty, that what they represent does not exist, you start taking your own "self" much less seriously.

Conclusion

The reality is that the more we study how the mind and brain intertwine, the more we find how well it maps with Dharma. The Buddha clearly understood this cycle of using the mind to change the brain, which then changes the future mind. If this is done well, it reduces suffering. He showed us ways to examine our experience, see how this works, and use that intuitive, direct understanding to free ourselves from suffering—completely free ourselves, in this very life, potentially. Just about everything we have found in neuropsychology supports the idea that he was right. This should give us a lot more conviction in our practice, along with a continuing source of practical tools to make it a reality.

Buddhism & Psychotherapy: Mindfulness-Based Interventions

Gregor Lange

> *If we look deeply into such ways of life as Buddhism, we do not find either philosophy or religion as these are understood in the West. We find something more nearly resembling psychotherapy.*
>
> **Alan Watts**

Introduction: Origins of Mindfulness-Based Interventions (MBIs)

The influence of Buddhism on psychological theories and therapy can be traced back to the early 20th century, which was marked by an avid appreciation and appeal to traditional attitudes of peacefulness, mindfulness and kindness toward all living beings, and the gradual incorporation of these elements in healthcare approaches by the Western world. Its impact was especially pervasive in paving way for various mindfulness-oriented therapies that have benefited generations of clients and the general public at large to this very day.

Historically, one key factor that contributed to the eventual fusion of Buddhist ideas and techniques with Western psychology was the direct contact between Japanese and

Western psychiatrists and therapists following World War II, which ultimately led to a great wave of interest in Zen Buddhism in the United States. For instance, a Japanese approach to psychotherapy known as Morita Therapy developed by Shoma Morita in the 1920s (Morita, 1928; translated in English in 1998), aimed to help clients with anxiety disorders (*Shinkeishitsu*) by developing acceptance of their symptoms with calm awareness (Reynolds, 1976). It essentially comprised two mindfulness elements: *arugamama* (acceptance of feelings and of the self as it is experienced) and *muga* (absorption in tasks) (Jacobson & Berenberg, 1952). This was radically different from the traditional Western medical approach of attacking one's symptoms (Dryden & Still, 2006) and sparked great interest. However, Morita therapy had little influence internationally even after being brought into the United States (Dryden & Still, 2006).

At the same time in Europe, there was growing interest in Eastern philosophy. Renowned Swiss psychiatrist Carl Jung took an interest in Buddhist concepts. Later, a generation of psychoanalysts or psychologists including Alan Watts, Erich Fromm, and Karen Horney, amongst others, who themselves became Buddhist practitioners contributed vastly to establishing a discourse of common ground between Eastern and Western philosophies (e.g., Watts, 1961).

The prevalence of Buddhist ideas, such as non-judgmental acceptance, was also reflected in the development of the humanistic school of psychology (e.g., Maslow, 1968, 1971). Maslow's infamous hierarchy of needs (1968) urged for psychology to talk about wholeness, morality, self-sufficiency, and ultimately self-actualization. Carl Rogers (1951) included these humanistic themes in the client-centered therapy that

he developed. The therapist utilizes empathy and unconditional positive regard to facilitate the client's exploration of their thoughts and feelings without the fear of criticism. The foremost aim is to achieve personal transformation instead of symptom relief, and this is brought about by awareness and acceptance (Dryden & Still, 2006).

In the 1970s the first scientific studies on Transcendental Meditation (TM) conducted by Benson (1975) demonstrated the benefits of meditation on physical and mental well being. However, as the word 'meditation' had religious connotations, it was not accepted and integrated into traditional medical and psychological discourse and treatment. Western medicine and psychology were not ready to embrace meditation and mindfulness despite their promising effects.

Mindfulness-Based Stress Reduction (MBSR)

It took another two decades and the work of Jon Kabat-Zinn (1982) for mindfulness to slowly gain acceptance within mainstream Western medicine and healthcare. In the 1970s, Kabat-Zinn discovered from his conversations with medical doctors that there was a large proportion of patients whose symptoms were not alleviated by traditional Western medicine. With this in mind, he developed a program that he hoped would offer them some solace. Given that he was working within a primarily Western medical context in the 1970s, Kabat-Zinn had to name the program wisely in order to avoid alienating any of the doctors or patients, making it accessible and appealing to the widest audience possible.Since stress is a universal phenomenon and was a common problem in the 20th century, the program came to be known as Mindfulness-Based Stress Reduction (MBSR) and Kabat-Zinn opened a stress reduction

clinic at the University of Massachusetts Hospital. The clinic was later renamed the Center for Mindfulness in Medicine, Health Care, and Society.Interestingly, Kabat-Zinn had no academic training in clinical psychology or psychotherapy and his work was entirely influenced by his own exposure and practice of Buddhism.

In MBSR, patients learn through various mindfulness practices about the transient nature of sensations, thoughts, and emotions. As a result, they come to realize that at least some amount of their suffering is a result of their emotional reactions to pain and not the actual source of pain itself (Kabat-Zinn, 1990). Kabat-Zinn hoped that patients could transform their relationship with pain as a result. In his experience, mindfulness emerged particularly helpful for individuals experiencing anxiety disorders and other strong emotions as patients come to realize that a lot of their suffering is associated with their internal emotional reactivity and not external stimuli that are outside of their control. The MBSR program has since been extended to include people with various kinds of physical, psychological and stress-related conditions. It is important to note that the suitability of each patient to the programme is individually determined before they are invited to participate.

MBSR is typically structured as an 8-week intensive course for groups of up to 30 participants. These group sessions comprise various formal and informal mindfulness practices (mindfulness of breath, mindful walking, body scans, mindful eating), Hatha Yoga, and group discussion and span 2-3 hours. According to Dryden & Still (2006), these practices were inspired by a variety of sources, including Buddhist practitioners Jack Kornfield, Joseph Goldstein (Goldstein &

Kornfield, 1987) and Thich Nhat Hahn (1991; first published 1975). One key feature of MBSR is that participants are required to practice mindfulness at home for 45-60 minutes daily at least six days a week for the duration of the program. This significant demand on clients is made very clear from the start when they are selected for the MBSR program. It serves as a key element of what Saki Santorelli (1999) called 'participatory medicine', where patients are encouraged to take responsibility for their own health and well-being. The ultimate goal is to incorporate these practices into everyday life (Kabat-Zinn, 1982, 1994, 2005).

Saki Santorelli is the second key figure in bringing MBIs into the mainstream. He was one of the first interns at the stress reduction clinic who later became a close friend to Kabat-Zinn, a fellow teacher, and eventually the director of the center for mindfulness. Together they have been responsible for this hugely successful program and pioneered what many have called a mindfulness revolution within healthcare, psychological therapies, and even within the public. As a testament to this, more than 20,000 people have completed and benefited from their MBSR programs since 1979 (Center for Mindfulness, N.d.).

Kabat-Zinn and his colleagues at the stress reduction clinic knew from the start that in order for MBSR to be acceptable to the medical profession and beyond, they had to engage in scientific research proving the effectiveness of MBSR. As such, they have been tirelessly carrying out numerous research studies from the first group program up to the present day. The findings have been largely positive, and have since been successfully replicated across various groups (e.g. medical patients, business professionals, students), conditions (e.g.

cancer, pain, anxiety disorders), and settings (e.g. hospitals, medical schools, general public) (e.g., Kabat-Zinn, 1982; Miller et al., 1995; Carmody & Baer, 2008; Shapiro & Carlson, 2009) and with sustainable positive outcomes even in the long term (Miller et al., 1995; Grossman et al., 2010; Vollestad et al., 2011).

Dialectical Behavior Therapy (DBT)

Cognitive Behavioral Therapy (CBT) has been the most widely used evidence-based psychological treatment approach in the last 30 years. It has been used in treating a wide array of psychological disorders ranging from depression, anxiety disorders, eating disorders to even schizophrenia. CBT revolves around the notion that the ways we think and behave are interrelated and have an impact on our emotional and physical well-being. For example, negative thinking and rumination, a common denominator among many psychological disorders, is believed to arise from a tendency of clients to interpret and engage with life experiences through a negative lens. As such, CBT focuses on exploring and modifying core beliefs and behaviors that underlie these inaccurate perceptions. However, the effectiveness of CBT seen elsewhere was not as strongly demonstrated in the treatment of a severe psychological disorder known as Borderline Personality Disorder. Individuals suffering from this disorder experience strong emotional reactivity, including anger, depression, emptiness and anxiety. Self-harm, substance abuse, and suicidal ideations and behavior are also common.

Marsha Linehan, a professor of psychology at the University of Washington, sought to address this gap in the hope of finding a more effective and suitable treatment for individuals

who suffered from this chronic condition, including herself. As such, she pioneered Dialectical Behavior Therapy (DBT), a comprehensive and intense intervention that merges traditional CBT techniques with mindfulness and acceptance strategies (Linehan, 1993b; Rizvi et al., 2009). DBT aims to strike a balance between helping clients to accept their condition, while striving to learn better ways of dealing with their maladaptive behaviors (Linehan & Dimeff, 2001). Mindfulness techniques are utilized to facilitate this core process of acceptance and change, and to help the client achieve greater emotional self-regulation. Linehan paralleled Kabat-Zinn's description of the impact of mindfulness on difficult emotions in agreeing that learning such skills enabled clients to decenter from their thoughts and feelings. Ultimately, clients become more resilient and able to take a step back and choose a more adaptive and appropriate way of dealing with their strong feelings, rather than getting swept away by them (Linehan, 1993 a/b).

DBT involves three main components, namely individual therapy, group therapy, and also a support structure for therapists. This last part is of particular importance as working with clients with BPD can be quite demanding and can lead to therapist burn-out. Weekly instalments of individual therapy offer the client an opportunity to discuss personal issues that have arisen during the week, as well as help the therapist address any self-harm or other harmful behaviors that interfere with the treatment course, with the intention of improving the client's overall quality of life. The group setting best serves as a platform to teach the various DBT skills (mindfulness, interpersonal effectiveness, emotion regulation, and distress tolerance) and facilitate their practice within the group.

A noteworthy feature of DBT is that it assumes that people are doing their personal best to deal with their difficulties, but either lack the adaptive skills or are bound by reinforcing conditions that interfere with their functioning. Additionally, Linehan realized that individuals with BPD require a therapeutic relationship that counteracts the negative and invalidating environment that they typically come from. In response, DBT offers a climate of loving kindness and validation, and emphasizes a strong therapeutic alliance between the therapist and client.

DBT has emerged as an effective treatment for BPD through various research studies ranging from randomized clinical trials (Linehan et al., 1991, 1993, 2001) to a recent meta-analysis (Kliem et al., 2010). The extension of DBT interventions to other serious psychological conditions, such as eating disorders (Rizvi, Welch, & Dimidjian, 2009), sexual abuse (Decker & Naugle, 2008), and substance dependency (Linehan et al., 1999) has increasingly been the subject of many research studies as well.

Mindfulness-Based Cognitive Therapy (MBCT)

John Teasdale, Zindel Segal and Mark Williams were a team of clinical psychologists and researchers who were interested in the underlying information-processing mechanisms of depression and how cognitive behavioral therapy (CBT) could be adapted to meet the needs of clients with recurrent depression (Teasdale et al., 1995; Williams, 2010).

When they learned about the work of Linehan (1993) and the mindfulness component of DBT in particular, they were struck by its effectiveness in interfering with turbulent cycles of

thought and affect, typically seen in clients with BPD. Clients who learned mindfulness techniques seemed better able to recognize these cycles and take appropriate actions to deal with them or let them pass without reacting. As a result, they were curious if mindfulness could be beneficial in the treatment and prevention of depression.

Despite their reservations about the associations with Buddhism in Kabat-Zinn's work given their scientific background, the team decided to approach him for his expertise. Through extended meetings and dialogues, they developed Mindfulness-Based Cognitive Therapy (MBCT) that incorporated the essence of MBSR and customized it to be an accessible and effective solution for individuals suffering from recurrent depression and relapse (Segal et al., 2002).

As with MBSR, MBCT is also offered as an 8-week group program, with a similar home practice requirement.However, the weekly sessions are shorter, there is less emphasis on Yoga, and mindfulness meditations are combined with cognitive-behavioral interventions. The focus is to break the negative ruminative thinking cycles and associated behavioral and emotional symptoms of depression. Ideally, once the mindfulness techniques and other cognitive skills are learnt, clients are able to recognize problematic ways of thinking and feeling early on such that they are able to avoid relapsing into a full depressive episode.

Most notably, MBCT has proven effective in treating depression (Barnhofer & Crane, 2009) and has led to the reduction of recurrence rates in clients with three or more previous episodes of depression by 40-50% (Segal et al., 2002). This effect is comparable to the use of antidepressants. Owing to

its careful design and execution, MBCT has been instated as an evidence-based intervention and is recommended by the UK Government's National Institute for Health and Clinical Excellence (NICE) for those with three or more episodes of depression in their Guidelines for Management of Depression (2004, 2009). The application of MBCT has recently been widened to other psychological and medical problems, such as bipolar disorder (Miklowitz et al., 2009), Parkinson's disease (Fitzpatrick et al., 2010), PTSD (King et al., 2013) or generalized anxiety disorder (Evans et al., 2008), to name but a few.

Acceptance and Commitment Therapy (ACT)

Acceptance and Commitment therapy as the name suggests, draws strongly from Buddhist ideas and mindfulness techniques aimed at developing a sense of awareness and acceptance. Developed by a team of psychologists, Steven Hayes, Kirk Strosahl and Kelly Wilson in the 1980s (Hayes, 1984; Hayes, Strosahl & Wilson, 1999), the underlying model of ACT challenges the dominant Western psychological idea of 'healthy normality' that assumes that human beings are by nature psychologically healthy. Rather, it points to the predominantly Buddhist idea that human suffering is ubiquitous. Most people have a tendency for experiential avoidance, and psychological problems are proposed to be a result of this psychological rigidity and failure to be in touch with core values that guide appropriate behavioral responses.

ACT is a contextual psychotherapy, heavily influenced by behavioral theory and therapy, and is based on the Relational Frame Theory (RFT). RFT is a comprehensive theory that attempts to explain the origin of psychological problems to be in

the use and interplay of language and cognition. Furthermore, ACT is an experiential form of therapy with plenty of practical exercises aimed at helping clients step out of the analytical, cognitive or language driven mode that is often related to the creation or maintenance of their problems.

Instead of focusing on changing the content or frequency of thoughts, feelings and cognitions, or focusing on merely reducing symptoms, mindfulness techniques are used in ACT to help patients change their relationship with these categories. Clients strive toward a meaningful life that is guided by their values, while accepting that challenges are inevitable. The ACT therapist utilizes a number of different experiential techniques that are designed to help clients move toward greater psychological flexibility and vitality, such as mindfulness practices, metaphors and paradoxes, exposure, and having clear values-based life goals (Harris, 2006).

There are six core principles that can be examined and worked on depending on the needs of the client (Harris, 2006):

1. The first principle of 'cognitive defusion' signifies the clients' shift in perspective from believing cognitions (e.g. thoughts, feelings, memories) to be irreversible facts or rules, to ultimately learning that these cognitions are merely mental events that come and go. Clients are empowered in the knowledge that these cognitions bear no inherent ability to control their choices (Harris, 2006).

2. The second principle of 'acceptance' refers to guiding clients to allow unpleasant experiences, such as difficult emotions, painful sensations, or urges to come

and go without grappling with them, avoiding them, or according unnecessary attention to them (Harris, 2006).

3 The third principle, 'contact with the present moment', is the key mindfulness element of ACT. Clients are taught to bring their awareness to savoring the present moment, with an attitude of openness, curiosity, and receptiveness.

4 Fourthly, 'the observing self' refers to helping clients access a transcendent sense of self or a continuity of consciousness that is unchanging, ever-present, and impervious to harm (Harris, 2006). Through this perspective it is possible for clients to experience for themselves that their identity is above and beyond their thoughts, feelings, memories, urges, sensations, images, roles, or physical body, which they otherwise identify with (Harris, 2006).

5 The fifth principle of 'values' aims to support clients in their exploration of what is most important and meaningful to their true self. Values serve as the goalposts for the clients' journey, representing the ideal person the client aspires to be.

6 Finally, 'committed actions' refers to assisting clients to set goals in alignment with their values and outlining an effective action plan geared toward achieving them (Harris, 2006).

ACT has been deemed effective for a wide array of psychological problems including depression, chronic pain,

stress and anxiety, obsessive-compulsive disorder, substance use, and even schizophrenia through research studies and clinical trials (Hayes et al., 2006; Ruiz, 2010; Gifford et al., 2011, Zettle & Raines, 1989; Twohig, Hayes & Masuda, 2006; Johnston et al., 2010, Ruiz, 2010). In fact, Bach & Hayes (2002) demonstrated that with only four hours of ACT, hospital re-admission rates for schizophrenic patients dropped by 50% over the next six months (Harris, 2006). Recent initiatives have seen the application of ACT practices to children, adolescents and their parents (Wicksell et al., 2009; Murell et al., 2006). With its protracted success, ACT is now recognized as an empirically validated treatment by the American Psychological Association (APA, N.d.).

Other Mindfulness-Based Interventions

Additionally, Mindfulness-Based Interventions have taken on various customizations and conformations in an effort to harness the unparalleled potential of mindfulness therapies for the enhanced benefit of specific target clientele and disorder-types. Many follow the 8-week group structure as MBSR, while others have been adjusted accordingly. Selected examples of four recent MBIs are outlined briefly below.

Mindfulness-Based Relapse Prevention (MBRP)

Mindfulness-Based Relapse Prevention (MBRP) is based on the work of Alan Marlatt, who was the Director of the Addiction Behaviors Research Center at the University of Washington. Marlatt and his colleagues integrated mindfulness practices into their work with addiction, as an aftercare program and a supplement to their initial addiction treatment programs. It includes various mindfulness practices, such as non-

judgment, compassion, self-control, observing present experiences, and bringing awareness to the range of choices clients have before responding. These practices are combined with traditional CBT principles to help clients break free from habitual and destructive behavioral and cognitive patterns and have proven to be highly effective (e.g., Bowen et al., 2014).

Mindfulness-Based Eating Awareness Training (MB-EAT)

Mindfulness-Based Eating Awareness Training (MB-EAT) was devised by Jean Kristeller and her colleagues as a group intervention for the treatment of binge eating disorder (BED) (Kristeller & Wolever, 2011). Binge eating is characterized by a significant imbalance in food intake regulation and accompanying emotional, behavioral distress and self-esteem. It is often comorbid with other psychological problems, such as depression and medical problems, such as obesity. MB-EAT is designed to help clients develop mindfulness and self-acceptance skills to manage underlying issues of BED, such as problems regulating emotions and arising automatic behaviors relating to food. Clients learn to become more aware of their cues relating to hunger and satiety and to make food choices more deliberately (Kristeller & Wolever, 2011).

Evidence from a randomized clinical trial supports the efficacy of MB-EAT in decreasing binge episodes, improving one's sense of self-control with regard to eating, and diminishing depressive symptoms (Kristeller et al., 2013). MB-EAT is being researched intently as an effective intervention for other eating related conditions as well (e.g., Miller et al., 2013).

Mindfulness-Based Childbirth and Parenting (MBCP)

Mindfulness-Based Childbirth and Parenting Program (MBCP) was created by Nancy Bardacke, Assistant Clinical Professor, University of California, San Francisco, and nurse-midwife. MBCP is based on MBSR and aims to help parents manage the challenges of childbirth, related physiological distress and anxiety. Furthermore, it helps parents be more skillful in nurturing and caring for their children (Bardacke, 2012). MBCP integrates a variety of mindfulness practices with childbirth and parenting education. For example, MBCP includes gentle yoga, awareness of breath, and also mindful communication between partners. There has been much support in preliminary studies on MBCP, with far-reaching benefits that include strengthening parental and familial bonds (Duncan & Bardacke, 2010).

Mindfulness-Based Mind Fitness Training (MMFT)

Mindfulness-Based Mind Fitness Training (MMFT) was developed by Elizabeth Stanley, who also served as Associate Professor of Security Studies at Georgetown University. Stanley mobilized the combination of her military experience, research expertise and mindfulness training to create MMFT. The program aims to prepare professionals in highly challenging environments, such as military service members, firefighters and disaster relief workers, to deal with extreme stress by harnessing mindfulness and stress resilience skills and is either taught over a period of eight weeks, or in an intensive 7-day format (Stanley, 2014). What makes MMFT distinct from other basic mindfulness approaches is the strong focus on body-based stress resilience skills training and research on MMFT has yielded a number of positive results to-date (e.g., Johnson et al., 2014).

MBIs as Third Wave Therapies

DBT, MBCT, and ACT and the other MBIs are often referred to as being the 'third wave' of behavioral therapies that arose out of limitations in the first two waves. The first wave commenced in the early 20th century in accordance with the theories and principles of early behaviorists such as Pavlov, Watson, and Skinner and their work on conditioning and behavioral reinforcement. The second wave emerged from the work of Ellis (1977) and Beck et al. (1979) in the 1970s and their respective models of cognitive theory and therapy. These models focused particularly on negative or dysfunctional thinking styles. However, this way of classifying MBIs is not without debate, with some researchers proposing that it might be more accurate to classify the MBIs as outside of the behaviorist tradition altogether (Gordon, 2009). Rather, they seem more closely aligned with the more holistic and humanist or subjectivist traditions (Gordon, 2009). Similarly, Harris (2006, p. 2) suggested that ACT is "a therapy so hard to classify that it has been described as an 'existential humanistic cognitive behavioral therapy'.

Conclusion

Mindfulness-based interventions have ignited a transformation in traditional Western medicine and healthcare, toward a more holistic mind-body approach of wellness. Similarly, clinical psychologists and psychotherapists have welcomed the techniques of these 'third-wave' therapies. It is endlessly fascinating that the fundamental attitudes of the early Buddhist teachings and traditions have lent themselves so effortlessly to be reinvented in the form of mindfulness therapies that have been integrated as a preventative or general health and stress management intervention for the

general public. However, there remains a lot to be explored and understood regarding MBIs and further research is required to consolidate these findings and cement their effectiveness as evidence-based treatments. In addition, for example, it is essential to develop and test out models explaining the underlying mechanisms of MBIs (Malinowski, 2008), develop reliable and valid tools to measure this complex construct of mindfulness (Grossman, 2008; Chiesa, 2013), and have a better understanding for whom MBIs are most suitable and what potential risks they might present (Kuyken et al., 2010). Nonetheless, this can undoubtedly be described as a mindfulness revolution in Western medicine, clinical psychology, and in the larger public sphere.

RECOMMENDED READINGS & WEBSITES

*** General Reading**

- Baer, R. (2014). *Mindfulness-based treatment approaches*. Amsterdam: Academic Press.

*** Mindfulness-Based Stress Reduction (MBSR)**

- Kabat-Zinn, J. (2005). *Coming to our senses: Healing Ourselves and the World Through Mindfulness*. New York: Hyperion.
- Kabat-Zinn, J. (2013). *Full catastrophe living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness*. Piatkus.

http://www.umassmed.edu/cfm/

*** Dialectical Behavior Therapy (DBT)**

- Linehan, M. (2014). *DBT skills training manual* (2nd ed.). New York: Guilford Press.

http://www.linehaninstitute.org/index.php

*** Mindfulness-Based Cognitive Therapy (MBCT)**

- Segal, Z., Williams, J., & Teasdale, J. (2012). *Mindfulness-based cognitive therapy for depression* (2nd ed.). New York: Guilford Press.
- Williams, M., Teasdale, J., Segal, Z. & Kabat-Zinn, J. (2007). *The mindful way through depression: Freeing yourself from chronic unhappiness*. New York: Guilford Press.

http://www.oxfordmindfulness.org/

*** Acceptance and Commitment Therapy (ACT)**

- Hayes, S., Strosahl, K., & Wilson, K. (2012). *Acceptance and commitment therapy*. New York: Guilford Press.
- Harris, R. (2009). *ACT made simple: An easy to read primer on Acceptance and Commitment Therapy*. Oakland: New Harbinger Publications.

http://contextualscience.org

*** Mindfulness-Based Relapse Prevention (MBRP)**

- Bowen, S., Chawla, N., & Marlatt, G. (2011). *Mindfulness-based relapse prevention for addictive behaviors*. New York: Guilford Press.

*** Mindfulness-Based Eating Awareness (MB-EAT)**

- Nhất Hạnh, T. & Cheung, L. (2011). *Savor: Mindful Eating, Mindful Life*. New York: HarperOne.
- Goodall, J., McAvoy, G., & Hudson, G. (2005). *Harvest for hope: A guide to mindful eating*. New York: Warner Books.

*** Mindfulness-Based Childbirth and Parenting (MBCP)**

Bardacke, N. (2012). *Mindful birthing: Training the Mind, Body and Heart for Childbirth and Beyond*. New York: HarperOne.

*** Mindfulness-Based Mind Fitness Training (MMFT)**

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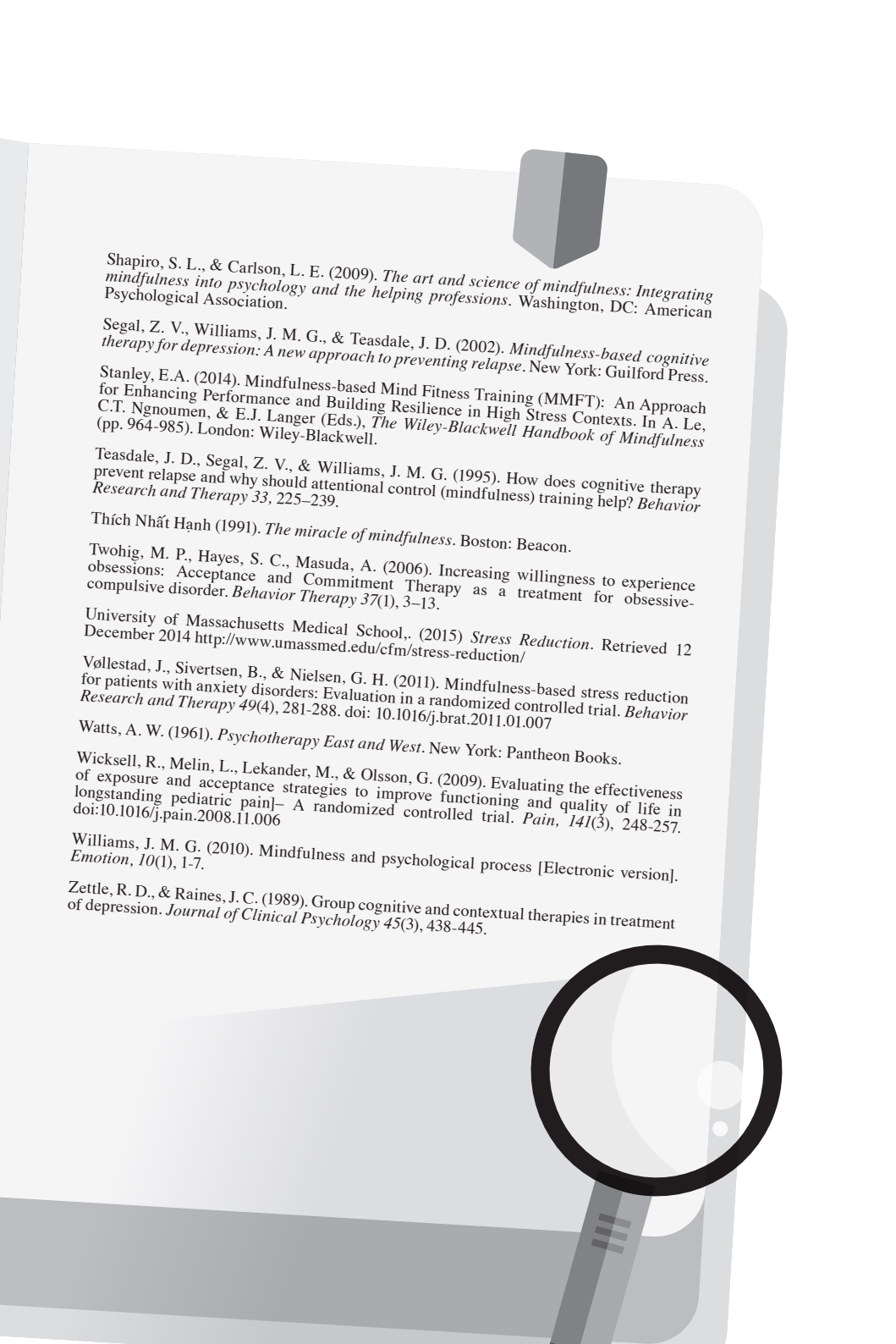

Key Concepts Underlying Mindfulness Psychotherapy

Venerable Ratmalane Somaloka

Introduction

Mindfulness technique is an effective therapy model with a solid theoretical and conceptual system on the mind, person, and mental illnesses — their course and recovery — comparable to any evidence-based psychotherapy model. In fact, it has a far wider perspective and objective than any intervention currently in practice in psychotherapy. There are many psychotherapy models and they all seem to work (Seligman 1995). Does this mean that these models have their own uniqueness that bring about the positive effect or is there a common element? Some studies suggest that mindfulness seems to be the element common to all major psychotherapy approaches (Germer 2005). To fully appreciate the uniqueness of mindfulness technique it is important to understand the theoretical and conceptual system underlying it in its original Buddhist framework. This conceptual system discovered and

presented by the historic Buddha is universal, although the concepts and cultural idioms used to express it are culture-bound. Fortunately, research findings on this subject have provided us with scientifically meaningful concepts to communicate it without being constrained by particular cultural idioms.

Current research on mindfulness technique

Mindfulness meditation practice has a long history. Many people have practiced this technique without knowing its underlying biological or other meditative mechanism, having only its experimental and experiential approach and the empirical evidence and insight of its therapeutic benefit to motivate them. Recently, however, this seemingly simple technique that aims at awakening the faculty of mindfulness by developing one's attention to behavioral, cognitive and emotional response to stimuli has attracted scientists' attention for its openness to experimental approach, simplicity, and universality. Up to 2013 there are more than 1,500 research papers exploring mindfulness technique and its clinical application and efficacy as an intervention approach.

It was primarily Jon Kabat-Zinn's works that brought this technique to the clinical world. His many years of research studies and clinical application at University of Massachusetts Medical School are recognized for their scientific rigor and documented health benefits. In the USA, more than 200 clinics and hospitals use Kabat-Zinn's Mindfulness-Based Stress Reduction (MBSR) therapy, which has also now been incorporated into mainstream medical systems worldwide.

Mindfulness has been found to have positive psychological and physiological benefits for patients suffering from a number of physical and psychological illnesses, such as preventing relapse of major depression, and treating residual depressive symptoms, anxiety, psychosis, body-image problems, substance abuse, trauma, exhibitionism, eating disorders, nicotine dependence, attention-deficit hyperactivity disorder, and psychological distress and neuroticism. Mindfulness-based interventions have also proven efficacious for treating a number of physical complaints such as psoriasis and chronic pain, and improving mood and well-being in individuals with cancer and fibromyalgia. Emerging research also point to the efficacy of mindfulness for treating secondary effects of severe and chronic physical conditions in children and adolescents (Chambers, et al. 2009).

Besides stand-alone mindfulness interventions, many current interventions have incorporated mindfulness in combination with other psychotherapy approaches. For instance, Dialectical Behavior Therapy (DBT), considered one of the most effective therapy interventions for borderline personality disorder, has adopted mindfulness practice as its core module. Findings also indicate that another intervention, Mindfulness-Based Cognitive Therapy (MBCT), applied on those who suffer from many episodes of chronic depression, has considerable therapeutic promise. The clinical subjects were first treated with antidepressant pharmacotherapy, and then exposed to MBCT to prevent relapse (Teasdale, et al. 2000). Considering mindfulness technique's universality and potential for treating a wide range of physical and psychological disorders, it deserves further scientific study so that it can be applied to a wider population, both as an effective therapeutic intervention and as a preventive intervention.

Origin in Buddhist teaching

Mindfulness practice originated in early Buddhist teachings as an empirical approach to deal with the human predicament, as well as for personality development and to gain the highest form of happiness, '*nibbāna*'. Buddhist scholar Edward Conze considered it the heart of Buddhism: "If one were to ask what distinguish Buddhism from all other systems of thought, one would have to answer that it is the '*dhamma*' theory and the stress laid on mindfulness. Mindfulness is not only the seventh of the steps of the holy eightfold path, third of the five virtues, and the first of the seven links of enlightenment. On occasion it is almost equated with Buddhism itself" (Conze 1962). In contrast, the current scientific approach has been adapted to Western secular context to treat patients with physical and psychological conditions (Epel, et al. 2009).

Consistent with Buddhist tenets, mindfulness practice does not demand adherence to or belief in any particular religious or ideological system, except observing certain ethical manners for healthy social interaction. Because mindfulness is about attention, it is a universal phenomenon rather than Buddhist, as Buddhist traditions themselves recognize (Kabat-Zinn 1985).

Some concerns

Some concerns have been raised by mindfulness practitioners regarding the intentions and implications of this recent mindfulness research movement. In the light of history that shows us how science approaches its subjects and how its findings are being used to cause so much suffering to humans, animals and the environment, this concern needs to be taken seriously (Wallace 2007). Others are concerned

that secularization of this technique may undervalue its original spiritual significance. As this technique has been practiced for more than 2,500 years without needing scientific experimentation, one can question the need for further research to validate its usefulness. Perhaps it is true in the East practitioners did not study the mind in the same way as it is done in the West, but this does not mean that their approaches, methodologies and findings are less scientific (De Silva 1973). Kabat-Zinn has openly said that even if there is no science of mindfulness he would still continue to practice it for it has its own logic and validity (Kabat-Zinn 2003).

However, questioning with the intention of knowing is not a sign of disrespect in the Buddha's eyes. Buddhist teachings, and a particular technique like mindfulness, are sacred for Buddhists for good reasons. However, putting mindfulness to test does not mean that its sacredness will be lost. It is in the spirit of Buddha's advice that we should investigate the '*dhamma*', his teachings, as investigation into the '*dhamma*' with good intention, not blind, unfounded faith, is what reinforces one's faith, '*saddhā*', and confidence in one's practice. As such, constructive communication and sharing views and findings in both science and Buddhism can be mutually beneficial. Current interest in mindfulness technique has provided a ground for such interface between Buddhist psychology and psychotherapy: Buddhism has given us a verifiable, robust theory that we can validate with modern technologies, which are good at measuring, quantifying, and analyzing.

Psychological methodologies, such as assessments and diagnostic tools, can be helpful, particularly in the initial stage of introducing mindfulness technique to someone who

is new. There are now some useful psychological assessment instruments to gauge individual differences in states of one's awareness (Brown & Ryan 2003). Considering the enormous work that go into constructing such instruments, they should be appreciated for what they are, without denying their limitations and biases in understanding a complex subject like the human mind. Buddhist tradition also recognizes that the objective of self-transcendence presupposes the necessity for transforming certain personality factors: this requires closer observation to understand the personality type and the modes of behavior of an adept so that guidance and practice can be given appropriately to the individual. For instance, in the early Buddhist traditions before a meditation method, '*kammaṭṭhāna*', was given, an adept's psychological maturity and capability had to be considered by the instructor, '*kammaṭṭhācariya*'. Character traits are thus studied before a meditation object is chosen ('*puggala paññatti'*).

Interest in mindfulness technique has also influenced psychology to pay attention to the importance of studying the positive aspect of the mind. Studies show that one of the factors that has been found in mindfulness technique to reduce stress is its promotion of positive attitude to life (Jacob, et al. 2011). Recent movements in positive psychology indicate that some psychologists have begun to appreciate the importance of fostering mental well-being, besides dealing with the psychopathology that has been the main focus in therapy (Seligman 1995). Hence, mindfulness technique and Buddhist psychology can be called precursors of this movement, an invaluable resource/model for research in this direction.

Concept of mental disorders in Buddhist psychology and psychotherapy

The Buddhist paradigm underlying its psychology and therapy is far more complex than its counterpart in Western psychology. We need to be cautious in approaching and using mindfulness as a therapeutic intervention not only because it is a difficult and complex subject but also because, as conceived within the Buddhist context, its aims extend beyond what is expected in the current understanding and practice of psychotherapy. Buddhist mindfulness practice has been seen as a practice oriented toward a higher goal, to awaken and attain the highest form of happiness, and optimal mental health. Thus, to call it a form of therapy is misleading or certainly limiting its scope and purpose, as if its aim is to deal with some psychological pathology, and its use limited to a few who are supposedly suffering from behavioral and psychological disorders. What is hence necessary is to shed light on both to see where they can be complementary and mutually enriching.

Although both psychotherapy and mindfulness technique are concerned with understanding and helping people deal with their suffering, the suffering that psychotherapy is concerned with is limited to those who are clinically diagnosed as having mental disorders, whereas in Buddhist psychology the suffering caused by mental disorders is conceptualized as part of a broader concept of '*dukkha*', which affects everyone. The way the Pali word '*dukkha*' has been rendered has given rise to the popular but false belief that Buddhism advocates a pessimistic attitude to life (De Silva 1973). The Buddhist view on life is not only realistic but optimistic. Life is seen as sacred and a rare phenomenon. Suffering is not the intrinsic nature of life but the natural outcome of the way life is normally lived, characteristic of the base level of personality, '*putujjana*'. But

the personality can be developed to the transcendental state of being, '*lokuttara*'. However, until one becomes a 'perfected person' ('*Arahant*') one is liable to some sort of mental instability or not free from the risk of becoming mentally ill for the roots of mental illnesses are within all of us.

Hailed as the greatest physician, '*bhayṣajjaguru*', Buddha stated that just as the ocean has only one taste, the taste of salt, his teaching also has one and only one taste, which is freedom from suffering. The suffering Buddhism refers to is a suffering that afflicts everyone irrespective of culture, society, socioeconomics, education, profession, and politics. As Freud noticed, there are more conflicts that cause suffering in the unconscious than what is given to our conscious awareness, which reflects the Buddhist concept of '*asavasa*'. In this sense we may call the mindfulness technique a form of therapy, for it is presented as an effective way to deal with this suffering as well. If this is the case, then everyone, not only those few who visit a therapist's office, is afflicted by this common disorder. Interestingly, there is now an official recognition of this prevalent malady and it is given a diagnostic code, ICD-9, in the International Code of Diseases (Germer 2005).

Buddhist paradigm of therapy

The objective of psychotherapy also seems to be different and limited compared with the objectives underlying mindfulness technique. Psychotherapy is limited to dealing with mental disorders and enabling a person to function in his cultural setting and social system, to help a client move from neurosis to common misery. It is very recent psychology that began to show interest in studying the positive aspect of personality. This reflects a limited conceptual system or paradigm on

the mind, person and the purpose of being; psychotherapy works on a truncated picture of the person (Bandura 1997; Mahoney 1972). The so-called scientific theory of reality that psychotherapy works on, upholds the view that what is not observable through empirical methodology does not exist. Hence, since subjective experiences belong to phenomena that are not directly amenable to such a methodology, psychological phenomena are considered in this view to be modes of behavior. As the history of ideas shows, until very recently there was resistance in the Western science to probe the mind (Wallace 2007).

The Buddhist view on person and purpose of being is far more complex and richer. Buddha discovered that human being is an evolving phenomenon ('*dullabanca manusṭṭhām*'), with an inherent potential for self-transformation and transcendence. One cannot attain Buddhahood as a celestial being, deva or in any other form of life, however alluring and blissful these may be; only a human being can attain such a state. Not only suffering but everything from mundane happiness to the highest form of happiness is all within this very being, '*nāma-rūpa*'. Personality can be developed even to the state of Buddhahood. Each state of personality is defined in terms of certain characteristics and affecting factors and conditions, '*hetu pratya*', within and without. There are negative factors impeding the process as well as positive factors that facilitate progress. One needs to understand the mechanism of each state of being in order to progress. Suffering in whatever form is the symptom, the reflection of the frustrations and fixations at the base level of personality development, or a sign of developmental arrest. Once the base level is transformed, progress is assured. Considering that the human constitution is endowed with so many positive qualities and the capacity

for self-development, it is one's right and responsibility to work toward that goal; not to do so is seen as self-disrespect.

Even though the objective of mindfulness practice has a deeper vision than solving mental disorders, such disorders are taken seriously since they are part of the suffering that Buddhism is concerned with. The underlying factors of mental disorders are the same as those involved in the ordinary way of being. Buddha having to work with people from different walks of life was well acquainted with the cases of psychopathology similar to those given in the (DSM) *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association 1994). Scientific studies and diagnosis, and interventions can be appreciated since Buddhist psychology recognizes these mental disorders. For instance, some behavior modification methods used in psychotherapy are found in Buddhist therapy as well (De Silva 1973).

Resolving a particular mental disorder does not mean one is free from the underlying dynamics that produce them. Psychotherapy is usually seen as concerned only with symptom relief, to help a client in daily functioning, as the main criterion used in defining mental illness or well-being is how a person functions in daily life. As long as one can function in the way the culture and social system one is a part of prescribes, one is considered normal. When mental or psychological issues get in one's way, interrupting dealings with family, oneself and others, then they become a problem. Part of this suffering that psychotherapy does not address is the frustration of not being able to awaken and express one's potentiality, and the factors that keep one from actualizing it.

Psychological disorders are, in Buddhist psychology, just a part of the suffering it is concerned with. Although Buddhist mindfulness practice takes psychological disorders seriously and deals with them effectively, its ultimate purpose is to develop the personality and not just to correct some pathology of personality. Understanding the mechanism of one's being, '*nāma-rūpa*', is essential not only for gaining freedom from suffering that interferes with one's daily living and functioning, but also for the actualization of one's inner potential. However, since the process of this transformation is long, one needs to learn to deal with the problems one encounters in daily living without being consumed by them. There are a number of behavioral modification techniques prescribed for dealing with such psychological and behavioral problems as well as preventive measures, quite similar to those used in psychotherapy. Though reaching this optimal state is a long and arduous process, there are many secondary benefits to be gained, such as freedom or prevention from being subject to mental disorders. Hence the aim in Buddhist mindfulness practice is curative and preventive as well as transformative.

Significance of awareness of '*nāma-rūpa*'

Even though suffering is not the intrinsic nature of life, the way life is ordinarily lived is, as the ordinary way of being is a form of attachment. The sense of self, purpose of being, happiness, etc. are all formed through attachment to certain things, which hinder awakening one's inner potential. Therefore attachment is seen as the proximate cause of suffering; if we are to be free from suffering, to awaken our potential and attain '*nibbāna*' we need to be free from attachment.

It is not the things themselves that force us to get attached; it is the perception or what we sense things to be that results in attachment, and activates our inherent reactions, such as like, dislike and other forms of attachment. We usually form our identity and relationships, seek to find meaning and happiness, and react to the environment based on information gathered through the perceptual process. However, perception cannot fathom the reality of things. For perception is a creative, engaging and complex process conditioned by many factors, and oriented toward gathering information about our environment. In the Buddhist view, our mode of cognition based on perception is not as reliable as we would like it to be. The function of perception is to create patterns, or seeing things as they are not. We usually project our thoughts and feelings on objects in nature and take those things as if they are saturated with emotional properties of their own (Fromm 1960). When these things change in appearance and behavior we get hurt and disappointed. If we realize that it is not the things themselves that cause the suffering but our own thoughts, attachments and expectations based on what we perceive them to be, we would be in a better position to regulate them. Even the reaction of the immune system is supposedly initiated by our cognitive appraisal.

According to the Noble Eightfold Path and the '*Satipaṭṭhāna sutta*' the way to be free from suffering and attain '*nibbāna*' is to see things as they are, to be aware of and gain insight into the nature of our being, '*nāma-rūpa*'. However, as our ordinary way of cognition, perception, cannot see things as they are, we need another mode of cognitive faculty, called '*sati indriya*', to help us be free from the cause of suffering. But this faculty needs to be awakened and develop. Mindfulness practice was presented to the world as an assured way of not only gaining

freedom of suffering but also of awakening one's potential, culminating in '*nibbāna*'. Perception binds us to the world; mindfulness liberates us from the tendency to get attached to things.

Mechanism of mindfulness

That mindfulness does have a positive therapeutic effect in mental and some physical disorders has been scientifically validated but the mechanism involved in effecting such positive outcome has yet to be investigated. To apply the mindfulness technique as a therapeutic intervention, one needs to know the mechanism involved, as thorough understanding of its theoretical foundation is essential even for normal meditation practice. Mindfulness as a technique may appear simple, but the application is difficult. The unassuming character of mindfulness, compared with the more colorful nature of devotion, visualization and imagination (Nyanaponika 1986), has hindered us in fully appreciating this technique.

Researchers are still trying to work out an operational definition of mindfulness. Sometimes we get the impression that just focusing attention on the breathing process or feeling is mindfulness, rather than that focusing on the breathing or feeling is part of a series of exercises designed to awaken mindfulness. Recently some researchers have recognized this distinction: "I define mindfulness operationally as *the awareness that arises by paying attention on purpose, in the present moment, and non-judgmentally*" (Kabat-Zinn 2013).

In the '*Satipaṭṭhāna sutta*', or awakening of mindfulness, the original discourse or text that introduced mindfulness practice, mindfulness is presented as a cognitive faculty, '*sati*

indriya', that needs to be awakened and develop by paying attention to the constitution of this being, '*nāma-rūpa*', its biological structure, and cognitive, emotional and behavioral activities, and function. When the reality of this being is seen as it is, suffering will dissolve and other qualities will be expressed. As Freud noticed when a client becomes conscious of his/her unconscious dynamics his/her problem is resolved. The nature of mindfulness is such that when mindfulness is there only positive things can be there, and healing will occur consequently. Once this capacity, "to see one's being as it is", is awakened and developed, that capacity will be carried over to other activities in one's life and add positive qualities to one's relation to oneself and to everything else one is dealing with.

Compassion: the therapeutic element in mindfulness

Although there are many studies that address the mindfulness technique and its clinical significance, the question of the emotional property of this mental phenomenon has hardly been explored. This deserves further examination. For any phenomenon that occurs within the body, which is a biological organism, could not be without some sensory, emotional feeling. Even '*dyānas*' or higher states of consciousness in mindfulness meditation seem to have certain emotional properties ('*Samaññapala sutta*'). So what could be the emotional property of mindfulness?

Compassion is the emotional property of mindfulness that brings about the positive healing qualities. Mindfulness technique helps one to look into the being who is suffering through the problems one is struggling with (Somaloka

2012). When we face suffering, we tend to look for something pleasurable in order to soothe the pain; in contrast, a '*bodhisattva*', a being who seeks enlightenment for the benefit of all beings, would go deeper into the problem to find where the source and the solution to the problem lies. It is this acute observation and awareness of suffering within oneself and in others that motivate a '*bodhisattva*' to search for a real solution to the problem of suffering rather than find an easy escape route. In other words, the awareness of suffering awakens and activates compassion. Compassion arises when one sees the suffering within oneself or in others, '*paradukkhesati hadaya khedanm karuṇā*'. As we observe the way we are, the continuous struggle and the suffering involved in doing and having what we want in order to make sense of who or what we are, and what we consider necessary to pursue happiness, we would begin to feel compassion for ourselves.

According to Buddhist psychology, the absence of awareness underlies all our suffering. Attachment which is the proximate cause of suffering is just the result of unawareness of '*nāma-rūpa*', or getting attached to things without knowing their true nature. '*Brahmadandana*', the greatest punishment one can give to a person, is the disassociation, excommunication, boycotting, or not paying attention to that person. Whatever good reasons we may have for ignoring or not paying much attention to another person, they are not good enough to stop the recipient from getting hurt. Not paying attention is a silent, non-verbal but very potent destructive message that is sent to a person.

One of the most effective therapeutic elements in psychotherapy happens when a client feels that (s)he is seen or heard by the therapist. We do not necessarily see what

(s)he is talking about, and may not even see any rationality in his/her problem, but we see the suffering (s)he is going through. It is the loneliness one feels when one is in a difficult situation that hurts most. The presence of awareness is like the presence of a virtuous friend, '*kalyāṇa mitta*', who sits beside us with unconditional attention and knows the pain we are in. It is not what it does but its very presence that matters. What helps clients in therapy is not so much what the therapists say or do. Clients cannot remember much of what the therapists said, but vividly remember the therapists' attitude, how they were with them, giving them their undivided attention, the caring feeling they felt. It is being with someone in pain, feeling another's pain in one's heart, that Buddhism calls '*karuṇā*' or compassion. Just to be with someone in pain without trying to do anything is not an easy task. Our usual tendency is to do something, to try to help someone get out of the situation, which in many cases only adds more to the problem. In successful therapy sessions, awareness-cum-compassion operates in the interaction between therapist and client. For instance, recognition of counter-transference may help a therapist see that his/her thinking, judgments and feelings are interfering with hearing and understanding what the client is saying and the suffering the client is going through.

The focus of '*Satipaṭṭhāna*' technique is to awaken the awareness of the '*nāma-rūpa*', body and mind. One of the reasons why we do not seem to recognize the unawareness of '*nāma-rūpa*' is the strong belief that we do know who we are, the feeling and sense of "I". But as in any other case of perception, when we look at this being called "I", or mine, what we see is an image of a self-perception created. Buddhism does recognize this sense of "I", but sees it as a

psychological construct or a conventional reality, a colorful creation of perception. Buddhism is concerned with the negative impact of this self-image: how it hinders one from paying attention to the '*nāma-rūpa*', thereby denying us access to the higher experiences. Observation of the self-image, as it operates in the ordinary way of being, reveals that though the self-image constructed through attachment to a number of things taking the body as its reference point, '*sakkāya diṭṭhi*', the body as it really is, is not seen in the self-image, just as in a play the person who acts the character is not seen. '*Satipaṭṭhāna*' technique aims at bringing this being, body and mind, who is doing the acting, not the character that is being acted out, to our attention so that we may see what it is. We are so busy with acting out the needs and demands of the self, that our assumed character hardly gets any chance even to see if there is a being at all, and all the stress placed on it and the suffering it has to go through.

When we become aware of the way we are, we begin to see the incessant struggle we have in getting hold of things, the suffering, the fear of losing, the anxiety of possible threat and loss of what we have, and the sadness involved in the process. Most importantly, it is the conflict between the desires of the self-image and the predicament of the body that stands in the way of achieving, maintaining and satisfying them, that results in dislike toward the body, '*vibhava thanha*'. The nature of the body or its predicament is felt as a formidable challenge, a threat to the self-image; when the predicament of the body is sensed, it may mobilize latent self-dislike, '*vibhavathanha, thantos*'. Just as we would feel compassion toward someone else who has such feelings, when we are aware of our own suffering, such as sadness, fear, negative attitude to our bodies, loneliness involved in being, and existential anxiety,

compassion toward this being whom we identify as "I" and mine, would also be awakened.

There is some misunderstanding about looking at one's body: some cultures even have a taboo against it. There is a difference between caring for and respecting one's body, and indulging or abusing the senses. But how can we care about something if we cannot see it properly or if what we see is not what it actually is? Some fear that paying attention to one's body might lead to obsession with one's body, narcissism. Interestingly, what Narcissus saw and fell in love with was not his body but its reflection. If he had known it was the reflection of his own body, would he still have felt the same? Obsession with things that are constructs or are related to one's self-image to the exclusion of '*nāma-rūpa*' exhausts our energy. Not knowing one's true nature and consequently failing to awaken one's potential for self-transcendence is the most powerful mental disturbance or illness.

Interestingly, from the Buddhist perspective, what we are obsessed with or react to, is not the body as it is, but what we perceive it to be. If we could see the body and anything else as it really is, our tendency to get attached would dissolve. This would result in a different relationship with and attitude to oneself and the world at large, and a peaceful mind. Instead of attachment and obsession with oneself or other things, we would be able to work on more constructive attitudes, such as loving kindness (*mettā*), compassion (*karuṇā*), rejoicing in others' happiness (*mudita*), and letting things be (*upekkhā*). Buddha, after studying and practicing many austerities and meditation methods, presented us this seemingly simple technique. We should take this mindfulness technique seriously, not with blind faith, but put it into practice, and test it.

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How Effective is Mindfulness for Anxiety Disorders?

Lobsang Rapgay

A Brief Background of Mindfulness

Mindfulness, *sati* in Pali, is defined in *Abhidharma Sangaha*, from the *Theravādin* tradition, as the process of recalling what was previously attended to. The *Abdhidharma-samuccaya,* a central Abdhidharma text from the Mahāyāna canon, shares a similar definition. However, it is in the Nikāyas, the Buddhist canon which records what is considered the actual teachings of the Buddha, that the teachings on how to cultivate mindfulness concurrently with meta-cognitive processing from a state into an enduring trait to be employed for personal transformation and liberation, is found.

There are two ways to understand mindfulness as a state. First, when it is activated consciously as the primary mental activity, and second, when it is a secondary, concurrent mental activity that is automatically activated to facilitate a primary mental activity. Abhidharma states that five secondary mental factors,

one of which is mindfulness, is necessary for any major mental activity to occur.

Mindfulness can be further classified into a regular type and a right type. Regular mindfulness refers to the above two kinds of state forms of mindfulness, and training in this type of mindfulness can lead to increasing cognitive control, self-regulation and relaxation skills to better manage psychological distress, and enhance general well-being. However, right mindfulness as the seventh component of the Noble Eightfold Path of Buddhist practice, refers to an evolved level of mindfulness, and more importantly the intent to employ mindfulness solely to overcome non-virtuous thoughts, feelings and behavior and replace them with virtuous ones.

The question then arises as to where modernized versions of mindfulness found in Burma, and those that are researched and popularized in the West, fit in. First, it is important to clarify the widespread misperception that westernized versions of mindfulness, such as Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT), are purely westernized adaptations of the original teachings of mindfulness. In fact, the origins for the westernized versions of mindfulness can be traced to the Southeast Asian Burmese tradition. In particular, the learned and respected Burmese teacher, Mahasi Sayadaw, is the likely originator of the modernized version (Sharf 2014). It appears that in order to make the teachings of mindfulness available to lay practitioners who had little to no background in the profound teachings of the Buddha as presented in the Nikāyas, Sayadaw simplified the teachings of mindfulness to something that could be easily accessible, understood and learnt. He taught that by being fully present to each moment

of experience in a non-judgmental and non-reactive manner one could eventually attain liberating insight.

However, the concept of accepting experiences in a non-judgmental and non-reactive way is fundamentally inconsistent with the Buddhist teachings of the Four Foundations of Mindfulness in the Nikāyas. For one, mindfulness is more a reflective, cognitive process that involves memory, sustained attention (*samatha*), meta-cognitive processing, and other concurrent mental activities, to carry out higher order cognitive functions. Engaging in mindfulness in a non-judgmental, non-reactive manner interferes with the development of such higher order cognitive processes.

The very purpose of right mindfulness is to differentiate between virtuous and non-virtuous thoughts, feelings and behavior through the process of valid perceptual and conceptual processing. Hence, the first perceptual and cognitive skill taught in the Four Foundations is the discrimination between long and short breaths. Since the practice requires prolonged periods of continuous discriminating between each long and short breath, it suggests that the Buddha used this simple, discriminatory task as a means to train in sustained attention (*samatha*). Developing discriminatory and categorization skills with bodily sensations lays the ground work for the subsequent ability to discriminate between virtuous thoughts, feeling and responses, and non-virtuous ones.

More specifically, the Four Foundations train to regard all judgmental thoughts, feelings and behavior as distractions to be noted and then inhibited as quickly as possible. Accepting them and letting them occur in order to process

them as suggested in the Mahasi and MBSR traditions is not recommended since the process prevents developing inhibitory skills that are critical for sustaining attention (*samatha*). Furthermore, acceptance is fundamentally a value-based attitudinal state. According to Buddhist psychology, a value is a form of preconception that will interfere with experiencing a sensation, thought or feeling as it really is. If one decides "I will accept whatever my child says happened", then after hearing the child's explanation, one may end up simply accepting what the child says, and end up inhibiting one's real feelings about how careless and forgetful the child was in the situation. Responding with acceptance in this situation will prevent the parent from teaching the child what (s)he did was carelessness, and how the situation could be handled differently.

Both Western cognitive and Buddhist psychology recognize the centrality of sustained attention for all major perceptual and cognitive performance tasks. Both traditions further agree that inhibition of distractions is a defining feature of sustained attention. Western cognitive science states, as does the teachings on Four Foundations, that allocating attention to distractive thoughts, feelings, and responses, interferes with learning to sustain attention on the object of focus. They maintain that sustained attention consumes attentional resources since the task requires enormous amount of effort and concentration. If attentional resources are not conserved, and are squandered on attending and processing distractive thoughts, feelings and reactions as recommended in the Mahasi and MBSR traditions, the ability to sustain attention will be significantly compromised.

While the modernized versions of the Burmese and Western proponents are inconsistent in a number of ways with the teachings of the Four Foundations of Mindfulness, there are strong grounds for acknowledging the effectiveness of MBSR for clinical application. What is of concern, however, for many Buddhist teachers and practitioners is when proponents of modernized versions teach them as consistent with Buddhist teachings and practice, and make little effort to clarify the major inconsistencies with the original teachings. If people are provided with accurate and honest information, then the modernized versions of mindfulness have an important place in the advancement of Buddhist teachings and practice to help people with psychiatric and health-related conditions.

However, to practice mindfulness as a pure Buddhist practice, it is critical to build upon the Mahasi and MBSR traditions with the Four Foundations of Mindfulness as taught in the Nikāyas. Right mindfulness is presented in the Nikāyas as the Four Foundations of Mindfulness of body, feelings, thoughts and dharmas. Body mindfulness is sustained attention training (*samatha* training) that involves a discriminative task of detecting whether the breath is long or short each time the practitioner breathes. What exactly does a practitioner do during this task? In order to accurately determine whether the breath is long or short during each cycle, the practitioner first relies on short term memory to recall what a long or a short breath is. The more clearly the distinction between the long and short breath is held in memory, the more efficiently, accurately and instantly will the length of the presenting breath be identified.

Research on an identical discriminative task involving a long or short bar presented visually on a screen is used widely

in behavioral research in cognitive psychology to measure sustained attention. Researchers have demonstrated with behavioral and neural evidence that both memory and attention are involved in the accurate and rapid discrimination of the length of the bar. Since the first of the four mindfulness uses a similar simple discriminative task, we can conclude that the definition of mindfulness according to Abhidharma from both the Theravādin and Mahāyāna traditions as a recollection of whatever was previously attended is supported with behavioral and neural evidence. There may, therefore, be a need to rethink the current definition of mindfulness, used by many modern prominent Theravādin teachers and scholars, as awareness of present moment experiences. In fact, this is already taking place. Highly respected scholars and practitioners in the Theravādin traditions, notably Venerable Bhikkhu Bodhi and Professor Rupert Gethin, have both revised their earlier interpretations of mindfulness from awareness to recollecting and remembering in order to conform to the early Pali canons.

Brief Review of the Scientific Literature

In the last several decades, many meta-analyses of meditation and mindfulness have been conducted by researchers. A meta-analysis is a scientific means of determining how effective a treatment is by taking several independent studies which meet certain criteria for selection, and then calculating their average effectiveness for a particular psychiatric or health-related condition. The general conclusion of these different meta-analyses is that mindfulness has a medium size effect on a host of psychiatric and health-related conditions. However, most of these meta-analyses suffer from a number of limitations that make it difficult to rely on their conclusion entirely.

The most rigorous comprehensive meta-analysis was commissioned by the US Agency for Healthcare Research and Quality, an arm of the Department of Human Resources and Health, to set recommendations for evidence-based care and treatment (Goyal, et al. 2014). The researchers from John Hopkins Medical School looked at about 7,000 studies. 41 studies that met their criteria of being randomized, with non-specific and specific controls were selected. Randomly assigning subjects to either the experimental or the active control group is critical to prevent a number of factors that could account for part of the treatment outcome. For instance, when subjects are not randomly assigned to the experimental and control groups, subjects who believe that mindfulness really work are likely to self-select themselves into the experimental group over the control group.

Out of the 41 studies, evidence of improvement was found for anxiety, depression and chronic pain. However, no support or insufficient evidence was found for negative affect, positive affect and attention. Seven of the anxiety related studies involved non-specific controls, where they received a non-anxiety related treatment that matched the MBSR experimental group in terms of length of treatment, and the amount of attention subjects received. The findings show that those who received mindfulness improved slightly more than those who received the non-anxiety treatment. Although the improvements were small, they were consistent from the conclusion of treatment to six months after the end of the treatment.

The other nine anxiety studies involved a specific active control wherein they received a comparative anxiety related treatment. Those who received mindfulness were compared

with another anxiety treatment such as spirituality. No conclusive evidence was found to show that the mindfulness group did better than the specific control group. In fact, in one study those who received a spiritual treatment did much better than the group that received mindfulness. These findings clearly suggest that while MBSR and MBCT improve general anxiety conditions such as social phobia, they are not more effective, and in some cases less effective than other treatments for anxiety conditions. However, it is important to remember the different context between how something is studied in a research setting, and real life clinical encounter between two individuals. While research findings form the basis of determining evidence-based treatment, many of the factors such as expectations, the amount of attention, and time spent with the patient in actual treatment, which are controlled in rigorous studies, are the very factors that contribute to effective patient care and treatment outcome.

Given the research evidence, and the relevance of MBSR and MBCT for clinical application, building upon MBSR and MBCT by incorporating components from the Four Foundations of Mindfulness may advance the research as well as the clinical utility of mindfulness further. In order to understand how the Four Foundations of Mindfulness might contribute toward the treatment of anxiety disorders, how MBSR works for anxiety will now be examined.

MBSR for Anxiety

There are more than five major groups of researchers who have tried to identify the main therapeutic components of MBSR. While there are overlaps, there are also varying versions of what mindfulness means among these researchers. In

general, the key components of MBSR are (1) intention, (2) non-judgmental and non-reactive awareness of each present moment of experience, (3) sensory, cognitive and emotional regulation, (4) exposure, (5) curiosity and interest, and (6) self-compassion.

Intention

Knowing what one intends to achieve and why, is critically important in accomplishing a task. It helps to motivate the individual to work toward a goal and to plan for it. When one seeks to engage in mindfulness to manage anxiety, one must be clear about one's intention to direct mindfulness toward anxiety related sensations, thoughts, feelings and responses in order to prevent them from controlling and interfering with one's daily sensory, perceptual, cognitive and behavioral processes. The intention must be recalled occasionally during the training in mindfulness in order to target the training in the right direction.

Non-judgmental and non-reactive awareness of each present moment of experience

When an anxiety related sensation, thought, feeling or response occurs, MBSR teaches one to be aware of them moment to moment without judging, or reacting to them (Kabat-Zinn 1998). The objective is to learn to accept such unwanted thoughts and feelings instead of trying to avoid their experience. Accepting them as they are allows one to then engage with and relate to them in a new way. Furthermore, this alternative way of relating to anxiety facilitates changing one's perceptual and cognitive processes rather than maladaptive contents.

Cognitive and affective self-regulation

Often when one first tries to be aware of anxiety related sensations, thoughts, feelings and responses moment to moment in a non-judgmental and non-reactive way, one may have difficulty identifying, and holding the thought or feeling since thoughts and feelings are hard to localize and retain. MBSR teaches one not to give in to one's frustration but continue to maintain a state of awareness, which will lead one to become aware of the body embodying the anxiety. By becoming aware of the sensation of tension in a particular part of the body from moment to moment in a non-judgmental and non-reactive manner, one may discover that by not working on the contents of the frustrations and trying to think about why the tension is occurring at this early stage, one may discover a new way to reduce one's tension.

Exposure

The longer one can maintain attention and awareness on the anxiety related sensation, thought or feeling in an accepting way, they will become increasingly less threatening. When tolerance of anxiety increases, one will over time notice that one's habitual pattern of reacting, worrying and catastrophizing will reduce.

Curiosity and interest

When one can tolerate the occurrence of anxious thoughts and feelings, one may become curious to know why and how a particularly anxious thought or feeling has such a huge hold and controls one's entire life. The solution is to simply allow an answer, an image or memory to unfold without actively

searching for an answer, or creating one. When one is no longer totally under the sway of one's anxiety related thoughts and feelings, and the body is relaxed, answers to questions can arise naturally and spontaneously to provide one with insights. These insights into how one thinks, feels and reacts can help one to better deal with anxiety related thoughts and feelings.

Self-compassion

Self-compassion is a more Western approach that shifts away from the Buddhist teachings of compassion toward others. Researchers on self-compassion state that self-compassion is learning to be understanding and considerate of oneself in the midst of suffering. While being judgmental, negativistic and harsh toward the self amplifies the degree of one's anxiety, self-compassion allows one to create a basis to find strength within oneself in the midst of great distress and suffering.

How is MBSR taught to patients?

Patients are instructed through prescriptive suggestions to attend to their breath and when anxiety related sensations, thoughts and feelings arise and interfere with attention on the breath, they should note and explore these thoughts and feelings with curiosity in a non-judgmental, non-reactive way. Prescriptive suggestions is a powerful mechanism of making a difficult cognitive or behavioral task appealing, possible and doable. It is the means by which hypnosis works. Research in response expectancy theory shows that response patterns can be changed in the desired direction, by using convincing suggestions to influence the expectancy of the individual. It is possible that a large part of the effectiveness of MBSR

may be due to the power of expectancies rather than increased levels of attentional control and processing. Research shows mixed results as to whether MBSR really increases attentional control. If the power of expectancies is central to MBSR's effectiveness, this may conflict with the core purpose of mindfulness which is to teach attentional control.

Another drawback of MBSR is that it leads to disassociation through teaching the patient to disengage and distance their anxiety related sensations, thoughts and feelings in order to observe them. In addition, they are taught to not-judge, not-react, and to tell themselves that all thoughts and feelings are just thoughts and feelings, not facts. This blocks out important informational processing, leading to a disassociated state. The patient may then develop aversion toward thinking through things, making tough decisions, and recalling painful childhood experiences.

The Four Foundations of Mindfulness

The Four Foundations of Mindfulness teaches one how to sustain attention on a stimulus in order to encode the details of the stimulus in the mind's eye, and then recall that information to facilitate further prolonged attention. In addition, sustained attention training involves learning how to inhibit unwanted information instantly and effectively in order to conserve attentional resources. Unlike MBSR, where limited attentional resources are expended rapidly by engaging with distractions, in the Four Foundations, attention toward distractions are conserved, so that the resources are available for the stimulus of focus. Contrary to MBSR where one accepts all experiences without judging them as good or bad, in the Four Foundations sustained attention is used as

a means to teach discrimination between different types of sensations, thoughts, feelings and behavior so that one can through self-discovery develop those that are beneficial and overcome those that are harmful.

Learning to first differentiate between two opposing objects or experiences prepares the ground for becoming aware of how one instinctually prefers one over the other. As mindfulness practice deepens, the practitioner may discover a preference for the sensations produced by the long breath as compared to the short. (S)he will gradually become aware that the preference arises because the long breath, unlike the short breath, produces a pleasant, enjoyable sensation in the body. The practitioner will then discover that there is an instant attraction to another stimulus that is perceived as producing a pleasant sensation, and an instant aversion toward one that produces an unpleasant sensation. (S)he will see how these forces are so powerful that they automatically activate an approach or an avoidance response respectively to stimuli that attract or repel. The same step-by-step processes are subsequently applied to the second and third Foundations which are feelings and thoughts respectively. Once the practitioner discovers what is beneficial and what is harmful, (s)he then engages in the last Foundation to clear the obstacles that can get in the way to realizing the beneficial while overcoming the harmful.

How can MBSR and the Four Foundations teachings be integrated for treating anxiety disorders?

When anxiety is very severe and impacts the thinking, problem solving and decision making capacity of a patient, MBSR is probably the appropriate form of mindfulness to apply.

This is because the prescriptive suggestions to accept all anxiety related sensations, thoughts and feelings makes it possible, and doable without requiring complex cognitive and affective processing. However, once the patient is able to tolerate the anxiety related sensation, thought or feeling, and is developing a curiosity toward how and why they control and possess him/her, then the patient may be ready for Four Foundations training. The patient is cognitively in a position to train in sustained attention to discriminate sensations, thoughts and feelings that are harmful and those that are beneficial. When the patient can tolerate his/her anxiety related thoughts, feelings and reactions, (s)he is then ready to overcome the obstacles that stand in the way of cultivating the beneficial thoughts, feelings and behavior and turning away from those that are not. Researchers at the University of California, Los Angles (UCLA) are working on how the best of MBSR and the Four Foundations of Mindfulness can be combined to complement cognitive behavioral therapy to develop an effective treatment of anxiety disorders.

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ACT on Buddhism [1]

Appreciating early Buddhism through Acceptance and Commitment Therapy (ACT)

→ *Piya Tan*

[In the footnotes, references with the initial "R" refer to "Reflections" by Piya Tan, followed by its unique number. For example, "R170" means "Reflection no 170." For a full list of Reflections, see the Dharmafarer website (dharmafarer.org) or Piya TAN 2009, 2011a, 2011b, 2013.]

1 What is ACT? [2]

1.1 DEFINITION AND HISTORY [3]

1.1.1 Definition. Acceptance and commitment therapy (abbreviated and pronounced as "ACT") is a contextually based

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[1] This essay contains only excerpts and the last 3 pages of the original 42-page essay, "**Buddhism as a method of self-healing**," which is ch 1 of the Sutta Discovery vol 43, Singapore: The Minding Centre, 2013, freely accessible (search key: **SD 43.1**) at dharmafarer.org. Piya Tan ©2008, 2013, 2015 (abridged).

[2] See Strosahl, 2002.

[3] See Hersen & Sledge, *Encyclopedia of Psychotherapy,* 2002:1-8.

cognitive behavioral therapy (CBT)[4] that significantly borrows from early Buddhist teachings and practices.[5] ACT attempts to teach us (the counselee) to accept, rather than control or eliminate, private experiences that are not amenable to immediate change. Acceptance is accomplished through teaching us (the counselee) to see these private experiences as conditioned verbal responses, rather than actual realities. ACT emphasizes that we (the counselee) should *approach*, rather than avoid, valued life goals, even though pursuing such goals may evoke "uncomfortable" private experiences. (Strosahl, 2002:1)

1.1.2 ACT in Buddhist light. Like many theories, systems, and methods in western psychology, "Acceptance and Commitment Therapy" speaks a remarkably Buddhist language, both in theory and practice, especially in the mindfulness aspect. Hence, it is sometimes generically spoken of as being "mindfulness-based."[6] It is now common knowledge that Buddhism has become like a gold mine from which the psychological miners mine and craft the Buddhist gold ore into remarkably useful and precious tools. This is not so much of a comparative study of ACT and Buddhism as it is a reflection on ACT as a tool for a better understanding of Buddhist psychology, especially by way of self-help through counseling and meditation. Hopefully, such an enterprise would be mutually beneficial to those interested in modern psychology and Buddhism, and those seeking personal development or healing.

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[4] See eg Baer, 2003:128. On similarities and differences of ACT and CBT, see Herbert & Forman, 2011, esp 233-263. On differences between ACT and CBT, see Hayes & Pierson, 2004:3.

[5] On Buddhist influences on CBT, see Herbert & Forman, 2011:326 f. On Buddhist influences on ACT, see special Buddhism issue of *Cognitive and Behavioral Practice* 9,1, esp Hayes, 2002.

[6] See Fruzzetti & Erikson 2010.

2 The key ACT concepts and terms

2.1 RELATIONAL FRAME THEORY (RFT)

2.1.1 A human language problem. ACT psychopathology and therapy is based on **relational frame theory (RFT)**, a comprehensive contextual theory of behavioral processes underlying language and cognition.[7] It is a post-Skinnerian account of the structural and functional properties of human language and thought that is based in contextual behaviorism. RFT views language and thought as relational behavior that is controlled by learning factors.[8]

According to Hayes, the essence of RFT is that "humans learn to relate events mutually and in combination, that this relational response is brought under the control of arbitrary contextual cues, and that the stimulus functions of events are modified by the functions of other events related to them" (2002:59). Such a relational learning behavior — deriving meaning by relating words and events, words and words, events and events by thinking, listening and speaking — is found only in humans, not in non-humans. We are conditioned with such conceptions by adults since our infancy.[9]

2.1.2 Problems of language. Even very positive environments can lead to pain through relational means, such as when a great success reminds us of past failures. Unable to avoid pain simply by avoiding external circumstances, we try to avoid negative private experiences directly, a process ACT terms as "experiential avoidance." For example, we "try to forget

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[7] Hayes, Barnes-Holmes & Roche 2001. Hayes, Shenk, Masuda & Bunting 2006:434-436.

[8] Strosahl 2002:1.

[9] 9 Lipkens, Hayes & Hayes 1993.

about" past traumas, or try not to feel anxious in situations that lead to anxiety. All such processes substantially increase our capacity for suffering. (Hayes, 2002:59)[10]

2.2 FEAR

2.2.0 Key concepts. The acronym FEAR expresses 4 of the key concepts in an ACT approach to psychopathology, that is, Fusion, Evaluation, Avoidance, and Reasoning, or more fully, cognitive fusion, verbal evaluation, experiential avoidance and reason-giving.[11] A familiarity with these key ACT ideas helps us better in understanding their psychological connections with Buddhist teachings, especially in terms of self-healing.[12]

2.2.1 Cognitive fusion

2.2.1.1 Cognitive fusion refers to the domination of *derived* functions over *direct* ones. As behavior becomes more verbally regulated, it also tends to be less reflective of direct or real experience. In other words, we perceive private experiences, such as emotions, thoughts and feelings from the perspective structured by a "private event" itself as a *fixed* mental state, rather than the perspective of an observer of that event as a *process*. We then begin to "live inside our heads" or create our own perpetual world of suffering.

The ACT term "cognitive fusion" closely parallels the Buddhist term, "conceptualization" (*mañña-na*), the verb of which is "to conceptualize" (*mañ̃ati*) [4.2.3.5]. However, in Buddhist psychology, there is a host of other verbs that describe this

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[10] See also Hayes & Smith 2005:17-32 & Törneke 2010.
[11] Hayes, Strosahl & Wilson 1999.
[12] On this section, see Hayes 2002:59 f.

"fusing" activity of the mind, such as "I-making" (*ahaṁ, kāra*),[13] "mine-making" (*mamaṁ, kāra*)[14] and reification (*tam,mayatā*).[15] On a simpler level, this is a kind of emotional reactivity.[16]

2.2.1.2 Reducing fusion or "defusion" is a key target of meditation, mindfulness, and deliteralization interventions in ACT[17] [4.2.1.3]. Indeed, in Buddhist meditation and mindfulness training, we train ourself to cut down thinking (*vitakketi*) or conceptualizing (*maññati*) — in other words, to cut down, even abandon, the use of language and concepts — so that we can shut down (as it were) the 5 physical senses — so that we can deal directly with our mind.

2.2.1.3 An alternative method (especially helpful if we are overwhelmed by thinking) is to apply wise attention (*yoniso manasikāra*) to the process itself or use the perception of impermanence (*anicca,-saññā).* Wise attention refers to habitually and mindfully regarding a thing or an event for what it really is (say, a thought or a sound), or seeing it as fluctuating (rise-and-fall) event. This is the famous "Bāhiya teaching," as recorded in **the (Arahatta) Bāhiya Sutta** (U 1.10) and **the Māluṅkya,putta Sutta** (S 35.-95), thus:

Here, in things that are to be seen, heard, sensed and cognized [known] by you:

in the seen	there will only be the seen;
in the heard	there will only be the heard;

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[13] See I: **The nature of identity**, SD 19.1.
[14] See **Mine: The nature of craving**, SD 19.3.
[15] See ***Atammayatā***, SD 19.13.
[16] See ***Anusaya***, SD 31.3 (3.2).
[17] Strosahl 2002:1.

in the sensed	there will only be the sensed;
in the cognized	there will only be the cognized.
	(U 1.10), SD 33.7 = (S 35.95,12), SD 5.9

2.2.1.4 The perception of impermanence is a simple mindfulness practice that we are advised to do constantly. Its benefit, when regularly and habitually done, is the attainment of streamwinning, the first stage in the path to full awakening, in this life itself.[18] The simplicity of this practice facilitates us, even as a beginner or a counselee, to do it as part of our therapy or as a personal practice.

2.2.2 Verbal evaluation

2.2.2.1 Verbal comparative relations are useful where they allow us to examine or evaluate conceptualized consequences, and thus facilitate problem-solving and planning. This same process, however, also opens us to experiences that are feared or wished for, thus greatly amplifying our capacity for suffering. Verbal evaluation then worsens the problem arising from cognitive fusion.

For example, a very successful person believes himself to be a "failure" because his enterprise does not produce what he had hoped for. Such a person might imagine idealistic results, but will be dissatisfied even when he achieves considerable success which is less than his imagined ideal. This is mostly because he keeps telling himself that he is a "failure," that he has not achieved his "goal."

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[18] See **(Anicca) Cakkhu S** (S 25.1), SD 16.7; **Entering the stream**, SD 3.3.

2.2.2.2 In Buddhist meditation, the meditator is often instructed to avoid mental chatter or unmindful subverbalizing, because it prevents the mind from settling and focusing. "Mental chatter" is a meditation neologism that covers a range of mental activities, especially thinking and reasoning (*vitakka,vicāra*). The verbs here are "to think" (*vitakketi*) and "to reason or ponder" (*vicāreti*)[19]. On the attaining of full focus or samadhi, *vitakka,vicāra* ("thinking and reasoning") are reduced to a subtle mental activity of "initial application and sustained application," that is, we are fully able to direct the mind to the meditation object and keep it there.[20]

2.2.3 Experiential avoidance

2.2.3.1 Experiential avoidance is the unwillingness to accept a particular private experience (such as bodily feelings, behavior, emotions, thoughts, and memories) and to endeavor to mollify their form, frequency, or situational sensitivity, even when such a neglect brings about psychological harm.[21] Ironically, the more we try to avoid the negative private events, the more they tend to recur and worsen, so that the suffering is reinforced.

Deliberate (that is, verbally self-guided) attempts to avoid private experiences remind us of the very experiences we want to avoid, deflect us from effectively attending to the current environment, and often tend to evoke the very negative emotions that we are trying to avoid. Take a simple example: if a child fears that a "ghost" might be under his bed, it does

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[19] See ***Vitakka,vicāra***, SD 33.4.

[20] See **Dhyana**, SD 8.4.

[21] Hayes, Wilson, Gifford, Follette & Strosahl 1996.

not help to say, "There is no *ghost* under your bed!" It is more helpful to say something like, "I will leave the light on, and I'm just next door, if you need me."

2.2.3.2 **The Alabbhanīya Ṭhāna Sutta** (A 5.48) gives some very practical advice on how to deal with five basic human problems, namely, decay (aging), sickness, death, destruction and failure of our own as well as of others. While an untutored worldling would be troubled by them, a noble disciple (or a wise practitioner) would not. Here is the passage on how the wise reflects on the problem of decay:

> And, bhikshus, for a noble disciple, too, what is subject to decay decays [grows old].
>
> When what is subject to *decay* does decay, he reflects thus:
>
> "I'm not the only one who, subject to *decay*, decays.
>
> For as long as there are the coming and going, passing away and rebirth of beings, for all these beings what is subject to decay decays.
>
> And when what is subject to decay decays,
> if I were to sorrow, *be stressed, mourn, beat my breast, or lament,*
> I would only fall into confusion.
> I would have no appetite for food, too.
> My body would discolor [turn ugly], too.
> I would not be able to get any work done, too.
> My enemies would rejoice.
> My friends would be saddened."
>
> So, when what is subject to *decay* decays,
>
> he sorrows not, feels stressed not, mourns not, beats not his breast, laments not, falls not into confusion.

> This, bhikshus, is called a noble disciple, not pierced by the venomous dart of sorrow, like the untutored worldling who only torments himself.
>
> The noble disciple is sorrowless, the dart drawn out, attains nirvana himself. (A 5.48), SD 42.1

This passage then applies mutatis mutandis to the other four human realities, and should be reflected accordingly. The Sutta closes with this verse on a proactive mental attitude:

> If he should know, "Not to be attained
> then, ungrieving, he would bear it thus:
> is this goal by me, or by any other,"
> "What shall I do now with resolve?"
>
> (A 5.48), SD 42.1

The Sutta here exhorts us to see the human situation as it really is: *it is subject to decay (aging), sickness, death, destruction and failure*. The idea is not to privatize or own any of these conditions, which would be foolish because everyone else, too — including those we dislike and our enemies — are subject to them. Furthermore, in learning to be habitually and wholesomely happy in this way, we are walking the path to true happiness, to nirvana itself.

2.2.3.3 **The Vitakka Saṇṭhāna Sutta** (M 20) is a remarkably instructive discourse on how to clear the mind of hindrances or distractions during meditation. The methods, however, can also be used in helping us to overcome any unwholesome thoughts in our own minds. The Sutta gives 5 methods of overcoming mental distractions, that is, (1) thought displacement, (2) aversion therapy, (3) avoidance, (4) thought reduction, and (5) will-power.

Method (1), thought displacement, is described in this way:

> Here, bhikshus, while a monk [a meditator] is attending to some sign [mental object], and there arises in him bad unwholesome thoughts connected with desire, hate or delusion, then he should turn his attention to *a different sign* connected with the wholesome. (M 20), SD 1.6

A parable then follows for each of the 5 methods. Here, it is the parable of a carpenter *using a smaller peg or nail to knock out a larger one in a piece of furniture*. This figure is based on the notion that only one thought can actually arise each moment (just as only a single bit or binary digit of computer data is transmitted each time).

If the first method fails, then we should go on to apply **method (2)**, aversion therapy. Here, we examine *the disadvantages or dangers of the unwholesome thoughts*, thus: "These thoughts are unwholesome, they are blameworthy, they bring suffering." The parable here is that of *a well-dressed young person with a carcass of a snake, a dog or a human around his neck*, which he, at once, discards with disgust.

If this second method fails, too, we should go on to apply **method (3)**, avoidance or non-attention, that is, *simply disregard* the unwholesome thoughts. Here, we have the parable of the looker, "not wishing to see sights around him, *would shut his eyes or look away in another direction*."

Should this method not work, then we should go on to **method (4)**, thought reduction, that is, we *should attend to the stilling of the thought-formation* (by progressively identifying the causes) of those bad, unwholesome thoughts. The parable

here is that of a walker who, *finding no reason for walking fast slows down, then stands, then sits down, and finally lies down to rest*.

Finally, **method 5**, that of exerting will-power, is described graphically: "*with clenched teeth and the tongue pressing on the palate*, he should subdue, restrain, attack the (bad) mind with the (good) mind." Here we have the parable of the wrestlers: "just as a strong man *holding a weaker man by the head or by the shoulders*, would restrain, subdue, attack him," even so, we should subdue the negative mind.

Although the Sutta instructs us to apply these 5 methods progressively as needed, from the Sutta title, it is clear that method (4) — **thought reduction** — is the key one. In other words, we can use just this one method as and when we are inclined or need to. Or, for that matter, we could also use any of the other four methods should we find that it works for us when needed.

2.2.4 Reason-giving

2.2.4.1 Finally, according to the ACT therapeutic process discussed here, reason-giving draws us into futile efforts to understand and explain the outcome as a method of self-control. Often the "good reasons" we give for our problems or experiences only increase experiential avoidance. Furthermore, these "reasons" only provide us with a language that reinforces our resistance to change, fearing that we would "be wrong."

The more we rationalize, the more difficult it is for us to see our issues for what they really are,[22] and the more likely we are to engage in harmful worrying, reacting to the negative moods.[23] Such rationalizing and self-rumination have very little or no benefit for us, as we helplessly fall into their rut, extending our sufferings.[24]

2.2.4.2 In Buddhist psychology, however, the term "reason-giving" (*vicāreti)* is only one of a number of mental activities at the preconscious level. In psychoanalysis, "**preconscious**" refers to "knowledge, emotions, images, etc., that are not momentarily in consciousness but which are easily accessible."[25] In the Buddhist context, "preconscious" refers to that level of private thinking, planning, reasoning and deliberating that is basically known only to ourself, and also constructs, evaluates or filters what we experience or perceive.

This level of mental processes is represented by verbs such as *vitakketi* (he thinks), *mañ̃ati* (he conceives), and *vicāreti* (he reasons), and by nouns such as *mañ̃ana* (conceptualization) and *mano,pavicāra* (mental investigation). Conceptualizing is closely related to "mental proliferation" (*papañca*), both of which refer to thoughts and ideas arising from the 3 roots of mental conception or mental proliferation, that is, craving (*taṇhā)*, view (*diṭṭhi*) and conceit (*māna*).

In short, the troubled mind incessantly talks to itself, biasedly motivated by greed, hate, delusion or fear. As these are the 4

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22 Addis & Jacobson 1996.

23 Addis & Carpenter 1999.

24 Borkovec, Hazlett-Stevens & Diaz 1999.

25 A S Reber, *The Penguin Dictionary of Psychology*, 1985:565; also Reber et al 2009.

biases (*agati*), such a state is not only unhelpful to solving the problem at hand, but aggravates it. One thought leads to many more, and they proliferate into thought-explosions (*papañca*). If the mind continues so and remains untreated and unhealed, it is likely to sink into a very pathological level.

3 Conclusion

3.1 BUDDHICIZATION OF PSYCHOLOGY?

3.1.1 Will psychology become religious? Buddhist teachings and practices have proven their human value over 2500 years, but the question for ACT and other members of the cognitive behavior therapy (CBT) family is this: What further value can they gain by considering these practices from the viewpoint of cognitive behavioral psychology? Importing Buddhist practices into cognitive behavior therapy is fine, but how far is this really helpful? Buddhist ideas and methods are two and a half millennia old, and Buddhism is already well-acculturated and deeply entrenched in many societies and communities in Asia and is now quickly spreading in the west and Westernized societies (especially Australia).

Buddhism today has its various traditions of faith, rituals, practices, and communities that support positive mindfulness and wholesome actions. Without including all such traditions can psychotherapy use Buddhist ideas and methods to their fullest benefits? If psychotherapy does include them, would it then become a religion, too?

These are questions whose answers we cannot yet know. However, since the mid-20th century, Western psychology has benefited tremendously from Buddhism. So significant is this gain that psychology now has been given a radical boost as a

family of mind sciences.[26] It is meaningful to say that this is a post-Freudian and post-Skinnerian era for the mind sciences, which in an important way is picking up from where the true pioneers of modern psychology, such as William James (1842-1910) and Wilhelm Wundt (1832-1920), left off.[27]

3.1.2 Buddhist benefits for psychology. A real step forward in empirical clinical practice could come, however, by considering these concepts and practices in scientific terms. This might lead to something new. Scientific psychology is still an adolescent. From a science viewpoint, we still do not know what is to be really gained (or lost) in the end by approaching an ancient wisdom. Moreover, Buddhism isn't any ancient religion: it has a well-tested and efficacious theoretical corpus of mind teachings, problem-solving methods, meditation system and case-histories that are rooted in ethical training, something of immeasurable value to modern psychology.

In each area examined, there are clear parallels between ACT and Buddhism. These parallels suggest that there can be a common core of understanding human nature and suffering in the light of religion and science. They also suggest that issues of acceptance, cognitive fusion and defusion, self, and valued action may be worth exploring as one way that behavior counselors might consider Buddhist concepts and practices from the point of view of modern behavioral psychology.

3.2 PSYCHOLOGIZATION OF BUDDHISM?

3.2.1 Future psychology. "Psychology is an academic discipline and therapeutic practice that emerged in the cracks

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[26] See **Meditation and consciousness**, SD 17.8c (1-5).

[27] See Kelly et al 2007 & reviews by Kennedy 2006 & by Moreira-Almeida & Koenig 2008.

made by religion as it disintegrated in the West. In the late 19th and early 20th centuries, everything from mystical experience, to the belief in an afterlife, to sexual neurosis, to possession by spirits was unceremoniously stripped from religion and taken over by the psychologists; to the extent that Sigmund Freud was able to comment, 'Religion is an illusion and it derives its strength from the fact that it falls in with our instinctual desires.'" So Sujato begins his paper on "How Buddhist traditions are transforming — and being transformed — through their relation with Western psychology" (2011).

The psychology tide rises and sweeps on unrelentingly: nowadays, we even hear of "Christian meditation" amongst the Catholics[28] and "Christian mindfulness" amongst the Protestants.[29] Unfailingly, they will, in some way, allude to breath meditation and lovingkindness cultivation in their own adaptation of Buddhist meditation methods. Meditation has indeed become all things to all people.

The roots of such urgency and assimilation go back over a century. When the Sinhala anagarika (lay renunciant) **Dharmapala** (1864-1933),[30] in 1903, attended one of William James's lectures at Harvard, James was quoted as having said to him, "Take my chair. You are better equipped to lecture

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[28] In 2001, the Buddhist monk Santikaro, a pupil of the famed Buddhadasa Bhikkhu of Thailand, was in Singapore, on invitation, to teach meditation in Damien Hall at the Church of the Blessed Sacrament, and two other Convents.

[29] On 6 June 2013, I attended (on invitation by another Buddhist elder) a Seminar on "Mindfulness and Acceptance-based Cognitive Behaviour Therapy: A Christian Perspective" (7 CPE hours) conducted at the TCA College (or Trinity College), Paya Lebar, Singapore, conducted by Rev Dr Tan Siang Yang (Senior Pastor of First Evangelical Church Glendale and Professor of Psychology at Fuller Theological Seminary, USA). The whole learning experience was so familiarly Buddhist, except with the occasional smattering of Christian testimony by the trainer.

[30] Dharmapala attended the Parliament of World Religions in Chicago, 1893: see SD 17.8c (10.3).

on psychology than I."[31] In 1904, after one of Dharmapala's meditation lectures there, on the topic of non-self, James declared, "This is the psychology everybody will be studying twenty-five years from now."[32] But, as we shall see, he was too optimistic.[33]

3.2.2 A better choice

3.2.2.1 Contemporary Buddhism and modern psychology have been mutually influencing each other since the late 19th century (when modern psychology first arose). This meeting and melding of two great systems resulted in the mainstreaming and secularizing of meditation: it is now taught by a growing number of non-Buddhists, including other religionists, and practiced by a growing cross-section of the urban community throughout the world.

Modern psychotherapies, such as ACT, adapting some of the best theories and practices that Buddhism has to offer, are in turn offering efficacious personal healing. We do not need to turn to the shamans and alternative healing, since the new psychology gives us truer and more workable explanations of pain and its relief. Would Buddhism become outmoded and obsolete, then? Not if Buddhism can carefully present its teachings and methods of self-healing as an efficacious and meaningful choice for those who may not be able to pay for the high cost of therapy, and indeed even be more efficacious than secular therapy, at least in some areas.

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[31] Ananda Guruge (ed), *Return to Righteousness: A Collection of Speeches, Essays and Letters of Anagarika Dharmapala*. Sri Lanka: Ministry of Education of Cultural Affairs, 1965:681.

[32] David Scott 2000: 335.

[33] See **Meditation and consciousness**, SD 17.8c (2.7).

3.2.2.2 What about the new and scientific explanation of life and the world? Would the new science and psychology provide us with evidence-based teachings, and displace religion, including Buddhism? Indeed, throughout history since the Renaissance, we have seen the arrogance, imagination and power of religion being tamed and contained, so that today any informed religious leader or teacher would see the advantage and necessity of presenting their faith with humility, truth and love.

Will key and defining Buddhist teachings such as karma and rebirth be outmoded? This remains to be seen. However, since they are not dogmas, but schemata for a better understanding of the meaning and purpose of life and death, we do not have to accept them at once as tenets of faith. Rather we, as Buddhists, are free to *provisionally* accept them (or even reject them, provisionally), until such time when we better understand them.

As already noted [5.2], the Buddha advises us to diligently note whether his teachings (which also applies to post-Buddha texts) are "stating the truth," whose meaning has been drawn out (*nīt'attha*), or are "pointing to the truth," whose meaning needs to be teased out (*neyy'attha*). A rule of thumb is that teachings that are unhelpful in our better understanding or practicing of meditation should be set aside (perhaps provisionally). Those teachings that conduce to mind-training should be carefully studied, taught and propagated.

We need not bowdlerize our scriptures nor ban post-Buddha literature. However, for the sake of our own social progress and spiritual health, we must see things for what they really are. We need to see the non-humans that populate the Buddha

stories for what they are; we should accept the later teachings for what they are and nothing more, that is, not to canonize them into "Buddha word." We have no right to do that (since we are not awakened), except to work on our own minds to be able to see beyond words and views, into the true reality of things.

3.2.3 Mutual benefits

3.2.3.1 BEYOND REDUCTIVE MATERIALISM. Advances in psychology in recent times may bring radical changes to the way we view religion, and grow as the roots for the future displacement of religion with "mind science." This would be a quantum leap from the kind of Buddhism currently defined and propagated by the affluent and technocrats.[34] Buddhism as mind science[35] can be a serious Buddhist's way of consistent sutta-based learning and Dharma-moved practice of the second of the 3 Buddhist trainings.

The rise of modern psychology, as such, is not a danger to Buddhism. On the contrary, "it will be the wellsprings of the continued vitality of the Buddhist traditions, as they reflect and examine themselves in the light of new and emerging understandings" (Sujato, 2001). Both Buddhism and psychology have much and mutual gain from their cross-fertilization, as noted by Sujato:

> Psychology and Buddhism have much to offer each other, when they are willing to listen and understand with

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[34] We may view our times—the 21st century—as the age of the vidyadhara or "knowledge professionals": on the various populist Buddhist ideals through the ages, see SD 17.8c (10.1).

[35] The "science" here refers to a self-knowing orientation by the avoiding of *narcissism, superstition and self-doubt*, which are gross yet pernicious manifestations of the 3 fetters of self-identity, attachment to ritual and vows, and doubt [3.3.2.2].

> humility. Psychology offers a detailed understanding of psychological development and the formation and nature of mental illness that is far more detailed than anything found in Buddhism. And Buddhism offers contemplative techniques that have been repeatedly proven to be uniquely effective, not only in relieving symptoms of mental illness, but in expanding consciousness to heights unsuspected by Freud. (Sujato, 2011)

3.2.3.2 BEYOND REDUCTIVE MATERIALISM. The Buddhism that is accepted in psychology is, of course, not the totality of the teachings and methods of the Buddha, the greatest sage of the mind who ever lived. The reason for this is clear: psychology is a *science*, while Buddhism is *spirituality*. While science looks outside at things and measures them, spirituality teaches us to look within and see ourself and others immeasurably. Will the two paths of human quest meet as a common universal discipline? Very likely as parapsychology — clear signs are already here.[36]

For the moment, the psychologists can only pick and choose from the Buddha's cornucopia of calm and wisdom, leaving aside what they cannot digest (for the moment). A promising sign is that as Buddhism becomes Westernized and globalized, we hear less or none of man-eating ogres[37] and merit-transfer[38] but more of self-transforming psychotherapy. This is what will uplift both Buddhism and psychology from their prevailing

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[36] See esp Kelly et al, *Irreducible Mind*, 2007.

[37] Besides humans, Buddhist cosmology and mythology often refer to non-humans such as devas, nagas, asuras, yakshas, gandharvas, apsaras and kimnaras. Many of these closely parallel beings in Greek myth, such as gods, serpents, titans, cyclops, minstrels, dryads and harpies respectively. See SD 36.13 (4.5): Doṇa's 4 classes of existence? & Thī 374 f nn = SD 20.7.

[38] On the "merit-transfer" controversy, see SD 2.6a (3).

reductive materialism[39]. In short, the new psychology will be a wellspring of the vital growth for the various Buddhist traditions as they reflect and renew themselves in the light of new and emerging wisdom.

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[39] "Reductive" here means the tendency to over-simplify a problem, subject or idea, esp in a crude or vague way. While modern psychology tends to define psychological merely as the process of the brain, modern Buddhists tend to define Buddhism in terms of worldly success, professional abilities, or social status, and see happiness as tangible self-achievement here and now. See eg criticism of "materialistic" meditation in David Desteno, "The morality of meditation," http://www.nytimes.com/2013/07/07/opinion/sunday/the-morality-of-meditation.html?smid=go-share. A bowdlerized version appeared in The Straits Times (Saturday 20 July 2013: D19).

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Realizing Human Happiness: Toward a Noetic Science of Matter, Mind and Spirit

David Paul Boaz Dechen Wangdu

Integrating Science and Spirit

In the 2nd century CE two great scholar-masters — Nāgārjuna in the East and Plotinus in the West — began the *nondual revolution* in human consciousness that is only just now unifying our wisdom traditions, East and West. This noetic (subject/object unity) view understands the ontological interdependence — the prior unity — of all arising phenomena with their basal primordial ground. On this nondual view then, there is no *essential* separation, no intrinsic duality of knowing subject and its appearing objects. Mind and body, spirit and matter are a unified unbounded whole (*mahabindu*).

As the developmental dialectic of human intellectual, emotional and spiritual evolution proceeds, and the cognitive estrangement of global Modern and Postmodern Scientific Materialism recedes, a "new science of consciousness" has

emerged. This new science has revealed an inchoate integral noetic paradigm that integrates our *subjective cognition*—the "soft," interior "first person" personal experience, and the transpersonal contemplative technologies of the spiritual paths of our wisdom traditions—with *objective cognition*, the "hard," exterior "third person" data sets of the neurosciences. We need hard neuroscience to explicate the hardware of brain, and a soft, contemplative science of consciousness to penetrate the software of mind. An integral noetic science of mind must utilize this epistemic "doublet" of both objective (and interobjective) and subjective (and intersubjective) methodologies as we evolve, individually and collectively, toward our next lifestage, that is ultimately, in the fullness of time, a bright new species—*Homo gnostica*.

Neuroscientists utilizing functional MRI technology with the Dalai Lama's highly trained meditators have discovered an astonishing plasticity of the brain's emotional circuits (Begely 2007). This discovery has demonstrated that negative human emotions (fear/anger) may be healed, and positive emotions (compassion/joy) generated through contemplative mind training.

Choosing Reality

Moreover, such temporary positive "state" changes may become, through contemplative practice, permanent personality "trait" changes as brief glimpses and experiences of the whole become stable consciousness structures. Contrary to the dreary neurogenetic determinism of the positivist old paradigm social sciences, negative emotions are not "hardwired" into the brain. Humans may be deluded (*avidya, hamartia*), but we are not evil. Nor does there exist a

fixed individual "happiness set point" selected by our genes. We are free to *choose* "basic goodness" — happiness itself — this inherent presence of the great whole that is always already present at the heart/*hridyam* (H.H. The Dalai Lama 2009).

Thus it is, the nondual *View* and the compassionate, non-goal directed "be here now" practice of the *Path* can transform the mind, and this changes the self-centered behavior that cloaks the compassionate *wisdom of kindness* as it spontaneously arises from our primordially present wisdom mind (gnosis, *jñāna, yeshe*). An effective lifeworld practice frees us from the destructive negative emotions (fear/anger, hostility, greed, pride), and from blind faith in the fundamentalist protoreligion that is the Scientific Materialism metaphysic — the cult of fundamentalist Scientism — with its naïve and catastrophic reduction of perfectly subjective, all-embracing nondual Spirit to mere consumable matter. This new science of consciousness is an urgent juncture in the integration, then unification of Science and Spirit, and the emergence of a truly integral noetic science of mind, nature, ethics and spirituality.

The "Hard Problem," and the Really Hard Problem of Consciousness

This incipient integral science of mind has cast new light upon the perennial "Mind-Body Problem." This is the "Hard Problem" for Western cognitive science, the neurosciences and contemporary philosophy of mind (Boaz 2014).

The problem is usually expressed as the "explanatory gap" between exterior, exoteric objective physical brain, and interior esoteric subjective awareness states, *qualia*, or phenomenal experience; in short, the gap between body/matter and mind/

spirit. Can the many dimensions of mind actually be reduced to merely objective physical/chemical "emergent properties," or epiphenomena of brain processes, as the old dualistic Scientific Materialist paradigm insists? Will scientists and philosophers ever see that this materialist/realist "web of belief" (Quine 1969) presupposes the very consciousness necessary to formulate a denial of consciousness (Boaz 2014)?

Our new post empirical, integral noetic paradigm relaxes this "taboo of subjectivity" inherent in the metaphysical dogma of the prevailing objectivist Scientific Materialism/ Scientific Realism paradigm ("The Idols of the Tribe," [blog] www.davidpaulboaz.org). The emerging integral noetic view acknowledges the urgency of a noetic science of consciousness that explores the subjective aspect of mind, particularly the emotions — our prepersonal and personal negative emotions (anger/aggression) that destroy us, and transpersonal emotions (compassion/joy) that heal us.

Our view and understanding of this apparent *problem of subjectivity* determines the root relation of knowing subject to our perceived objects — the epistemological question as to how and what we can know, and the "ontological problem" of "what there is" (Quine 1969), namely, the ultimate reality of appearing phenomena, our essential or ultimate mode of being here. In short, who am I? "No small matter is at stake. The question concerns the very way in which human life is to be lived" (Plato, *Republic, Book I*).

Note that this perennial duality of mind/body, subject/ object, self/other, finite appearance/infinite reality, matter/ spirit, humanity/God arises only at the *outer* and *inner* levels

(concept and belief) of the *four views* that are our four levels or strata of being, understanding and explanation.

The trans-rational aspects or faces of the four views are the post-empirical, trans-conceptual *innermost secret* and *nondual* understanding of phenomenal reality. Here arising and appearing reality is objectively, conventionally or *relatively* real, but its *ultimate* nature is known by our wisdom traditions to be a perfectly subjective, ontologically prior, interdependent unity of spacetime matter/energy, arising through its emptiness "groundless ground" (*shunyata, Tao, Nirguṇa Brahman*). As Buddhist *Madhyamaka's* Nāgārjuna told, "In emptiness there is not a shred of intrinsic existence." Mahāyāna Buddhist emptiness is empty of any essential, permanent, intrinsic or absolute existence.

Thus do we live in two worlds at once! These two conceptual categories, these two dimensions or realms of our being here—form and emptiness, objective and subjective, Relative and Ultimate Truth, "Small Mind" and "Big Mind," appearance and reality—arise via the subtlest nondual teaching of our wisdom traditions as variations on the theme of that essential unity of the "Two Truths" and these four levels of understanding. Thus the Two Truths are one unified truth that is invariant through all human cognitive state changes.

Now there is a subtler aspect to this problem of subjectivity. The *really* hard problem for human beings is the healing and unification of this seeming primordial split, the apparent duality of these Two Truths that are our two worlds of experience. The objective, *finite* existence of our bodymind and its actions (ethics) in the relative conventional world of cause and effect (karma) must be reconciled and reconnected

to our perfectly subjective *infinite* sourceground, the vast, acausal, atemporal unbounded whole (*Bhavaṅga, chittadhātu, mahabindu, Dzogchen*) itself. After all, our nondual supreme source is our supreme identity in which, or in whom this all arises and participates. It's who we actually are. So how do we reconnect? Or are we already connected? Let's see.

Human Happiness: Zen Mind, Wisdom Mind

An enduring commitment to the trans-rational, noetic nondual *View*, and to the relative psycho-emotional/spiritual *Path* lifts the apparent obstruction — the negative emotions of the separate self-sense, the ego-I — and reveals the fully awake, always already present indwelling *presence* of that basal primordial ground. Then gradually, then suddenly the stable *Result*, the fruit that is primordial wisdom mind (gnosis, *jñāna*) arises. And that (*tat*) is the realization of the prior epistemic unity of the Two Truths, these two modes of being here as we participate in the vast self-reflexive "implicate order" (Bohm), the all-embracing unbounded whole itself. Where there's a whole, there are participating holonic parts that are themselves less inclusive wholes. Where there are parts, there's a more inclusive subsuming whole.

As to the Result of the Path, "The fruit is no different at the pinnacle of enlightenment than it is at the primordial ground" (Adzom Rinpoche). The spontaneous compassionate expression of this great realization in our everyday lifeworld is the secret of relative happiness (*eudaemonia, felicitas*), but it is also ultimate happiness itself (*mahasuka, paramananda*); the happiness that cannot be lost.

Here is the crazy, miraculous paradox: not only do we realize this double happiness by not seeking happiness — by "letting it be as it is," as Shakyamuni Buddha told — but we utilize the ignorance/*avidya* of "Small Mind" to realize "Big Mind," our indwelling perfect wisdom mind! In other words, we utilize the relative truth of the Path, to realize the ultimate truth that is the Fruit or Result, liberation from suffering, happiness itself. We cannot *become* happy later; we can only *be* happy now. Indeed, a most unusual paradox. It is only through transformation and transmutation of the afflictive negative emotions — the ignorance/*avidya, marigpa* — inherent in being in the realm of *relative* spacetime reality, that we realize the "crazy wisdom" that is the radical freedom and happiness inherent in the all-inclusive embrace of *ultimate* reality, the conceptually unfabricated beautiful prior unity of this present moment now, but always in the context of a past and a future. An idealized "now" without a personal past and future is meaningless. Our past and future are interdependently enfolded in this moment now, while always unfolding in the timeless continuum of that very same now (Dōgen 1986).

View, Path and Result

Our wisdom traditions have a View, Path and Result. The *View* provides both conceptual and trans-conceptual noetic knowledge and insight, and an increased tolerance for the cognitive dissonance — contradiction, paradox, anxiety — of the Path. Just so, the *Path* provides the method, that ascending subtler strata of teaching, practice and courage necessary to deconstruct the self-sense, the destructive ego-I. Together, the View and the Path awaken always present wisdom mind that develops, then completes the *Result*, the fruition of enlightenment that is radical happiness itself. On this Path to

wholeness "development is envelopment" (Plotinus) at ever subtler, more inclusive levels of Spirit embrace.

From the view and understanding of the *outer* and *inner* levels or dimensions of the above Four Views, this process of the Path requires intention and effort — courage, discipline and perseverance. However, from the view and understanding of the timeless *innermost secret* and *nondual* dimensions, "It is already accomplished from the very beginning" (Garab Dorje). No problem at all. Now, there is nothing left to do. So all that we do is selfless, authentic and kind.

> When we forget ourselves we are actually the true activity of the big mind or reality itself. When we realize this fact, there is no problem whatever in this world. The purpose of our practice is to be aware of this fact... It may be too perfect for us, just now, because we are so much attached to our own feeling, to our individual existence... When we reach this understanding, we find the true meaning of our life.
>
> — *Suzuki Rōshi, Zen Mind, Beginner's Mind*

Who is it that I am? *Tat Tvam Asi*. All That I Am! Without a single exception.

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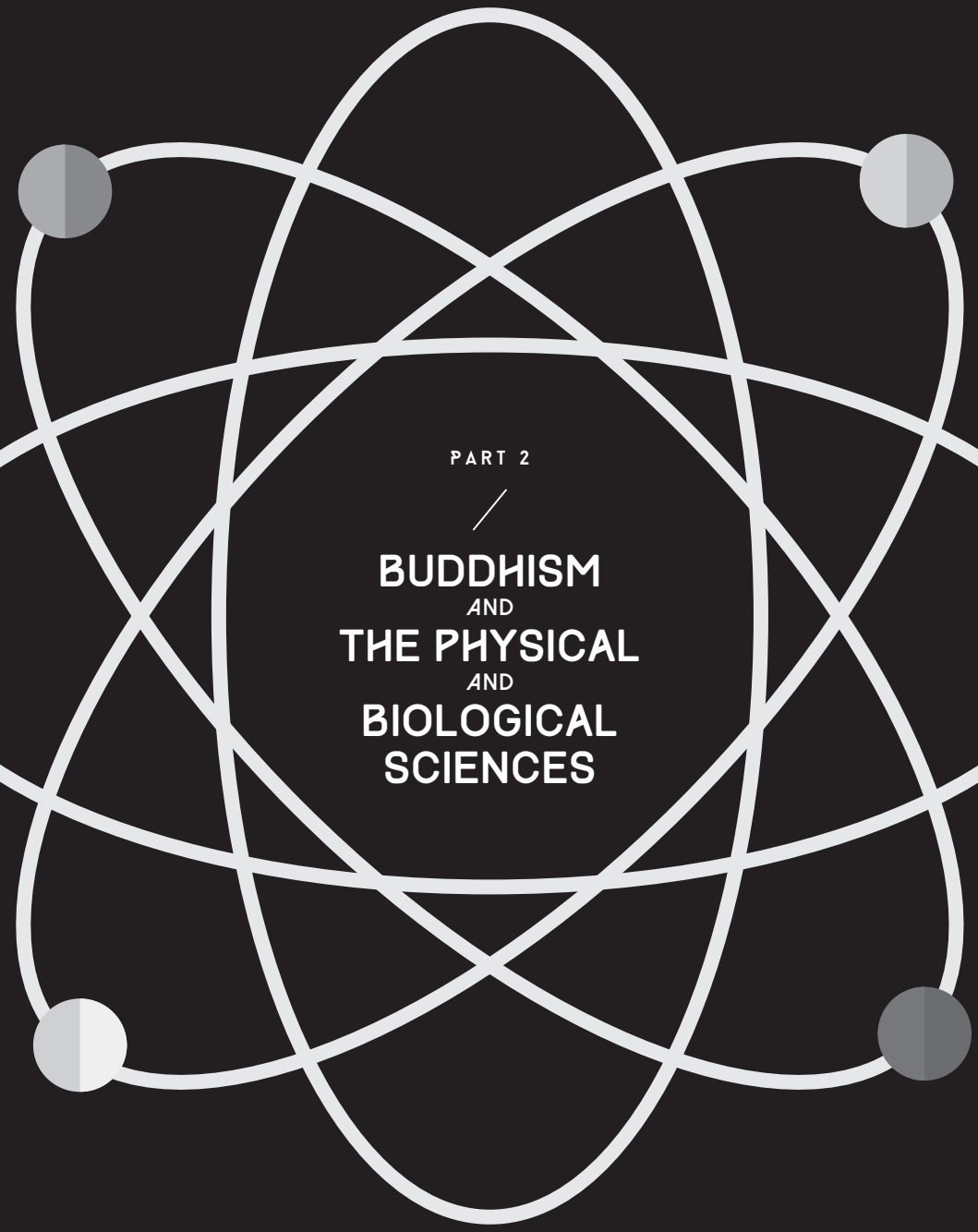

PART 2

BUDDHISM AND THE PHYSICAL AND BIOLOGICAL SCIENCES

Quantum and Abhidhamma[1]

Ankur Barua

Modern physics bears the impact of Albert Einstein more than that of any other physicist. His theory of relativity profoundly modified the notions of space, time and gravitation, and fundamentally changed and deepened our understanding of the physical and philosophical conceptualization of the universe (Jammer 1999). Although the study of the physical world was not the central focus of the traditional areas of learning and specialization in Buddhism, there are some striking similarities between Buddhist and modern scientific views regarding the concepts of time and space.

Buddhist scholars and contemplatives have developed views on matters related to the universe and its contents based on pure logical and rational thinking, even if no

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experimental model has been applied to prove or disprove these observations (Wallace 1996, 2003). These phenomena were discussed in detail in early Buddhism, the *Abhidhamma Piṭaka* (the Abhidhamma being one of the three "baskets" of the Pāli Canon — the scriptures of the Theravāda Buddhism), the *Visuddhimagga*, the Pali commentaries, *Mahāvibhāṣāśāstra*, the *Kālacakra Tantra* and in the literature on Buddhist epistemology (Bodhi 1993; Lopez 2005).

In the Theravāda Abhidhamma tradition, an atom is considered to be the smallest unit of matter which is an aggregate of a number of unitary material elements known as "rūpa-kalāpa" or a "cluster of material elements", and every cluster is delimited by intervening space such that they do not touch each other. According to the Sarvāstivāda tradition (one of the early schools of Buddhism), an atom is regarded as the smallest unit of a single unitary material element and so minute that it lacks spatial dimension. Such Buddhist concepts of matter are very close to Einstein's concept of quantum as the smallest unit of energy in the universe and to the modern theory of quarks which hypothesizes quarks as mere geometrical points in space that make up the protons and neutrons of an atom. In this essay, these concepts common to Buddhism and Einstein will be discussed.

Einstein's Theories on Quantum Physics and Relativity (Bharucha 1992; Jammer 1999; Lopez 2008)

Einstein is known for his remarkable scientific papers addressing fundamental problems on the nature of energy, matter, motion, time and space. Those theories that could be viewed in light of the Abhidhamma concept of matter are as follows:

- The quantum theory of light that Einstein put forward in March 1905. This theory dealt with the idea that light exists as tiny packets, or particles, which he called photons. Einstein theorized that we live in a quantum universe, one built out of tiny discrete chunks of energy and matter.

- The two research papers that Einstein published in April and May 1905. In one he invented a new method of counting and determining the size of the atoms or molecules in a given space and in the other he explained the phenomenon of Brownian motion. They proved that atoms exist, ending a millennia-old debate on the fundamental nature of chemical elements.

Quantum and the Concept of Matter in Abhidhamma

The Abhidhamma analysis of matter is a significant component of dhamma theory. There are in total 28 rūpa-dhammas or material elements that constitute material existence. These 28 material elements represent not only the matter that makes up living beings (organic matter), but also the matter that exists in the external world (inorganic matter). Matter is here defined as that which has the characteristic of "ruppana", which means the susceptibility to being modified or the receptivity to change due to the impact of contrary forces. This is also known as "visaduppatti" or the "genesis of dissimilarity" or change: change is the disappearance of one material element and the appearance of another material element in its place. Hence, the concept of change is not mere alteration between two stages of a single material element (Karunadasa 1989, 1996; Lopez 2008).

The four primary elements of matter recognized in Buddhism are: (a) Earth element — representing solidity and extension; (b) Water element — viscidity and fluidity; (c) Fire element — the temperature of coldness and heat; and (d) Air element — distension, fluctuation and mobility. These four primary elements are necessarily conascent and inseparable. They arise, exist and cease together and cannot be separated from one another. Except for the difference in intensity, there is no quantitative difference among these elements in the composition of material things (Karunadasa 1989; Lopez 2008; Richard and Thuan 2001).

As defined in Theravāda Abhidhamma, the earth-element (paṭhavi-dhātu) has the characteristics of solidity and extension, which means three-dimensional spatial existence, and it is present in every instance of matter. As a solid body emerges when matter occupies the three dimensions of space, every instance of matter is characterized by solidity (whatever the degree) and extension (whatever the extent). In this aspect, Theravāda Abhidhamma recognizes the Sarvāstivāda definition of matter as expressed in the concept of "pratighāta", which means resistance or impenetrability (Karunadasa 1989; Lopez 2008; Richard and Thuan 2001).

The *Visuddhimagga* (a fifth century Pāli text written in Sri Lanka by the Pāli great commentator Venerable Buddhaghosa from India) states that in a body the earth element (paṭhavi-dhātu), taken as reduced to fine dust and pounded to the size of atoms (paramāṇu), might amount to an average doṇa-measure full and is held together by the water-element (āpo-dhātu) measuring half as much. When any component of the body is reduced to the size of atoms, each atom in turn

should consist of the same four inseparable primary elements. The concept of atoms (paramāṇu) thus logically refers to an aggregate of primary elements. This is identical with kalāpa but, in a technical sense, it means the smallest cluster of material elements. As such, according to the Theravāda Abhidhamma tradition, an atom is an aggregate of a number of unitary material elements and is described not only as an atom (paramāṇu) but also as a "cluster of material elements" called "rūpa-kalāpa". Every "rūpa-kalāpa" is delimited by intervening space such that they do not touch each other, but the attractive force of the air-element keeps the atoms together from escaping. From the perspective of modern science, this indicates the possibility that some kind of electro-magnetic force exists between these elements, holding them in clusters without touching each other (Karunadasa 1989; Lopez 2008; Richard and Thuan 2001).

Although Einstein had experimentally demonstrated the existence of atoms as the smallest particles of matter, it was proved later that atoms could be further divided into its charged components of protons, electrons and neutrons which are separated from each other due to their respective electrical charges. This is thus similar to the concept of atom perceived as the "smallest cluster of material elements" in Theravāda Abhidhamma which also points to the further divisibility of atoms (Bharucha 1992). In the modern theory of "quarks" which hypothesizes quarks as mere geometrical points in space that make up the protons and neutrons of an atom, quarks are also deemed to exist as clusters to give definite shape to these structures (Karunadasa 1989; Lopez 2008).

Abhidhamma Perspectives on Einstein's Notion of Escape Velocity and Black Holes

Einstein proved the theory of escape velocity used in the astronomical studies of modern times. When a space shuttle is launched from the earth's surface, it must have an initial speed of at least 11 km/s (25,000 miles/hour). If the shuttle's launch speed exceeds this speed, it can escape Earth's gravitational field and propel into space. If the launch speed is below this escape velocity, it will fall back to Earth. The value of the escape velocity from a planet or star depends on its mass and radius. The escape velocity is directly proportional to mass but inversely proportional to the radius and volume of a substance. If a star is compressed to a smaller size without changing its mass, its escape velocity will increase. This comes about because a greater speed is needed to escape the greater gravitational force on its surface since it is more densely compressed (Bharucha 1992; Einstein 1931; Jammer 1999). Einstein's concept of the escape velocity of a non-collapsing celestial mass is here again similar to the Abhidhamma perception of non-collapsing clusters of material elements ("rūpa-kalāpa") with the attractive force of the air element holding them in position.

According to Einstein's special theory of relativity, the speed of light is the ultimate speed limit in the universe. Nothing can travel faster than light. When a star collapses to the point that its escape velocity exceeds the speed of light, nothing can escape, not even light. A black hole is simply a star that has collapsed so much that its escape velocity is greater than the speed of light. Traveling into a black hole is thus the ultimate one way trip; there is no traveling back from it. This happens when the most massive stars, at the end of their

lives, explode as supernovae. If the central core of the star left after the explosion is at least about 2 to 3 times as massive as the Sun, there is no force known to modern science that can resist the inward tug of gravity. It will continue to compress until it collapses into a black hole. Because no known force can stop the collapse, all the matter in what was once the star is compressed into a geometric point, with a radius of zero.

This point is called the singularity. The singularity has the same mass as the core of the star that collapsed into the black hole, compressed into a radius and volume of zero. It thus has an infinite density (Einstein 1931; Jammer 1999). The distance from the singularity to where the escape velocity equals the speed of light is called the Schwarzschild radius or event horizon. The Schwarzschild radius of a black hole, ten times as massive as the Sun, is 30 kilometers. Karl Schwarzschild, a German astronomer, predicted this effect from Einstein's general theory of relativity. Although nothing can escape from inside the event horizon, black holes do not automatically absorb all things nearby; it is possible to orbit a black hole without falling in (Bharucha 1992; Jammer 1999).

In the Sarvāstivāda Abhidharma tradition, an atom is considered to be the smallest unit of a single unitary material element and so minute that it lacks spatial dimension. Hence, Sarvāstivādins believe that an atom is devoid of parts and exempt from resistance or impenetrability. Bearing this concept in mind, if we presume that atoms touch each other totally without any intervening space in between, they would then all collapse into one and occupy the same locus (Karunadasa 1989; Lopez 2008; Richard and Thuan 2001; Wallace 1996). This Abhidharma understanding of the complete collapse of elementary particles of matter can thus

relate to the theory of the origination of dimensionless dark holes with enormous celestial mass.

The concept of "emptiness" in the Madhyamaka tradition of Nāgārjuna also suggests that except in "nirvāṇa" and "space", whatever we perceive through our sense organs is virtual (Bodhi 1993; Kloetzli 1983; Wallace 1996). This can be interpreted as well in scientific terms. Although dark holes have enormous celestial mass and gravitational force of attraction, they lack dimension and are mere points in the universe; they can thus be regarded as dimensionless virtual mass. Despite their existence, they remain invisible to the human eye as they absorb all the light rays that fall on them and reflect none. We see only about 10% of the total mass of the clusters in the form of the individual galaxies in the clusters; the remaining 90% is dark matter. Since dark matter has immense mass and gravitational pull to trap all the light rays that fall on them and never reflect anything, they remain invisible to the human eye. This suggests that it may not be possible to locate 90% of matter in the universe which are in the form of dark matter (Jammer 1999).

Abhidhamma and Einstein's Views on Energy for Expanding Universe

Einstein thought earlier that space was not expanding, and used in his calculations a factor named, "Cosmological Constant", to cancel the expansion effect. However, he later changed his mind and supported the theory that the universe is expanding. He confirmed this expansion of the universe by demonstrating the shift of light toward the red spectrum. The universe is considered to have a constant amount of energy from the beginning and as mass is a concentrated form of

energy, what happens is a change of energy from one type to another (Einstein 1931; Jammer 1999).

To explain the expansion of the universe, there is the theory of spontaneous generation of matter, which means that mass appears from energy to fill space, thereby contradicting the "Big Bang" theory. Scientists do not know why space is expanding. Nonetheless, measurements and observations are best explained by considering the universe to be expanding. Although there are various possible explanations put forward by modern scientists, we do not know for certain if any of these is correct (Jammer 1999; Kloetzli 1983; Wallace 1996).

In Theravāda Abhidhamma, every "cluster of material elements" ("rūpa-kalāpa") is delimited by intervening space such that they do not touch each other but the attractive force of the air-element keeps the atoms together. However, there is no mention of how close these material elements are to each other and what the dimension of their intervening space is (Karunadasa 1989; Lopez 2008; Richard and Thuan 2001). Yet, from the standpoint of modern science, the very fact that they are held in clusters, with each element separated from each other, indicates the possibility that some kind of electro-magnetic force exists between these elements. If this phenomenon is true, then the strength of this force could be the possible reasons for the expansion or collapse of the universe.

Quantum Theory and the Buddhist Concept of Dynamic Flux

Abhidhamma considers events as space-time representations in a continuous dynamic flux. Nothing is static and permanent;

everything is in a state of constant change in our universe of experience. Although there are continuous momentary changes, there is no single enduring changing entity. The Buddha was often regarded as "Tathāgata" which means "one who comes and goes thus". The Buddha gave this famous doctrine of momentariness (kṣaṇikavāda) in terms of "here and now" (Wallace 1996, 2003).

Quantum field theory also considers physical phenomena as transient manifestations of an underlying fundamental unity. Einstein further demonstrated the spontaneous and random movements of atoms, called Brownian motion, which means that nothing exists in a constant, static state in this universe. All the particles in this universe are in dynamic motion in relation to each other, with their tendency to execute random movements restricted by their strong gravitational and electro-magnetic forces, similar to the concept of dynamic flux (Einstein 1931; Jammer 1999). The Dependent Origination doctrine of the Buddha further supports this concept by considering everything in this universe that we are able to perceive through our sense organs as impermanent and subject to change. This is another Buddhist counterpart of the phenomenon of dynamic flux.

Quantum Theory and the Buddhist Concept of Double Truth

The Buddhist concept of double truth is a logical extension of dhamma theory, an innovation on the part of the Theravāda Abhidhamma. Here, we find the concept of the two levels of reality: one is amenable to analysis and the other defies further analysis. The first level is called "sammuti" because it represents conventional or relative truth or consensual reality;

the second is called "paramattha" because it represents absolute truth or ultimate reality (Karunadasa 1996, 2009).

In the Madhyamaka system, "nītārtha" (nītattha) and "neyyārtha" (neyyattha) are the equivalent terms for these 2 respective levels of truth. Nāgārjuna's analysis of "Śūnyatā" (emptiness) was based on the concept of rejection of all impositions: anything internal or external that appears to exist is in fact unreal and virtual. Likewise, Mahāyānists claim that nothing exists in our universe of experience in real form; what we perceive through our senses are all virtual and subject to continuous change (Dhammajoti 2003; Bodhi 1993; Lopez 2005).

Einstein had similarly expressed that "there is no place in this kind of physics both for the field and matter, for the field is the only reality" (Jammer 1999; Bharucha 1992). Modern quantum theory further suggests that: "the 'classical' or 'conventional' world is an illusion which is derived from the deeper quantum realm. Thus the division into the 'classical' realm and the 'quantum' realm maps onto the Buddhist distinction between the 'conventional' mode of reality and the 'ultimate' mode of reality" (Smetham 2011, 1).

Although Einstein did not agree that "the way the world actually is (ontology) depends upon the way it is known or perceived (epistemology)", some quantum theorists have supported this possibility. For instance, Max Planck argued that: "All matter originates and exists only by virtue of a force… We must assume behind this force the existence of a conscious and intelligent Mind. This Mind is the matrix of all matter" (Smetham 2011, 20).

Einstein had further wondered if the moon would exist if no one was viewing it. In response, some physicists have contended that:

> ... even an object as large as the Moon, full of atoms held together by gravity and jiggling about with the random thermal motion appropriate to its temperature, does not exist when nobody is looking at it... The Moon doesn't simply disappear when nobody is looking at it... The probability waves spread out very slowly, from the states they were in when they were last observed; the whole moon begins to dissolve away into a quantum ghost. But because the Moon is so big the process is very slow. It doesn't take a few nanoseconds but millions (perhaps billions) of years for the Moon to dissolve away into quantum uncertainty (Smetham 2011, 22).

Conclusion

We have surveyed a fraction of what Buddhists and scientists have discussed about the contents and processes of the physical world. We should keep in mind that modern science did not emerge all of a sudden from nowhere. The process of evolution of modern science was slow and some basic philosophical and logical concepts could be discerned in religious practices. A number of modern scientists believe that there are philosophical concepts of modern science embedded in Buddhism worthy of careful exploration (Bharucha 1972; Lopez 2008; Wallace 1996). The interpretation of modern scientific theories related to Einstein's theory of relativity, in the light of the perspective of Buddhism, is an effort in this direction.

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Dependent Origination, Relativity and Modern Cosmology

Ankur Barua

The Buddhist concept of dependent origination is a vision in which sentient beings are not determined by forces beyond their control; instead, they are fully integrated in the co-arising of all things. Human beings are able to take responsibilities and create better conditions for themselves and others by becoming aware of the way things arise in mutual dependence (Lopez 2005; Bodhi 1993). The most important effort is to free ourselves from delusions and attachments, and widen our circle of compassion to embrace all living creatures and nature.

Albert Einstein also upheld these concepts of Buddhism and expressed his views in the light of modern science. Besides being awarded the Nobel Prize in 1921 for his outstanding contributions to Theoretical Physics and especially for his discovery of the "Law of the Photoelectric Effect", Einstein is also noted for his struggle for human rights, social justice and

international peace. He epitomized his philosophy of religion by stating that "science without religion is lame and religion without science is blind". According to Einstein, religions are not only compatible with science but are also promoted by science. Science enhances religion is the fundamental tenet of his concept of "cosmic religion": religion is nurtured by the feeling of wonder and astonishment that accompany the discovery of the laws of nature and the awareness of harmony in the universe (Dukas and Hoffman 1954; Jammer 1999; Barucha 1992; Lopez 2008). In this essay, three philosophical concepts common to Buddhism and Einstein will be discussed.

Einstein's Theories on Relativity (Jammer 1999; Barucha 1992; Lopez 2008; Richard and Thuan 2001)

Historians call the year 1905 the "annus mirabilis" or "miracle year" because Einstein published four significant scientific papers addressing fundamental problems regarding the nature of energy, matter, motion, time and space. Those theories that could be viewed in the light of the Buddhist doctrine of dependent origination are as follows (Barucha 1992; Einstein 1931):

- The concept of special relativity that Einstein proposed in June 1905. Einstein's March 1905 paper had treated light as particles, but special relativity estimated light as a continuous field of waves. Einstein thus observed light both as wave and particle.

- Einstein's extension of special relativity in late 1905, which proved that energy and matter are linked in the most famous relationship in physics: E=mc2. (The energy content of a body is equal to the mass of the

body times the speed of light in vacuum squared). This equation predicts an evolution of energy about a million times more efficient than that obtained by ordinary physiochemical means. It led to the theory of the conservation of energy, in the form of the first law of thermodynamics, which states that the total amount of energy in any isolated system always remains constant. Although it can only be changed from one form to another, e.g. friction turns kinetic energy into thermal energy, this energy cannot be created or destroyed. If we calculate how much energy is being produced within the volume by stars and galaxies and how much energy leaves the region, the difference between the two should equal zero. Therefore, hypothetically, the energy produced by the universe is zero. Another expression of this assumption is: "the total amount of energy in the universe is always constant. It is only that one form transforms into the other".

- Einstein's completion of the General Theory of Relativity: this demonstrates that matter and energy mould the shape of space and flow of time. What we feel as the "force" of gravity is simply the sensation of following the shortest path we can through curved, four-dimensional space-time. It was a radical vision where space was no longer considered to be the box enclosing the universe. Instead, space and time, along with matter and energy, are all locked together in the most intimate embrace.

Similarities between the Buddhist Doctrine of Dependent Origination and the Views of Einstein

The doctrine of dependent origination is a key insight of Buddha's teachings, or Dhamma. Buddhism regards it as: "One who sees dependent origination sees the Dhamma; one who sees the Dhamma sees dependent origination" (*Middle Length Discourses of the Buddha*, p. 284). Dependent origination means that all phenomena arise as the result of conditions and cease when those conditions change: "When this exists, that comes to be; with the arising of this, that arises. When this does not exist, that does not come to be; with the cessation of this, that ceases" (*Connected Discourses*, p. 575). Hence, nothing exists as a static, isolated entity (Lopez 2005; Bodhi 1993). Three philosophical concepts common to Buddhism and Einstein's views will now be discussed.

Time: A Psychological Concept

"Time" has been given extensive analysis in both the Buddhist and scientific traditions. Long before Galileo Galilei or Isaac Newton, many ancient philosophers had speculated on the nature of time. One view relevant to the history of non-mathematical concept of time is Saint Augustine's suggestion that the only time is lived-time. This notion reflects the existence of "psychological time", the sense of time that we experience. It is this psychological, rather than the mathematical or scientific concept of time, that was recently explored by the German phenomenologist, Martin Heidegger. Such "psychological time" has been discussed in Buddhism as well (Jammer 1999; Barucha 1992).

The first modern scientist to work with the concept of time was Galileo. He used a simple water clock to measure relative

passages of time while rolling balls down inclined planes. Despite his pioneering efforts, he could not provide any systematic or functional definition of time. A clear definition of time did not come until Newton, who universalized time and employed the concept of time in mathematical frameworks (Jammer 1999; Barucha 1992).

According to Newton, time was universal and unchanging, and provided a backdrop with space where all events took place. This concept was based on the view that time was uni-directional and unrelated to space. Einstein's contribution to the Newtonian understanding of time was revolutionary: he considered the uni-directionality of time to be an illusion (Einstein 1931; Wallace 2003).

In Einstein's theory of relativity, time (with space) becomes relative and contingent on speed and gravity. The faster one travels or the closer one is to an object with a very strong gravitational pull, the slower time elapses (Jammer 1999; Einstein 1931; Einstein and Seeling 1954). This theory was supported by Paul Langevin, who proposed the concept of "twin paradox", predicting that one twin traveling through space at great speeds will age much more slowly than the other twin who is living on earth (Jammer 1999; Wallace 1996).

The Buddhist concept of time is equally diverse. Like "psychological time", Buddhists recognize that time can be experienced as moving faster or slower in certain situations. Buddhist contemplatives have often claimed at being able to alter their experiences of time. What others might experience as only an instant could be experienced by a person meditating as a much longer period of time. From the Buddhist perspective, when one analyzes time, it is found to not really

exist. Buddhism considers time as "conventional truth" (paññatti) and a verbal or conceptual designation imputed onto experiences of a past, present, and future. It is called "conventional" because it is only established nominally on the basis of words and thoughts. The moment we try to point to an instant of time, that time has already passed and a future moment has become the "present." In this way, we cannot technically speak of any fixed, locatable present as it always vanishes upon close examination. Because of its conventional or dependent nature, time is an excellent example of the Buddhist concept of interdependence. The present only exists dependent upon the concepts of past and future, and none of these makes sense without the others (Karunadasa 2008, 2009; Wallace 1996, 2003).

Time is also considered an imputed entity in a yet more scholastic and technical context. This is because it is identified on the basis of something that is other than itself. A substantial entity, by contrast, is something that can be pointed to and identified directly. For example, when we speak of time, we point to a clock (a substantial entity) and as we watch the seconds hand go by, we perceive that we are watching "time" pass. We have not pointed to "time" in reality, but rather perceived it through designations on things that are not time, like the clock. Although the things which serve as the basis for designations of time can be physical or mental, time itself is neither physical nor mental. Instead, time fits in a third class of phenomenon technically referred to as "non-associated composite phenomena." Here, "non-associated" means that it is neither physical nor mental, and "composite" means that time is dependent on other factors and is impermanent (Bharucha 1992; Wallace 2003, 1996).

Hence, the Buddhist concept of "psychological time" is similar to Einstein's perception that time is illusory.

Space: The Concept of "Śūnyatā" or "Emptiness"

Another major area of discussion for Buddhists, physicists and cosmologists is the nature of empty space and cosmogony. The concepts of Time and Space in relation to Buddhism represent two varieties of paññatti. They are two conceptual constructs without any corresponding objective reality. The Theravāda concept of space is found only in *Miḷindapañha* (the *Questions of King Miḷinda* or Menandar - an exegetical work of Theravāda Buddhist tradition, written by an anonymous author, approximately between the 1st century B.C to 2nd century C.E.) where space is defined as infinite (ananta), boundless (appamāna) and immeasurable (appameyya). It does not cling to anything (alagga), is not attached to anything (asatta), rests on nothing (appatiṭṭha), and does not obstruct anything (apalibuddha). The Theravādins include the space element concept in the objective field of mental objects (dhammāyatana) which means that it is not visible but can be cognized only as an object of mind-consciousness. In *Miḷindapañha*, the only two things considered to be independent of kamma, causes or season are Nibbāna and space. But it carefully avoids the use of the term "unconditioned" (asaṅkhata) and relates space as neither conditioned nor unconditioned (Karunadasa 2008, 2009; Wallace 1996, 2003; Lopez 2008).

In the Sarvāstivāda Abhidharma, the counterpart of space element is referred to as asākāśa-dhātu. The space element is either light (āloka) or darkness (tamas); therefore, it is included in the objective sense-field of the visible (rupāyatana). Besides

this, the Sarvāstivādins recognize another kind of space which is called ākāśa and not ākāśa-dhātu. It is defined not as space bound by matter, but as that which provides room for the movement of matter (yatra rūpasya gati). It is omni-present (sarvagata), eternal (nitya) and its nature is non-obstruction (anāvaraṇa-svabhāva). However, space is not the mere absence of obstruction of matter, but something passively real. Hence, in the Sarvāstivāda Abhidharma, space is elevated to the level of an unconditioned dhamma: what the Sarvāstivādins call unconditioned space is the space considered absolutely real and serving as a receptacle for the existence and movement of material phenomena (Dhammajoti 2003; Wallace 2003; Karunadasa 2009).

In the Madhyamaka system, Nāgārjuna explained the Buddhist doctrine of dependent origination in the light of "Śūnyatā" which means "void or emptiness". The space in universe is also intimately connected to this Buddhist concept of Śūnyatā or emptiness. Just as nothing can exist without space, so too can nothing exist without emptiness. Because all phenomena are empty of a static, independent and permanent existence, they can come into existence, change their forms, and pass on. Emptiness is alternatively understood through the concept of dependent origination. It is because things arise by depending on other things that they exist. The notion of a permanent and independent phenomenon therefore can never exist without interacting with anything else, and itself undergoing some changes in the process. We should realize the "absolute truth" behind the concept of "emptiness" as absence of self-entity and attachment. We should also understand that interdependence is the nature of reality in order to eliminate ignorance and free our minds from the ocean of conditioned,

karmic-driven existence (Dhammajoti 2003; Bharucha 1992; Wallace 2003, 1996).

In physics, there are highly developed mathematical theories which suggest that the empty space of a vacuum actually contains an infinite amount of energy. It is speculated that this energy has a role in the evolution of the universe. While this is still an area of controversy and mystery within theoretical physics, it makes for an approximate parallel to the Buddhist concept of empty-particles and the universe arising out of space. In Buddhist literature, empty space is an important concept in understanding the origins of the universe. It is traditionally presumed that at the beginning of a cosmic cycle, various elements arise from empty space catalyzed by the karmic winds of sentient beings. From space comes wind or kinetic energy. From wind comes fire or thermal energy. From fire comes water or fluidity. Finally, from water comes earth or solidity (Wallace 1996, 2003; Karunadasa 2009).

According to Hinduism, these five elements (space, wind, fire, water, and earth) constitute the basis for matter in the universe. But Buddhism does not accept space as a primary element for matter and regards it as paññatti, which is based on conceptual constructs without any corresponding objective reality. The whole process of cosmo-genesis, according to Buddhism, is catalyzed by the actions of living beings or kamma (Lopez 2008; Wallace 2003, 1996). When an action or kamma is performed by an individual based on lust, anger, hatred and jealousy, that action creates an imprint on one's consciousness. This karmic imprint acts as a seed that lies dormant within the consciousness, until the day it matures into a fully ripened fruit or experience. When conditions are right, this imprint would manifest itself and be part of the creation

of some new universe of experience. Thus, the universe is considered to be the space of our various kinds of kammic experiences. In the context of cosmogony, kamma is what catalyzes the formation of a new universe. From the Buddhist perspective, there are said to be multiple world systems which constantly go through a process of formation and dissipation across vast expanses of space and time without having any particular point of beginning. Einstein also accepted this concept and emphasized the volitional activities of human beings (Jammer 1999; Bharucha 1992; Wallace 1996, 2003).

The Concept of the Co-existence of Multiple Solar Systems

That the universe was produced by a "Creator God" is a commonly-held belief. Buddhism transcended this notion by emphasizing the concept of impermanence in the doctrine of dependent origination: everything arises and ceases depending on causes and conditions, which themselves arise due to causes and conditions. There is no ultimate ground or primordial cause, but a network of causes and conditions. This does away with the view of a metaphysical selfhood, a permanent and fixed entity like "Creator God", or a substance that underlies the constant changes in life. It is the delusion or ignorance of dependent origination that keeps people confused and attached to views and actions, resulting in suffering. Dependent origination is the nature of reality, regardless of whether one realizes it or not, just as the law of gravity is true irrespective of one's opinion and present before it was scientifically proven by Newton. Dependent origination is the way things are and the Buddha simply realized and confirmed it (Lopez 2005; Bodhi 1993; Bharucha 1992). Einstein did not accept the principle of a "Creator God". He

clearly expressed his views as: “I cannot conceive of a God who rewards and punishes his creatures, or has a will of the kind that we experience in ourselves. Neither can I nor would I want to conceive of an individual that survives his physical death; let feeble souls, from fear or absurd egoism, cherish such thoughts” (Wallace 2003; Bharucha 1992; Lopez 2008; Richard and Thuan 2001; Einstein 1931; Einstein and Seelig 1954).

In Buddhist literature, the cosmos are perceived to be oscillating or continuously forming, enduring for a time, and then undergoing a final period of destruction. In the metaphysical realm, Buddhism emphasizes reasoning based on the principles of impermanence and causality. Although the perception of the co-existence of multiple solar systems was present in early Buddhism, it became even more widely held with the development of the Mahāyāna tradition of Buddhism. The Mahāyāna tradition believes that there are hundreds of thousands of galaxies in the universe and each galaxy has at least one Buddha at a given point in time. In short, we find that there was a notion of multiple galaxies in ancient India and their creation was explained by the Buddhist doctrine of dependent origination (Wallace 2003; Lopez 2005; Kloetzli 1983).

This concept of the co-existence of multiple galaxies resonates in modern cosmology. Einstein's general relativity theory predicts that strong gravitational fields will bend the path of nearby light rays. A very large mass like that of an entire galaxy with an enormous gravitational field can bend light rays from Quasars, which are the most distant illuminated objects in the universe. In this way, it can act as a gravitational lens. Other scientists have also confirmed this “beaming

effect" of "gravitational lens" by observing the increase in red-shift in the visual spectrum of light in the presence of a number of galaxies directly hit by a distant beam from Quasars. The presence of more than one solar system in the universe has further been confirmed by mapping the orbital path of the planet Pluto, the last planet in our solar system. It is found that this planet revolves around the sun of some other unknown solar system (Jammer 1999; Einstein 1931; Einstein and Seelig 1954).

Conclusion

Einstein was very much influenced by such Buddhist concepts as the absence of a Creator God, the absence of a soul or self (anattā), dependent origination (paṭiccasamuppāda), impermanence (anicca), and the emphasis on practicing compassion with moral-driven, volitional activities (kamma) (Dukas and Hoffman 1953; Jammer 1999). He also predicted that the religion of the future will be a "cosmic religion": it would transcend a personal God and avoid dogma and theology, and be based on a religious sense arising from the experience of all things natural and spiritual as a meaningful unity. To Einstein, Buddhism fits this description aptly: "if there is any religion that would cope with modern scientific needs, it would be Buddhism" (Dukas and Hoffman 1954).

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Modern Cosmology and Buddhism[1]

Shuichi Yamamoto and Victor S. Kuwahara

Introduction

Since ancient times, human beings have always pondered philosophical questions relating to living organisms, the planet Earth and the universe itself. What is life? Are human beings special living organisms? What is that twinkling star in the night sky? What is the universe? How big is the universe and where does it begin and end? These are just a few questions. However, these questions can hardly be answered yet. That is, life, the earth, and the universe are still deep with mysteries in modern day science. In this article, we would like to explore the topic of the universe and compare modern cosmology with Buddhist cosmology.

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Inflationary Big Bang Theory

The most accepted theory in cosmology today is the Inflationary Big Bang theory. This theory about how the universe was born is supported by two specific observations describing the expansion of the universe and its background radiation.

The expansion of the universe is considered the single most important observation in the Big Bang theory. This observation is known as Hubble's law. Hubble discovered in 1929 (Hubble 1929, 168-173) that there is a particular proportion between the magnitude of red-shift and the distance between the Earth and galaxies. In other words, the larger the expansions of wavelength toward the red end of the spectrum (red-shift), the faster the expansion rate of the galaxy. It is understood that the larger the distance of a galaxy from Earth, the faster the galaxy moves away from the planet. In short, this phenomenon describes that the universe is expanding.

A. A. Penzias and R. W. Wilson discovered background radiation (cosmic microwaves) in space in 1965 (Penzias and Wilson 1965a, 419-421; 1965b, 1149-1154). This is electromagnetic radiation which exists in all directions in the universe and has a spectral peak at 1-2 mm in the electromagnetic wavelength spectrum. It is sometimes referred to as cosmic background radiation since it fills the entire universe and all of the background of space. Background radiation has two important attributes: 1) background radiation in the universe is extremely uniform without a particular directionality; and 2) it accounts for the relatively stable temperature of the universe at 2.7 K (Kelvin) or -270˚C (degrees Celsius).

The Big Bang theory is a method of recovering the history of the universe by returning to the origin of the universe which

is theoretically expanding today. Further, the following facts have been recently clarified by observations from the WMAP (Wilkinson Microwave Anisotropy Probe) satellite. They are: 1) the history of the universe is about 13.7 billion years old; 2) at about 380,000 (three hundred eighty thousand) years after the universe was born in exponential expansion, the background radiation was dispersed; 3) the universe is geometrically flat (this is described later); and 4) at about 200 million years after the universe started, the first stars and galaxies were born. The most interesting findings from the WMAP is that the universe, aside from all of the galaxies, comprised substantial proportions of baryonic material, unknown matter (dark matter) and mysterious energy (dark energy) which are not easily observed. As a result, it is speculated that the universe comprised 4% so-called baryonic material, 23% dark matter, and 73% dark energy. Unfortunately, the problem is that the universe mostly comprised dark matter and energy that cannot be easily observed.

Steady-State Cosmology

Another cosmology theory besides the Big Bang theory exists. This theory is called the Steady State theory (Hoyle, Burbidge, and Narlikar 2000) which was advocated in 1948 by Fred Hoyle, Thomas Gold, and Hellman Bondi. This cosmology, unlike the Big Bang theory, suggests that the universe has fundamentally always had the same appearance up to the present time. The feature of this cosmology is that there is neither a beginning nor an end in the universe. In this scenario, the universe is naturally expanding. The universe generally appears the same whenever newly-born stellar bodies expand and fill the universe. Thus, there is always a constant balance between matter and energy in space.

The steady state cosmology has recently evolved into the quasi-steady state cosmology which explains prior unexplained phenomena. The quasi-steady state cosmology asserts that many small-scale mini-bangs occur continuously with the passing of time. Since the appearance of matter and energy from nothing appears similar to that of the Big Bang theory, the quasi-steady state theory is a mini-inflation concept. The observed background radiation is explained by minute dust particles of iron or carbon that exists innumerably in the universe between galactic systems and emits light by low temperature degree.

Problems of Modern Cosmology

Between the two current cosmologies, the Big Bang theory is overwhelmingly supported. However, each cosmology also has respective problems that need to be addressed and solved (Kondo 2000).

According to the Big Bang theory, the universe comprised two competing energy sources. One is the energy from the initial explosion by the big-bang, that is, the energy of expansion, and the other energy is that of gravity within the expansion such as gravity found in galaxies, that is, the energy of contraction or shrinkage. The universe becomes geometrically flat if these two energies are balanced and expanding. The expansion is expected to stop after an infinite amount of time. On the other hand, if the energy of the expansion is larger than that of gravity, it becomes an open universe. The universe would keep expanding in this case through all eternity. Conversely, if the energy of gravity is larger than the energy of the expansion, it becomes a closed universe. In this case, the universe will

contract and shrink over time and finally settle toward a single point. This is called the Big Crunch. The current observations support the idea that the energy of a geometrically flat universe is balanced by expansion (Big Bang) energy and shrinkage (gravitational) energy. In both the inflationary Big Bang theory and the quasi-steady state theory cosmology, the universe is expanding. The problems with these two theories lie in the explanation of the red-shift of energy from galaxies. Both theories assume that the red-shift phenomenon is attributed to expansive movement. However, there are other possible explanations for the red-shift phenomena such as the natural diminish (loss of energy) of light or red-shift due to contraction.

In addition, there is another problem. The biggest problem common to both cosmologies is the simple creation of matter in the vacuum of space. In the inflationary Big Bang theory, the idea is that the entire universe was created from a vacuum of nothing 13.7 billion years ago while the quasi-steady state cosmology suggests that matter is created constantly in the vacuum of space. To put this simply, there is no difference in the conceptualization of matter from a vacuum of nothing.

The biggest problem for inflationary Big Bang cosmology is the existence of dark matter and dark energy. Dark matter and dark energy are not necessarily relevant in the quasi-steady state theory since the universe has not changed over time. However, calculations of the mass-balance of the universe suggest that the mass of galaxies (gravity) is less than that of the expansion energy. This anomaly is not possible in physics. Thus, most astrophysicists attribute the compensation to the mass of dark energy and dark matter. In other words, it is necessary to

assume that the dark matter and the dark energy compensate for the inequality in balance. Thus, the two cosmologies are difficult to confirm based on these discrepancies.

Cosmological and Anthropic Principles

There are philosophical cosmologies besides that of scientific cosmology. These are cosmological and anthropic principles (Matsuda 1983, 1990).

In the case of the cosmological principle, the universe does not have a special place, that is, it is uniform and does not have direction. In this case, human beings are merely a product in the history of the universe. On the other hand, the anthropic principle requires a reason for the existence of human beings in the present state of the universe. In this case, the universe is suitable for human beings. If this were not the case then the principle stands at the logical deduction that human beings cannot observe the universe or the universe is unobservable.

In 1957 Robert H. Dicke (1957) suggested the age of the present universe at 13.7 billion years old. The calculation of this age was partly related to the scientific experiences of human existence. In other words, the age should range within an extent of ten billion years old based on the human experience that heavy elements such as carbon could not have been made if the universe were too young. Further, if the age of the universe were too old, stable planet systems would no longer exist. However, when considering the age of the universe, we must also take into account the bias or privileged conditions of the human existence. In 1974 Brandon Carter (1974) advanced Dicke's argument suggesting that if intelligent organisms such as human beings did not exist then the universe could not

be readily observed and therefore not exist. This is the concept of anthropic principle. That is, the universe exists because an observer exists at a particular epoch, and the universe must have structure so that intelligence (human beings) can exist.

From the standpoint of anthropic principle, this universe is miraculously well-balanced. This balance is based on blended scientific observations and scientific theories. For example, if the physical constants in nature (dimensionless physical constants) were variable in time and space, then life on the planet could not exist and even a fixed star could not exist. The possibilities in the universe, e.g. (for example) the physical constants in nature, are not uniform and thus space could not be three-dimensional. However, why does the universe have a suitable structure for generating a high-degree living organism (intelligence)? Stephen W. Hawking (1988, 174) suggested that our universe is neither open nor closed, but exists with no-boundaries in space and time. He discusses that although we can envision various possible universes, the expansion of the universe is mysteriously balanced. If the universe were expanding too quickly and powerfully, then living organisms and galactic bodies could not evolve in time; if the universe were expanding too slowly and weakly then living organisms and galactic bodies could not yet exist. The only certainty from this deduction is that the universe is keenly balanced for the existence of life and planetary bodies.

Buddhist Cosmology

The most interesting aspects of self-consistent ancient Indian Buddhist cosmology are the conceptualizations of vast space, incomprehensible time and the considerations of life existence. Buddhist cosmology is well expressed in a category

of Buddhist scriptures that explains all worldly phenomena called the *Abhidharmakośa-bhāṣya* (*Kusha-ron;* henceforth, italic terms in parentheses are Buddhist terms in Japanese), written by Vasubandhu (*Seshin*) in the fourth or fifth century (Sadakata 1973). The vast cosmology is described allegorically where Mt. Sumeru (Mt. *Shumisen*) is located at the center amongst a ring of seven mountains ranges and dividing seas. There are also four continents surrounding the rings of mountain ranges and seas. Human beings live on one of the four continents shaped in the form of a trapezoid called the Embudai (*Enbushu*). The world of the Hell exists vertically under the Embudai continent, while Heaven (*Ten*) and Meditator (*Zenjo-sha*) exists vertically above it. The sun and moon rotate around the entire one-world system.

The allegoric concept of the one-world system in Buddhism with Mt. Sumeru at its center extends 13 million Yojana (*Yujun*) or 90 million km, which is comparable to the distance between the Earth and Sun. This is in exact accordance with our solar system both in name and reality. Further, 1000 (one-thousand) one-world systems are called a small-thousand-world system, 1000 (one-thousand) small-thousand-world systems are called a medium-thousand-world-system, and 1000 (one-thousand) medium-thousand-world systems are called a large-thousand-world system. This system is called a three-thousand-world system which equates to 1 billion one-world systems! The galaxy including our solar system has about 200 billion fixed stars. There may be several hundred million planet systems in the Galaxy. In this sense, the galaxy corresponds to the medium-thousand-world system in Buddhism and the large-thousand-world system may correspond to the whole universe. There is no other ancient cosmology that grasps the vastness of the universe like Buddhism at a time when

scientific knowledge was non-existent. When considering other ancient cosmology, i.e. (that is) ancient Babylonia, Egypt, Greece, and China, we find that these cultures were only able to grasp a limited one world centered on the planet Earth. In comparison, Buddhist cosmology is astronomically robust.

There are other concepts of worlds and universes in Buddhism. For example, allegorically Aksobhya (*Ashuku-butsu*) lives in the Abhirata-buddha (*Myoki-koku*) land located one thousand Buddha lands to the east of the planet Earth, Amitabha-buddha (*Amida-butsu*) lives in the Sukhavati (*Gokuraku-jōdo*) land 10 trillion Buddha lands to the west while Bhaiṣajya-guru (*Yakushi-nyorai*) lives in the *Jōruri*-land over ten Ganga-nadi-valuka (*Gogasha*)-Buddha lands to the east. Here, Ganga-nadi-valuka (*Gogasha)* is 10^{52} (ten to the power of fifty two) which is equivalent to the number of sand granules in the Ganges River. Current cosmology suggests there are 200 billion galaxies which includes each of the 200 billion fixed stars. Therefore, there are $4x10^{14}$ (four multiplied ten to the power of fourteen) fixed stars. In short, the universal view of the Buddha land suggested in Buddhism grasps a far larger world than those prescribed by modern science. One concept in present cosmology is the idea of a multi-dimensional cosmology which includes many universes. Thus, Buddhist cosmology can be said to be most similar to or resemble the multi-dimensional cosmology.

Buddhism also discusses the concept of the time continuum using the four kalpa (*kō*) periods, i.e. (that is), *jo-kō*, *ju-kō*, *e-kō* and *kū-kō* which are the four steps from construction to destruction of a star, galaxy and universe. Individually, they are: *jo-kō*, a period of creation; *ju-kō*, a period of continuity

at a stable state; *e-kō*, a period of destruction; and *kū-kō*, a period of transition in a state of emptiness. Each period is 20 kalpas. The term kalpas literally means a very long time in Buddhism, but in Hinduism it means 4.32 billion years. From this context, each step or period is about 80 billion years equating to a full cycle at 320 billion years, which is an extremely long time. These four periods are one cycle and continues eternally, the history from creation to extinction drawn in Buddhism. Therefore, the period from creation to extinction of the universe in Buddhism is far longer than that from start to present in modern cosmology.

Here it is important to note some interesting points about the relationship between life and the four kalpa periods. During the pre-*jo-kō* stage a faint wind begins to blow creating a one-world system with Mt. Sumeru at the center. The faint wind is generated from the karma of sentient beings. Once the one-world system is created the sentient beings are reborn, returning and descending, for example, from heaven or the *ju-kō* stage. When all sentient beings are reborn from the *e-kō* stage via the *kū-kō* stage, the *jo-kō* is completed. In Buddhism (Yamamoto 1998, 2001), the expression of the faint wind is the force of increasing karma, the common karma of sentient beings which creates their own environment, such as a planet, a star, a galaxy and the universe. Furthermore, the living entity is constructed by the five aggregates, i.e. (that is) body, mind and their behaviors of sentient being, from individual karma. In Buddhism, the body and mind of life is temporarily harmonized.

Conclusion

The inflationary Big Bang theory described in modern cosmology adheres to a linear method of conception, because the open or flat universe in the theory has a starting point. On the other hand, a closed universe would be an oscillating enigma which repeats the expansion and contraction cycle eternally; the universe would restart at the turning point of the Big Crunch. However, based on recent observations it appears as though the closed universe is not a possibility. The quasi-steady state cosmology continuing in a constant condition is similar to that of Buddhist cosmology in not having a beginning or an end. Buddhism is circular in thought due to the fact that the four kalpas in stars and galaxies repeat. Therefore, Buddhist cosmology might be similar to the quasi-steady state cosmology. Whether it is true or not, it is interesting to ponder why ancient people in India were able to recognize such expansive world-systems and incomprehensible time continuums. Perhaps, it might not be that ancient India recognized it physically, but that they were able to perceive inconceivable worlds through the connection between the spiritual world and the universe.

There is a large difference between modern cosmology and Buddhist cosmology. While science is fixed on the functionality and creation of matter, Buddhism is focused on the life-centric view. A life in Buddhism does not necessarily point only to a living entity, but also characterizes life force as a fundamental power or principle. Modern science investigates all phenomena from the perspective of the evolution of matter in cosmology. This is the cosmological principle. However, there is actually a large gap between material (matter) and life (living entities), and science has yet to resolve this gap. In other words, science is tasked to solve very large universal questions from only the

viewpoint of the evolution of material. The anthropic principle categorically evaluates human beings or intelligence. This principle's standpoint is different from that of Buddhism: it evaluates intelligence or human beings only, while Buddhism formulates a life-centric view.

The perspective of life and the universe in Buddhism positions life at the center of everything. In Buddhism, since the universe and the Earth are the environment for sentient beings, they are constructed by the common karma of the sentient beings. The theory of "the Earth as Gaia" by Lovelock in 1979 (1979) is similar to that of Buddhism. In the hypothesis of Gaia, life on Earth controls the environment and creates a suitable environment on the planet. In Buddhism, life activity is not only regulated by materials (matter) recognized by science, but that individual karma (life activity) also regulates and produces life from material accumulated in the environment. Therefore, the concept of karma persistently plays a central role in the functioning of the universe. Buddhism has the depth to explain well the functionality and importance of life and the environment in parallel with scientific evidence. In that sense, modern times may require a conversion of ideals.

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Energy Dynamics[1]

B. Alan Wallace

Traditional theories of vital energies developed in the classical civilisations of China, India, and Greece are commonly viewed in contemporary scientific and philosophical circles as antiquated expressions of folklore physiology. All such notions appear to be variations of the school of 'Vitalism', which held that living organisms are endowed with a kind of energy unique to life. No such energy has been found by the physical or biological sciences.

The downfall of Vitalism can be traced back to the establishment of the principle of the conservation of energy, for which Hermann von Helmholtz presented the first mathematical formulation in 1847. In a paper presented in that year, he treated mechanical phenomena, heat, light,

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electricity, and magnetism as different manifestations of energy, which he correctly foresaw would serve as a unifying principle in physics. The term 'energy' was first used as a general and fundamental concept by William Thompson two years later. In his view, energy is an objectively real, quantitatively immutable entity that is convertible and links all of nature in a web of energy transformations.

Western views

Helmholtz saw his formulation of energy conservation as key to "the complete comprehensibility of nature," (P. M. Harman, *Energy, Force and Matter: The Conceptual Development of Nineteenth Century Physics*, Cambridge University Press, 1982), which could be understood thoroughly in terms of mechanisms. For light, electricity and magnetism, such a mechanical explanation required the existence of a luminiferous ether. But in 1887, the assertion of this mechanical medium for electromagnetic energy was disproved by the renowned Michelson-Morley experiment. Looking back, Albert Einstein and his colleague Leopold Infeld declared, "All assumptions concerning ether led nowhere!" (Albert Einstein and Leopold Infeld, *The Evolution of Physics*, originally published in 1938). And this was a critical blow to the mechanistic view of nature as a whole.

In 1905, Einstein revolutionized the scientific understanding of energy with his special theory of relativity. With his famous equation E=mc2, he demonstrated that matter is convertible with energy and in fact is nothing other than a form of energy. With the subsequent development of quantum electrodynamics, energy and matter came to be viewed as oscillations of abstract field quantities in space. A far cry from

the mechanical explanation idealized in the mid-nineteenth century, particles and waves are not even oscillations of space proper, for nothing actually oscillates. In the words of physicist Henning Genz in *Nothingness: The Science of Empty Space* (Perseus Books, 1999), "Real systems are, in this sense, 'excitations of the vacuum' — much as surface waves in a pond are excitations of the pond's water... The vacuum in itself is shapeless, but it may assume specific shapes. In doing so, it becomes a physical reality, a 'real world'." This vacuum contains an infinite supply of radiation energy even at zero temperature.

The mechanical view of nature, in which the principle of energy conservation played a crucial role, has now been overthrown by physics itself. Richard Feynman concluded that the conservation of energy is a mathematical principle, not a description of a mechanism, or anything concrete. Moreover, "It is important to realize that in physics today," he acknowledged, "we have no knowledge of what energy is."

To relate this conclusion back to the origins of Western science and philosophy, Pythagoras was renowned for his claim that all things are numbers, and later Pythagoreans identified these numbers with geometrical forms. Inspired by the Pythagoreans, Plato developed his own theory that the world of appearances is derivative of an underlying realm of pure ideas. Democritus, on the other hand, claimed that the world ultimately consists of discrete atoms in motion in space and that all subjective experiences are derivative of configurations of atoms. In terms of the quantum mechanical understanding of the nature of energy, Werner Heisenberg commented in *Physics and Philosophy* (Penguin Books, 1989), "With regard to this question, modern physics takes a definite

stand against the materialism of Democritus and for Plato and the Pythagoreans."

Descartes has left science with a legacy of dividing the world into an absolutely objective realm of physical phenomena and an absolutely subjective realm of mental phenomena. In this context, classical physics came to regard energy as a primary attribute of the objective, physical world, and all subjective, mental phenomena were seen as secondary, derivative qualities of configurations of atoms. But in light of the above discussion of advances in modern physics, I would characterize the real physical world as nothing more than dynamical configurations of some kind of quantized background, about which there are a variety of mathematical ideas. These mathematical ideas serve to pick out possible regularities that may be of some predictive and explanatory value. Some believe these ideas are subjective creations of the human psyche, while others maintain they are objective entities existing independently of consciousness. But a third alternative, as Plato proposed, is that they may belong to a dimension of consciousness that transcends the ordinary human mind and that plays a key role in the formation of the universe as a whole.

Buddhist insights

Under the influence of the mechanistic views of Democritus and Descartes, physics has probed the nature of space and energy in a world devoid of consciousness and subjective experience of any kind. But the real world — the only one we know exists — is the universe of which we are conscious. Many traditional cultures have viewed this world of experience as being filled with energy, conceived in various ways. The Greek

pneuma, Indian *prana*, Tibetan *loong*, Chinese *qi*, Japanese *ki*, and Native American *mana* are all believed to be present in the human body and the surrounding environment. *Mana*, like the energy of the physicists, is thought to underlie, empower, and regulate all physical and mental phenomena.

In Buddhism, the energies coursing through the human body are investigated from a first-person perspective by first honing the attention by means of sophisticated contemplative training. Many techniques have been devised to regulate these energies with the practice of physical exercises, controlled breathing, visualisation, and mantra recitation. But another approach entails a passive mindfulness of the respiration, without trying to regulate or modify it in any way. Through such practice, the energies in the body naturally balance themselves, and in so doing, the mind is also calmed. This is a practice highly praised by the Buddha, who described its effects with these words:

> Just as in the last month of the hot season, when a mass of dust and dirt has swirled up, a great rain cloud out of season disperses it and quells it on the spot, so too concentration by mindfulness of breathing, when developed and cultivated, is peaceful and sublime, an ambrosial dwelling, and it disperses and quells on the spot detrimental unwholesome states whenever they arise. (Saṃyutta Nikāya, *The Connected Discourses of the Buddha*, Vol. II, translated by Bhikkhu Bodhi, Wisdom Publications, 2000).

The practice of mindfulness of breathing is one of many Buddhist techniques for developing the stability and vividness of attention, culminating in the highly refined state of

meditative quiescence (samatha), in which the mind can remain perfectly focused for hours on end. The development of quiescence is closely linked to three kinds of 'signs' (nimitta) that are the objects of meditation. The first of these is the sign for preliminary practice, which in the case of the mindfulness of breathing consists of the tactile sensations of the respiration. The second is the acquired sign (udgrahanimitta), which may appear to different people like a star, a cluster of gems or pearls, a wreath of flowers, a puff of smoke, a cobweb, a cloud, a lotus flower, a wheel, or a moon or sun disk. All these signs of the breath arise from the space of the mind, and their various appearances are related to the mental dispositions of individual meditators. The third is the counterpart sign (pratibhāga-nimitta), which is a subtle, emblematic representation of the whole quality of the breath, or air element, which it symbolises (Paravahera Vajirañāna, *Buddhist Meditation in Theory and Practice*, Buddhist Missionary Society, 1975).

Higher states

The experience of the counterpart sign corresponds to the achievement of meditative quiescence, which entails a dramatic shift in the energies in the body. This is initially characterised by a sense of heaviness and numbness on the top of the head, which is correlated to the emergence of an exceptional degree of mental pliancy and fitness. Vital energies that result in unprecedented physical pliancy then pervasively course through the entire body, filling it with the power of this dynamic energy. A sense of bliss then saturates the body, which, in turn, triggers an experience of mental bliss. This gradually subsides, leaving both the body and mind balanced and supple.

The achievement of quiescence marks the contemplative's initial access to a higher realm, or dimension, of existence. Prior to this achievement, one's mind was confined to what is known as the desire realm (kāmadhātu), which is so called because it is dominated by sensual desire. With the experience of the counterpart sign, the mind ascends to a realm of pure forms (rupadhātu), which is a more rarefied dimension of existence beyond the human physical senses. Upon gaining access to this realm, one's consciousness is stripped of its uniquely human characteristics, including one's ethnicity, gender, language, and other modes of biological and cultural conditioning. From this dimension of conscious experience, one transcends the limitations of human sensory perception and human concepts.

Buddhist contemplatives discuss a variety of pure forms, or ideas, that are perceived once one gains access to the form realm. These include rarefied, archetypal representations of phenomena experienced in the desire realm, including the elements of earth (solidity), water (fluidity), fire (heat), air (motility), light, and space. In addition, they claim that physical reality may be altered by the contemplative manipulation of these signs (Buddhaghosa's *The Path of Purification*, translated by Bhikkhu Ñāṇamoli, Buddhist Publication Society, 1979, Part II). While such abilities are commonly viewed in the West as miraculous, in Buddhism they are considered to be natural abilities of consciousness that have been elevated to the dimension of the form realm. The Indian Buddhist contemplatives Nāgārjuna and Asaṅga clearly state in their treatises *Precious Garland and Compendium of Higher Knowledge* that the elements perceived by our physical senses are derivative of a subtler dimension of existence.

The form realm accessed by achieving meditative quiescence bears remarkable similarities to the realm of number, geometric forms, and ideas proposed by the Pythagoreans and Plato. These are not purely objective, in the sense of existing independently of consciousness, but nor are they purely subjective in the sense of being of the human mind. Rather, they exist in a subtle dimension of experience that can be perceptually accessed by means of contemplative practice, and conceptually accessed by means of mathematical analysis. Theoretical physics provides us with conceptual, quantitative insight into the nature of space devoid of consciousness, whereas Buddhism presents experiential insights into the nature of subtle dimensions of space suffused with consciousness.

Primordial consciousness

When meditative quiescence is achieved, the human psyche, conditioned by biological and social influences, dissolves into a more fundamental dimension of consciousness known as the substrate consciousness (ālayavijñāna). This is characterised by the three qualities of bliss, luminosity, and freedom from human conceptuality. When resting in that state, what objectively appears to this consciousness is a space-like vacuity and blankness, devoid of sensory and mental appearances. This is also accessed in deep, dreamless sleep, when fainting, and in the dying process, but in those situations there is usually not enough mental clarity to recognise this mental void for what it is.

Buddhist contemplatives have probed beyond this relative vacuum state of the mind, penetrating to the deepest

dimension of awareness, known as primordial consciousness (jñāna). This is the non-local, atemporal, ultimate ground state of awareness, and it is nondual from the absolute space of phenomena (dharmadhātu), out of which the whole world of space-time and mind-matter emerges. This luminous space of primordial consciousness is also imbued with infinite energy, out of which all other forms of thermal, kinetic, electromagnetic, and gravitation energy emerge. As such, this dimension of reality transcends all conceptual dualities of matter and energy, space and time, subject and object, mind and matter, and even existence and non-existence.

In the Buddhist view known as the Great Perfection (Dzogchen), all mental and physical phenomena are viewed as manifestations of this primordial unity of infinite consciousness, space, and energy. Düdjom Lingpa, a renowned nineteenth-century Tibetan Buddhist contemplative, describes the absolute space of phenomena in this way in *The Vajra Essence* (B. Alan Wallace, trans. Alameda, CA: *Mirror of Wisdom*, 2004):

> Due to the radiant, clear aspect of space, it can appear as earth, fire, water, air, form, sound, smell, taste, and as tactile objects. That is like the appearance of various reflections, the planets, and stars due to the limpid and clear aspect of the ocean. All those reflections, planets, and stars are none other than the ocean itself, and they are of the same nature... Due to the unceasing power in the nature of primordial consciousness, there is total knowledge and total awareness of all phenomena, without its ever merging with or entering into objects. Primordial consciousness is self-originating, naturally clear, free of outer and inner obscuration; it is the all-pervasive, radiant, clear infinity of space, free of contamination.

Complementarity

According to many contemporary physicists, the energy of empty space played a key role in the formation of the universe following the Big Bang. Science writer K. C. Cole comments in *The Hole in the Universe: How Scientists Peered over the Edge of Emptiness and Found Everything* (New York: Harcourt, 2001), "Like water freezing into ice and releasing its energy into its surroundings, the 'freezing' of the vacuum liberates enormous amounts of energy... As simply as water freezing into ice, the inflated vacuum froze into the structure that gave rise to quarks, electrons, and eventually us."

This view provides deep insight into the nature of the physical universe, but it is one in which consciousness plays no role whatsoever. In contrast, according to the Great Perfection view of Buddhism, empty space, permeated by the light of consciousness is the ground of all existence. Düdjom Lingpa describes this ground as follows, "This ground is... like water in its natural, fluid state freezing in a cold wind. It is due to dualistic grasping onto subjects and objects that the ground, which is naturally free, becomes frozen into the appearances of things."

Neither the scientific nor the Buddhist view of energy is complete. The scientific view of the universe has little to say about the origins, nature, or role of consciousness in nature. And the Buddhist view has no objective, quantitative means of examining energy. Rather than viewing the modes of inquiry of these two great traditions as incompatible, it may be more fruitful to regard them as complementary. Like focusing two eyes on the same reality, with the integration of these two perspectives, we may discover a deeper, more encompassing vision than either tradition has achieved on its own.

The Potential of Emptiness: Vacuum States of Space and Consciousness[1]

B. Alan Wallace *Edited by Lynn Quirolo*

Science does some of its best work in a vacuum. Radio, television, computers, and many other life-changing and philosophy-boggling advances are the results of work with the vacuum. As it turns out, Nature may abhor a vacuum, but technology loves it.

Like Western physical science, Buddhist contemplative science also makes discoveries using vacuum states. Since the concept of emptiness is integral to Buddhist philosophic, religious, and cultural traditions, discovering wisdom in emptiness requires no paradigm shift. As technology loves a vacuum, so does insight.

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Science, both physical and contemplative, uses analogy and metaphor to extend understanding and predictive ability. Analogy and metaphor are particularly important in descriptions of realms outside the reach of the five senses. I will be drawing parallels between two manifestations of the vacuum — that of the outer world, the physical vacuum studied by physicists, and that of the inner world, the mental vacuum studied by Buddhist contemplatives — for the purpose of extending metaphor and thereby extending understanding.

Generally speaking, Western science investigates physical phenomena and Buddhist science investigates consciousness. Since Western science has as yet no method of identifying or measuring consciousness, its study as a natural phenomenon has been marginalized in modern Western science. The reverse is true in Buddhist cultures. Not known for technological innovations, in Buddhist cultures the study of consciousness is an expertise. Some rapprochement is in order, some sharing of skills and knowledge, and to facilitate this process, I will highlight the known parallels of the twin poles of the reality spectrum — the outer vacuum of physical science and the inner vacuum of contemplative science.

Preoccupied with the stunning discoveries of early science, only in the closing decades of the last century did Western scientists begin to grapple with the nature of consciousness. At this time, the West remains without an objective definition and without an objective means for detecting the presence or absence of consciousness. We have sciences of quarks, the Big Bang, galactic clusters 12 billion light years away, but we don't have a science of what makes it all possible, consciousness. Within Western science, consciousness is an anomaly.

There are some striking analogies between Western science, which studies primarily the physical world, and Buddhist contemplative science, which studies consciousness. First, a historical perspective of Western science. In the seventeenth century, Galileo (1564-1642) refined the telescope and rigorously examined celestial phenomena. His discoveries provided compelling evidence in support of the heliocentric cosmology of Copernicus. As a naturalist, Galileo placed his attention outward. As a devout Catholic, Galileo's goal was to understand the mind of the Creator by understanding His creation. Historically, Galileo shares credit for starting what was later called the Scientific Revolution and his student, Evangelista Torricelli (1608-1647), Italian mathematician and physicist, started a revolution within that revolution. Torricelli was first to remove everything material from a container within the limits of the technology of his time. Torricelli defied Nature and started the revolution of the vacuum.

In the seventeenth century, the onset of the Vacuum Revolution was not newsworthy. You can get a little bit of empty space, so what? Much better to make something. In the last three centuries, however, the vacuum has been used in hundreds of technological applications: thermometers, thermoses, radios, refrigerators, electron microscopes, x-ray tubes, particle accelerators, and, very significantly, instruments for extending our senses to more closely investigate the nature of reality. In fact, modern life as we know it depends on the vacuum.

Now step outside of Western civilization, to sixth century B.C.E India where Siddhartha Gautama was receiving contemplative training. I will call Gautama a naturalist because, like the founders of the Scientific Revolution, he was intent on

exploring the world experientially and rationally, as free from subjective bias as possible. It's unlikely that Gautama thought of himself as a founder of a new religion, for at that time in India there was no term or concept for "religion" as we conceive of it in the modern West.

Gautama, age 29, trained in a contemplative practice to create a vacuum state within his own mental space, a vacuum state of consciousness. Gautama's first teacher, Ālāra Kālāma, taught him techniques to enter a state described as "nothingness" in which the mind is voided and disengaged from the physical senses. This is a state of concentration of luminous awareness of nothing, a state more subtle than meditative stabilization, which is also described in the early literature. Gautama accomplished the state of "nothingness" very rapidly, apparently a prodigy. He wanted to go further and trained with another contemplative, Uddaka Rāmaputta, who brought him to a state even more subtle than nothingness, a state disengaged from the phenomenal and sensual world, drawn into a space purely of the mind, and then disengaging even from mind. This is subtle. When even this was accomplished, Siddhartha Gautama was not satisfied; he wanted to go further.

What Gautama did next was revolutionary. Having refined the mind, having developed extraordinary states of attentional stability and vividness, Gautama used his mind as an instrument to actively explore the nature of reality. Gautama began to explore consciousness itself and started what we can call, from a historic vantage point, a Noetic Revolution. By using states of meditative concentration to rigorously examine mental and physical phenomena, Gautama began a contemplative science parallel to the physical science of the West. The techniques are similar, the tools are very different.

The parallels between the inner science of Gautama and the outer science of Galileo lead to extremely useful metaphors. Just as Galileo did not invent the telescope but refined it as a tool for observation of the planets, Gautama did not invent meditative concentration (*samadhi*) but was first to use extremely refined, focused, magnified awareness as a tool for investigating the nature of consciousness. As the West has developed different tools for the investigation of the outer world, Gautama devised different types of mental vacuums to explore and develop consciousness. Gautama's methods, for example, extended mental perception, explored consciousness and related phenomena, and cultivated wholesome mental traits. Gautama was not interested in knowledge for knowledge sake, but believed that investigating reality should be beneficially transformative. Benefit has remained a central priority in Buddhist practice ever since.

As people of the seventeenth century did not foresee much use for the physical vacuum, contemporary Westerners may wonder what use there could be for the mental vacuum. Like the physical vacuum, the mental vacuum presents a surprising set of qualities and potentials. What is left when the turbulence — memories, thoughts, desires, emotions, mental images — has been released, is not a state of empty-headedness. Instead, the mental vacuum is a state that is luminous and vivid with an extraordinary power for concentration.

Gautama, as a naturalist, turned away from the dogma of the dominant religion of his time and studied the world rationally and empirically. Gautama's working hypothesis was that physical and mental events take place due to causes and conditions within the natural world. This is the same hypothesis held by the founders of Western science and was

as innovative in sixth century India, when phenomena—hailstorms, earthquakes—were attributed to supernatural agencies, as it was seventeenth century Europe. Naturalism, just like being of benefit, became central to the theory and practice of Buddhism.

Now let's examine the physical vacuum. What is it? In the words of James Clerk Maxwell, "The vacuum is that which is left in a vessel after we have removed everything which we can remove from it." The vacuum is defined as the lowest possible energy state of a volume of space. What can be removed depends, of course, on technology. The vacuum itself is shapeless but it may assume specific forms as it takes on the configurations of mass-energy resulting in what is conventionally called the "real world." The phrase "configurations of mass-energy" refers to everything that is around us. "Excitations of the vacuum" are commonly described as being like the surface waves on a pond. Why is an oscillation of an abstract field quantity in space not an actual oscillation of space itself? The field we are concerned with is not a substance. It is an abstract quantity, a very useful abstract quantity, but still considered by physics as an abstract quantity. Therefore, configurations of mass-energy are oscillations of an abstract quantity in empty space and no objectively real substance actually oscillates. Mass itself is sometimes referred to metaphorically as frozen energy. Additionally, general relativity theory tells us that fluctuating masses of the vacuum, despite their abstract nature, cause curvatures of space.

The physical vacuum is very weird. As described, an oscillation of an abstraction is substantial enough to curve space. But space is not so substantial either. We hear from quantum mechanics that within space, virtual particles and

antiparticles spontaneously emerge from a vacuum and become "real" little particles only if you add x energy. When energy is added to virtual particles, the resulting longevity entitles them to be called "real." If no energy is added, virtual particles dissolve right back into the vacuum. It is like instant soup without the soup, but instead of adding water, add energy.

The physical vacuum has two divisions, both having a parallel in contemplative descriptions of vacuum states of consciousness. The two divisions of the physical vacuum are (1) the false vacuum and (2) the true vacuum.

A false vacuum is the lowest possible energy state under the circumstances, but it is not completely devoid of energy. The false vacuum has energy and structure and is not perfectly symmetrical. Physicists work with false vacuums on a day-to-day basis. A false vacuum is like water that falls to a lower state, cooling and freezing as it releases energy. The false vacuum is often referred to as "frozen."

The true vacuum is called "melted." Scientists are not sure what remains once everything that nature allows us to take from a well-defined space has been removed. Again, the false vacuum is determined by the limitations of technology. But the true vacuum depends on all the laws of nature, whether they have been discovered yet or not. The true vacuum would be perfectly symmetrical. Unlike the false or frozen vacuum, in the true or melted vacuum, particles, fields, and electricity are undifferentiated. In the false or frozen vacuum, these entities are distinct from each other. To understand the true vacuum, it is necessary to thoroughly understand the false vacuum.

Scientists speculate that quantum mechanical fluctuations within a vacuum initiated not only the stuff of our world but also space-time itself. Perhaps the absolute nothingness discussed in philosophy and religion should be considered as a state wholly innocent of laws, space, and time — a state in which nothing exists but possibilities.

Now consider consciousness, inner space, the space in which dreams, mental images, thoughts, emotions, desires, hopes and fears, joys and sorrows, all arise. The fundamental discovery of Buddhist contemplatives is that the nature of consciousness is empty and luminous. Buddhist terminology is very precise in describing the characteristics of consciousness. Consciousness is empty for it is, like space, intangible and unsubstantial. Consciousness is luminous in being clear cognizance, or knowing. Additionally, consciousness can manifest in all kinds of forms. As we have just heard from physics, space also manifests, also takes on form. The difference between space and consciousness is that consciousness not only takes on form but also has a quality of being aware which, as far as we know, space does not have.

If you could observe bare consciousness, without mental states, it would appear empty and luminous. What obscure the luminosity of consciousness are thoughts, mental constructs, dullness, excitation, and an endless array of mental contents. In many aspects of science, special conditions are necessary to investigate natural phenomenon. In contemplative science, the mandatory prerequisite for the investigation of consciousness is getting to its ground state, a vacuum.

Entering the ground state of consciousness can be done. We have already drawn a parallel between physical vacuums and

vacuum states of consciousness. Now we take the analogy deeper. As physicists distinguish between false and true vacuums in the physical world, contemplatives distinguish false and true vacuum states of consciousness. The false vacuum state of consciousness is known in Buddhist literature as the *bhavaṅga*, from Pali and Sanskrit, which is a kind of substrate consciousness. The *bhavaṅga* is a relative ground state of consciousness, more vacuous than deep sleep and free of mental dullness, in which all mental activation is dormant. The *bhavaṅga* is an empty, luminous state of awareness and, like its analog, the false vacuum of physics, it is a potentially creative state.

Contemplatives follow a variety of procedures to create a mental vacuum. One common strategy is to powerfully contract consciousness by focusing on a small mental image, the smaller the object on which consciousness is focused, the more potent the consciousness becomes. When the mind is so concentrated that all physical senses have gone dormant and awareness is luminous and pure, the image is released. What is left? An absence, a vacuum state of consciousness characterized by bliss and luminosity, without thoughts, mental constructs, or images. In this state, bliss, luminosity, and non-conceptuality are experienced distinctly, just as the various attributes of the false vacuum of physics — particles, fields, and so forth — are distinct from one another.

Since differentiating, accessing, and utilizing different states of consciousness is somewhat unfamiliar terrain in the West, I'll go into a bit of detail here explaining the *bhavaṅga*, or false vacuum state of consciousness. The *bhavaṅga* is the individual ground of becoming from which all mental activities arise, both positive and negative. Positive states

include generosity, friendliness, and compassion. Negative states include malice, cruelty, and spite. Negative activations of the mind warp the mind, destroying its equilibrium. Positive activations restore the mind to a state of relative balance. However, distortions of the space of consciousness occur only when energy is invested into mental activities, positive or negative. Investing energy in mental events is called grasping or identification. When we give energy to an idea, thought, or emotion that emerges spontaneously from the *bhavaṅga*, it changes status from virtual to "real," analogous to the potentials of the false physical vacuum. With the energy of identification, the now "real" mental event starts influencing other mental activities as well as physical behavior. The *bhavaṅga* spontaneously, effortlessly, and often unpredictably gives rise to a wide range of mental activations. If one does not grasp onto them or identify with them, they tend to persist for relatively brief periods and do not perturb the equilibrium of the mind. Grasping onto and identifying with the natural phenomena of the *bhavaṅga*, the false vacuum of the mind, infuses them with energy. In a mixed terminology of Buddhism and physics, you could say that mental activations arise virtually from the ground state and then, if no energy is infused into them, disappear back into the ground.

When a mental activation is infused with energy through grasping or identification, the activation changes status from virtual to "real." Having an investment of energy, the mental event obscures the substrate consciousness by interacting with other mental, verbal, and physical activity, and leaves its imprints upon the substrate consciousness. These activities and their residue in the substrate are called karma and karmic imprints, respectively, and can accrue indefinitely with positive and negative imprints canceling each other out. This is the

contemplative understanding of the nature of consciousness that is the foundation of the Buddhist concept of karma.

According to Buddhism, the *bhavaṅga* is not a true or absolute vacuum because precognitive conceptual structuring of awareness still persists. Even though concepts such as subject and object are not manifest, awareness is still structured by conceptual and biological influences. Like its analogue in physics, the false vacuum of consciousness, the *bhavaṅga* appears to be empty but has structure and energy.

Vacuum states of consciousness, whose potentials go largely unrecognized in the West, may be responsible for as yet unexplained phenomena, such as the so-called placebo effect and other mental effects on the body that originate from a source deeper than conscious volition. Buddhist contemplatives view the substrate consciousness as the source of creativity, genius, and other potentials that can be accessed when it is drawn into consciousness. However, to tap the potentials of the substrate consciousness, it is necessary to create a mental vacuum. Studies have shown that all geniuses have something in common — exceptional degrees of sustained voluntary attention, the same ability cultivated by yogis as a spring board to developing vacuum states and exploring consciousness.

Like the false vacuum states, the true vacuum states of physics and consciousness have similarities. In Buddhist literature, the true vacuum is called primordial awareness and, like the false vacuum state, it can be realized experientially. Most Western cognitive scientists believe that the mind cannot be emptied of content; conceptual constructs and impulses are built-in, so the mind always has content. In the West, there is

a good deal of cultural anxiety concerning emptiness. "I think, therefore I am," is Descartes' famous line. But Descartes also worried what happened when he was not thinking... and then quickly moved on.

Buddhist contemplatives state that an absolute vacuum of consciousness exists and can be ascertained by direct experience. How? In a way that is unlike any other form of knowledge. The absolute vacuum of consciousness is knowing in a way that is non-conceptual, by means of identity, without any sense of subject/object duality, and simultaneously not-knowing in all the ordinary ways. The realization of the true vacuum of consciousness is by way of achieving the false vacuum of consciousness.

With finely honed awareness, a mind stable, vivid, and highly focused, one can experientially probe all mental phenomena. The primary tool for this investigation is the false vacuum of consciousness, a state that is a clean lab without noise or pollution, in which mental events arise. Within these conditions, instead of settling for bliss, one can probe deeper into the nature of mental activity. From where do mental events arise and into what do they dissolve? What is the nature of the mind that can be probed and identified in this way? This is an ontological probe into the space of the mind itself.

Buddhists contemplatives have used vacuum states to investigate the nature of the mind for 2500 years. The collective result is the discovery that there is no thing that is the mind. In the state of not finding, awareness comes to rest in a state of luminous, empty, non-duality, without any sense of subject or object. This is the absolute vacuum of consciousness and is utterly free of all conceptual constructs,

including space and time, mind and matter, even notions of existence and nonexistence. In this state, bliss, luminosity, and non-conceptuality are undifferentiated. Like the true vacuum of external space, the true vacuum of consciousness is one of perfect symmetry, for it is non-local, timeless, homogenous, and devoid of internal differentiation. This absolute ground of consciousness is called the Great Perfection.

The Buddhist contemplative science, in parallel to Western physical science, describes two types of vacuums: (1) The false vacuum, or *bhavaṅga*, the relative ground of becoming, out of which each individual mind-stream emanates; and (2) the true vacuum, or Primordial Awareness, the absolute state of phenomena out of which space and time, mind and matter, everything in the universe, emerge.

Now to wrap this up a bit. Western cognitive scientists generally regard dreaming, imagination, and waking experience as basically the same phenomenon except that waking experience is constrained by sensory stimuli from the external world. Dreaming, imagination, and waking perception are all considered to be creations of the mind. Physicists describe the physical world as configurations of mass-energy consisting of oscillations of abstract quantities in empty space that may or may not exist independent of a system of measurement. When cognitive science is combined with physics the result is something like: Everyday waking experience is an illusion constrained by the oscillations of abstract quantities in empty space — a statement that raises questions about the nature of reality and our relationship to it. If we also consider that sensory experience of space and all concepts of space and time occur in the space of consciousness, the questions deepen.

Like physicists, Buddhists have investigated the nature of physical phenomena. Using contemplative techniques, Buddhist have found physical phenomena to lack any inherently objective nature independent of the conceptual framework within which they are identified. Contemplatives use the same techniques to investigate the nature of mental phenomena. What they discover is that consciousness itself lacks inherent identity independent of the conceptual framework in which it is identified. Contemplatives have discovered that the mind is just as empty of inherent existence as the external physical world.

Finally, contemplatives have taken the investigation of phenomena a step further and report that the division between external physical phenomena and internal mental phenomena is empty of inherent existence. The distinction between external and internal is an illusion; internal and external space are ultimately non-dual. This is the absolute space of phenomena. In Buddhist literature, this is the Great Perfection out of which the entire universe originates.

The Buddha summed up his investigations of reality with this statement: "All phenomena are preceded by the mind. When the mind is comprehended, all phenomena are comprehended." By "mind," the Buddha was referring to the deepest state of consciousness, primordial awareness, true vacuum.

In the West, many physicists believe the evolution of the universe began with a perfectly symmetrical vacuum that cooled into the current frozen vacuum state, which is what they study. The cooling of the original true vacuum is believed to have liberated enormous amounts of energy that gave rise to quarks, electrons, and eventually all of life.

His Holiness the Dalai Lama recently described the Great Perfection:

> Any given state of consciousness is permeated by the clear light of primordial awareness. However solid ice may be, it never loses its true nature, which is water. In the same way, even very obvious concepts are such that their 'place', as it were, their final resting place, does not fall outside the expanse of primordial awareness. They arise within the expanse of primordial awareness and that is where they dissolve.

The Dalai Lama is saying that the absolute ground state awareness is primordial awareness, the fundamental ground from which everything, space-time, mass energy, mind-matter, all arise and into which they eventually dissolve.

Over the past four centuries, Western science has made enormous progress in understanding the nature of external physical phenomena and the space in which, and from which, they arise. But scientific progress into the nature of the mind and consciousness has been far more limited. Buddhist contemplative science, on the other hand, has made innumerable discoveries concerning the origins, nature, and potentials of consciousness, but it lacks the physics, chemistry, and biology that have been developed in the West. When these two great traditions of experiential and rational inquiry are integrated, we will see a Noetic Revolution that will be of enormous benefit for humanity.

Varieties of Buddhist Experience, and Quantum Emptiness

David Paul Boaz Dechen Wangdu

Ontological Extremism, a Middle Way, and the Light of the Mind

In Buddhism the *Abhidharma* of the *Sarvāstivāda* and *Vaibhashika* Schools, along with Democritus and his master Leucippus, and Western functionalist Material Realism (Scientific Realism/Scientific Materialism), all hold the realist atomist position wherein reality consists of indivisible, physical/material atomic matter particles (atomism) that have an ultimately physical, objectively real, permanent, even absolute and eternal existence. This is the ontology of Physicalism.

So some Buddhist schools believe that atoms are eternal; and some particle physicists believe that electrons and protons within these atoms are eternal, that they do not decay. In the case of recent particle physics, the existence of ordinary

atomic baryonic matter (our beloved protons and neutrons) is believed to be independently arising from the "empty space" of the quantum vacuum potential, apart from any perceiving, experiencing, experimenting consciousness, or mind. Such realists, whether Buddhists, Hindus or physicists, are *essentialists*, believing that reality exists essentially and independently — just as it appears from its own side, of its own power — not interdependently as centrist *Madhyamaka* Buddhists would have it.

The essentialist view is observer-independent. The world of stuff is "out there," whether or not it's observed by a sentient consciousness. The Middle Way *Madhyamaka* view is observer-dependent or ontologically relative (relative to our linguistic semiotic deep cultural background "web of belief"). In this view, stuff exists not independently, but relative to the consciousness of an observer.

On this essentialist, usually realist and materialist view, reality as it appears to our senses is a perfect "mirror of nature" (Rorty 1979), a kind of "immaculate perception" that represents an eternal barrier between inherently unitary human consciousness and an essentially separate Platonic "real world out there" (RWOT). This observer-independent, theory-independent, realist/materialist view is opposed by the epistemological idealism of the Hindu *Sanātanadharma* — the hoary old Vedas and dualistic Vedanta. It is also opposed by Buddhist Idealists, the *Yogachara/Chittamatra* or "Mind Only" school of Asaṅga and Vasubandhu, and as well by Western Objective Idealists — Bradley, Royce, McTaggart — who broadly construe arising material objective reality as unreal, a subjective apparition or illusion of a sober, sentient perceiving consciousness.

For *Chittamatra* Idealism, appearing relative-conventional physical spacetime reality is relative and illusory (*avidya maya*) as it arises from our *concept* of its basal nondual ultimate source or "groundless ground" (*vidya maya*). So both form and emptiness are illusory concepts. As Shakyamuni Buddha told in his nondual *Heart Sutra*: "Form is emptiness; emptiness is form... all dharmas are emptiness; there are no characteristics. There is no birth and no cessation... in emptiness there is no form... no ignorance, no end of ignorance... no path, no wisdom, no enlightenment, and no non-enlightenment...."

Well, what is there? What indeed. Buddha asks us to "abide by means of *Prajñāpāramitā*," bright indwelling *presence*, always already present primordial wisdom, and thereby "fully awaken to unsurpassed, true, complete enlightenment." And yes, it takes a bit of trans-conceptual practice to understand the prior unity of the Two Truths, relative and ultimate as empty of essence.

Hence, for Chittamatra, this appearing phenomenal reality is "mind only." There can be no objectively knowable real things in themselves.

Kant's Transcendental Subjective Idealism — a duality of realist, material objective *phenomena*, and the perfectly subjective and unknowable, utterly transcendent *noumenon* — is a Western (Platonist) version of our Primordial Wisdom Tradition's "Two Truths" duality — objective relative and subjective ultimate — and parallels the "Neutral Monism" of William James.

Kant's incipient middle way idealism also parallels the non-essentialist, yet pragmatically realist centrist Buddhist

Middle Way *Madhyamaka Prasaṅgika* view of Nāgārjuna and Chandrakīrti. Here reality arises and appears interdependently (Buddha's "Dependent Arising" (*pratītyasamutpāda*), is ontologically relative and observer-dependent, that is to say, our realities are dependent upon the semiotic "web of belief" (Quine 1969) of the consciousness of a reflexively self-conscious observer, as we have seen.

Is such a middle way between these perennial Two Truths of relative form and ultimate emptiness/boundlessness cognitively realizable? Is there a centrist position between our seemingly competing paradigms, the epistemic extremes of descending, substantialist, objective Science (form) and the ascending idealism of subjective Spirituality (emptiness)?

Yes. Between these two philosophical extremes — the realist/materialist reification of a permanent, absolute, substantial, eternal and independently existing physical and mental phenomenal reality "out there," and the idealist nihilistic negation of it — abides the mean that is the Prasaṅgika Madhyamaka, the centrist, Nālandā Buddhist Middle Way Consequence School (H.H. The Dalai Lama 2009).

Prasaṅgika is the complementary theoretical basis, according to Longchen Rabjam (2007), and His Holiness the Dalai Lama (2009) of the utterly nondual view and praxis of Buddhist *Nyingma* School's *Dzogchen*, the Great Perfection, that acausal, trans-conceptual "correction" or completion of the inherent duality of Middle Way *Prasaṅgika*, and indeed of the entire great Buddhist Causal Vehicle (Klein 2006; Boaz 2015b). His Holiness advises that *Prasaṅgika* is the Middle Way foundation of the great *Dzogchen* teaching.

Thus, in *Dzogchen* we have not only a centrist *Prasaṅgika* synthesis of the Two Truths — relative and ultimate — that are exoteric Realism/Materialism (matter), and esoteric Idealism (mind/spirit), but an optimistic and freeing soteriology — an "innermost secret" or greater esoteric view and practice for expedited human liberation/enlightenment, ultimate happiness itself. Indeed, this is the happiness that cannot be lost. We cannot *become* happy or enlightened in the future; we can only *be* happy here now. Why? Wonder of wonders, as *Dzogchen* founder Garab Dorje told, "It is already accomplished from the very beginning," deep within us. And 2500 years before, Shakyamuni Buddha: "Let it be as it is and rest your weary mind, all things are perfect exactly as they are."

Leibnitz's view of such a perfect "best of all possible worlds"; and recent cosmology's non-trivial tautological Anthropic Principle (both weak and strong versions), point out that our unlikely universe with its highly improbable "fine-tuned" physical constants that favor life forms must necessarily exist in order that human consciousness arise to observe and ponder it all. Both Leibnitz and the Anthropic Principle suggest that a nondual noetic view of this otherwise incomprehensible perfect subjectivity is necessary to understand it.

On the accord of Buddhist Vajrayāna epistemology, that perfect understanding is Buddha mind (*Samatājñāna*), the Great Perfection of *Dzogchen*, the mind of Ultimate Truth. Indeed, this is the very nature of mind. And that is who we actually are. Heady wine indeed to dualistic concept mind ensnared as it is in the prodigious quest for absolute objective certainty within this dimension of merely materialist "concealer" Relative Truth.

It is perhaps a bit sobering to remember that all of this heady conjecture is but self-stimulating concept mind. Yet, there is this unreasonable brightness of the mind that is always present.

"Everything that exists lacks an intrinsic nature or identity," asserts Alan Wallace (2003) explicating Nāgārjuna's Buddhist selfless (*anātman*) centrist *Madhyamaka* ontology. The appearance of objects arising from the basal primordial ground (the unbounded whole or *mahabindu, dharmakāya, chittadhātu*) are interdependently related, that is, their reality is dependent upon other related events and processes, a vast matrix of "prior causes and conditions."

Moreover, human discursive mind conceptually imputes, designates, then reifies these appearances into objectively "real" physical/mental/emotional spacetime existent realities in accordance with our atavistic, deep background cultural assumptions. Thus arises what W.V.O. Quine (1969) terms our socio-cultural "web of belief."

We then habitually reduce our bright subjectively real original noetic direct experience to objectified discursive cognitive entities abiding in an emblematic, seemingly separate "real world out there" (RWOT). With a bit of mindfulness practice we may learn to *choose our reality*; that is, we learn to maintain the initial nondual noetic purity of the primordial wisdom ground as it arises through ordinary direct perception, prior to conceptual intervention and judgment. With a bit more practice we can do this simultaneously with our parallel conceptual dualistic relative-conventional dimension of a RWOT.

So we live in these two worlds — objective real/material, and subjective mental/spiritual — at once; whether we are cognizant of this unity, or not. Is not our soteriological imperative the recognition, realization then compassionate expression of the prior unity of these two, at once? To reduce or not to reduce, that is the epistemic question of nondual enlightened awareness. Hence, from the epistemology you choose, arises the ontology you deserve.

Dōgen's Being-time

Dōgen, perhaps Japan's greatest Zen master, spoke of this arising, emerging dimension of relative time and its phenomenal contents — the spacetime dimension of Relative Truth (*saṁvṛiti satya*) — as "a being-time moment flashing into existence" from the vast spacious expanse of the basal, non-logocentric primordial emptiness (*shunyata*) base or ground that is nondual being itself — the all-embracing dimension of Ultimate Truth (*paramārtha satya*).

This "ultimate truth" or unbounded whole is nothing less than his *Ugi*, or Being-Time. Dōgen's *Ugi* is the here now, always already present unity of the Buddhist *Madhyamaka* "three times" — past, present, future. So there is no beginning, and no end to this vast expanse of reality itself. The dimension of spacetime Relative Truth, including us, instantiates this vast primordial "groundless ground" of everything that arises and appears to sentient consciousness. Yes, we are luminous primordial awareness instantiations of *That*. Human consciousness necessarily intends *That*.

For Dōgen (and Padmasambhava), the eternal present exists for us only relative to a past and a future. Being-Time/*Ugi*

is a simultaneous array of all three. Thus we live in a single vanishing instant now. Yet, this precious moment now, derives its meaning from the inter-subjective context of a personal and even collective past, and of a future. This momentous moment now is significant because all of our past and future are interdependently, causally enfolded within it, while always unfolding in the timeless continuum of this now. Yes, we live in the moment, but not only in the moment. To live only in the moment now, without awareness of past and future (karma) is to "make our life meaningless." Not to live in the moment now, is "to lose reality itself" (Boaz 2015a).

Philosophers of physics and cosmology, if not always physicists and cosmologists, are now discovering a post empirical *kosmic* being-time in Dōgen Zenji's syncretic view of the prior epistemic unity of our two faces — objective and subjective — of this inherently reflexive unbounded whole (*mahabindu*) that is reality being itself, the very nature of mind, and our actual "supreme identity."

Dōgen's great insight is that prior to the superimposition (*vikshepa*) and intervention of conceptual cognition, ordinary direct perception bestows the inherent (*sahaja*), immediate, luminous, "primordially pure" noetic nature of mind, the ultimate ground of all our relative conventional experience. Here, in the "bare attention" of basal "naked awareness" — ontologically prior to subject/object separation and habitual conceptual imputation and reification — abides trans-rational nondual noetic reality itself. This pristine awareness is our very aperture to that primordial wisdom ground. And as Buddha reminds us, everything arising therein is "perfect as it is."

Such immediate perception, an instant prior to conception, is pure perception. And we all do this, all the time, with every perception! Wonder of wonders, we are all "primordially awakened" (*bodhi, vidyā)* to this always "already accomplished" innate and perfect clearlight mind. That is our actual "supreme identity." The rub? We must recognize, then realize this great "perfectly subjective" truth. How do we do this? We consult the experts and follow their injunctions, of course. As H.H. The Dalai Lama (2009) told, "The clearlight mind which lies dormant in human beings is the great hope of humankind."

Hence, there is always, through all of our cognitive states — perceptual, conceptual, emotional, and trans-conceptual contemplative — an ontic prior unity of past, present, future, always being here now. We can learn to be present to the nondual noetic *presence* of *That*. And yes it takes a little transpersonal mindfulness (*shamatha/vipashyana*) contemplative practice. Who am I? As Buddha told, "Don't believe me, but come and see."

Toward a Noetic Science of Matter, Mind and Spirit

Physics and cosmology are quantitative. "The qualitative" (value, volition) is active yet largely suppressed and denied in the common orthodoxy of the physical sciences. Let us now recognize and strategically develop the qualitative dimension in science.

What is urgently required is an integral noetic ontology and a centrist epistemology and methodology that accounts for a trans-rational, yet contemplatively knowable subjective ultimate or universal trans-physical reality matrix emptiness base or "groundless ground" — the "supreme source" of our

wisdom traditions — in which objective physical relative spacetime particulars (energy, mass, force, charge, waves, particles and people) arise, interact and participate.

Clearly, such a noetic science requires a methodological, "post empirical" relaxing of the limits of the obsessively objective positivist view and praxis that is the "old paradigm" Scientific Realism and Scientific Materialism. Such a Kuhnian scientific revolution is now upon us (Boaz 2015b).

The basal quantum vacuum energy (dark energy, Einstein's cosmological constant Λ) of Quantum Cosmology, with parallel Buddhist openness/emptiness (*shunyata/dharmakāya/kadag*) in which this energy vacuum arises, is a good beginning. This of course requires noetic contemplative research methodologies that utilize both quantitative objective third person data sets, and the qualitative, though still objective data sets of personal, subjective, introspective, even contemplative first person reports (Boaz 2015b).

The Copenhagen Interpretation of Relativistic Quantum Field Theory (QFT); Stephen Hawking's recent Model Dependent Realism (MDR) view of QFT; Dirac's unification of Einstein's Special Relativity with Bohr's early quantum theory, that resulted in — yes, QFT; and the new Quantum Bayesianism (QBism) interpretations of QFT — these are Science's inchoate acausal cognitive architecture for such a middle way centrist (between the epistemic extremes of permanence and nihilism) methodology.

The challenge is this: that greatest of human intellectual achievements, the prodigious Standard Model of particles

and forces, with its Standard Model of Cosmology (ΛCDM) still clings to the orthodox, old paradigm dogmatic metaphysic of extreme objectivist Realism/Physicalism/Materialism of a classical Newtonian cosmos of real objects permanently and eternally existing in an absolute, objectively real time. Einstein's still classical (non-quantum) General Relativity has changed gravity a bit. Kuhnian scientific revolution or no, what has not changed much is science's cultural zeitgeist, classical, objectivist Platonic Scientific Realism, nor realism's epistemic handmaid, monistic physicalist Scientific Materialism. Notable exceptions to this unwholesome course may be the antirealist, ontologically relative quantum views of Bohr, von Neumann, Wheeler and Barbour.

Of the many physicists and cosmologists in recovery from this afflictive obsessive physicalist/materialist view, relativistic physicist Stephen Hawking's story is perhaps the most inspiring. The epistemic reversal of his hitherto Scientific Realism of *A Brief History of Time*, became an ever so slightly chastened antirealist MDR view revealed in his recent excellent book, *The Grand Design* (2010). Such rare intellectual openness and honesty in a great mind is indeed a joy to behold.

What might the culture of Modern Standard Model physics and cosmology, and post-Standard Model (Supersymmetry/M Theory, Multiverse Theory, the dark sector) look like with this methodological enrichment of the psychology, ontology and epistemology of Premodern — and now, with the mindfulness revolution in the West — Postmodern Buddhist Middle Way contemplative science? Let particle physicists, cosmologists, neuroscientists and Buddhist scholar-practitioners dialogue.

There is now an auspicious, inchoate union of Buddhism and science arising. This unified integral noetic ontology, with its inherent science of consciousness, presents a propitious opening for the new noetic science of matter, mind and spirit of our emerging Noetic Revolution; and the healing wisdom that abides therein (Boaz 2015b).

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A Systems Biological Interpretation of the Concept of No-Self (anātman)

Denis Noble

Abstract

Systems Biology is the study of the interactions between the elements (genes, proteins and other molecules) of living systems. Genes do not act in isolation either from each other or from the environment, and so I replace the metaphor of the selfish gene with metaphors that emphasize the *processes* involved rather than the molecular biological components. This may seem a simple shift of viewpoint. In fact it is revolutionary. Nothing remains the same. There is no 'book of life', nor are there 'genetic programs'. The consequences for the study of the brain and the nature of the self are profound. They lead naturally to the concept of *anātman*, no-self, and to a better understanding of the relation between the microscopic and macroscopic views of the world. Organisms are viewed as variable open systems, rather than as determinate closed systems.

Introduction

First, I will explain what I mean by Buddhism in the context of this paper. And what is Systems Biology?

Buddhism

Historically, and also today, Buddhism refers to many things, and some of these are even antithetic to science. Those who defend the tradition in a scientific context would say that this is because Buddhism, as it transformed itself in the various cultures to which it was transmitted from its origins, acquired many of the superstitious forms of folklore of those cultures – hence the wide variety of beliefs found in different Buddhist cultures. So much so that the early Western missionaries did not recognise them as all having the same origin, and even mistook some of what they found to be a modified form of western religion (Batchelor, 1994 : 167).

This history is the basis of the story (Jupitereans) in the last chapter of my book, *The Music of Life* (Noble, 2006). I imagine that some space travelers have found a form of religion in a civilization on one of the moons of Jupiter, but in fact the story represents the mistakes made by Western missionaries when they first encountered Buddhism and tried to make it conform to the structure of Christianity.

The reason for which that fails is that there is a central set of ideas that are not only far from superstitious; they themselves are incompatible with virtually all forms of what we, in the West, would call religious practice. Thus, one of the Korean Zen Masters writes: “The teaching of the Buddha is not really a religion at all. Buddhism is a path.” (Sahn_ Master_Seung_Sahn, 1997 : 17). He also writes, just before

this quotation, "Buddhism is a subject religion" to distinguish it from what he calls 'object religions', like Christianity, i.e. there is no revelation; practice resides in examining oneself. This is also true of many modern Western forms of Buddhism, as expressed in, for example, *Buddhism without Beliefs* (Batchelor, 1997) — see also (Batchelor, 1994; 2010).[1] These writers and practitioners follow the tradition that the Buddha himself encouraged people not to ask metaphysical questions that couldn't be answered (Gombrich, 2009).

I suspect that this is at least part of the origin of the Buddhist form of debate, the *kōan*, a kind of challenge that, like "what is the sound of one hand clapping?", has no straightforward answer. Its function is not to be answered, but rather to provoke reflection. In a debate in Oxford with HH the Dalai Lama seven years ago I was thrown such a challenge in the form of asking how far down the animal kingdom would I go in showing respect. My reply was to look around the audience and appear clueless, much to their amusement. But I think it was the correct reply — until, unfortunately, I opened my mouth and tried to say something![2]

Another way to express this view of Buddhism is to say that it is itself a form of science, open to test in the form of personal experience in examining oneself and one's relationship to others and to the world. It is a key aspect of that experience to find that there is no such thing as the self, an idea of no-self (*anātman* in Sanskrit) that resembles David Hume's view that

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[1] A dialogue between the author and Stephen Batchelor is on http://www.voicesfromoxford.org/video/buddhism-and-science-12-discussion-with-stephen-batchelor/110

[2] A more recent debate with HH The Dalai Lama can be found on https://www.youtube.com/watch?v=cpWNm81aews

the self is just a set of interconnected perceptions (see also (Parfit, 1986).

In this paper I will argue that modern systems biology leads, by a rather different route, to a similar conclusion.

Systems Biology

Twentieth century biology was characterized by the identification and characterization of the molecular components of living systems: their proteins, genes and other molecules, such as lipids and metabolites. Almost as an extension of this approach it was assumed by many that the higher functions, such as consciousness, the will, the self, would also eventually be identified as objects, in particular as parts of the brain, or the workings of those parts. I believe that this was a profound mistake and that the biology of the 21st century, which is a systems approach, is set to correct this mistake.

For this to be true, though, it is important to note that systems biology is not just a 'next step' development of molecular biology, as many of my scientific colleagues may think. It represents a profound revolution. The philosophy of systems biology is completely different from that of molecular biology (Kohl et al., 2010; Noble, 2010). To use a musical analogy, if molecular biology is the identification of the notes in a score, then systems biology is the music itself. If the molecular components are compared to the instruments of an orchestra, or the pipes of a cathedral organ, then systems biology is the performance. Whichever musical metaphor one might prefer (and I use several in my book, *The Music of Life* (Noble, 2006), each highlighting a different aspect of the difference between

molecular and systems biology) the microscopic alone, i.e. the identification of the smallest components, is not sufficient to characterize its function. Even the concept of a gene as a DNA sequence is in serious difficulty (Beurton et al., 2008) as a consequence of recent discoveries in the field of epigenetics. We need a systems approach even to assess what a gene is (Noble, 2008b). Beurton et al. go so far as to say that a gene "begins to look like hardly definable temporary products of a cell's physiology".

Systems Biology is revolutionary

So, my first question is: why do we need a revolution in biology?

The turn of the century saw the ultimate achievement of the molecular biological revolution that can be dated as having its beginning in the discovery of the double helix by Watson and Crick in 1957. The announcement in the year 2000 of the first drafts of the sequencing of the human genome was, appropriately, accompanied by governmental fanfares on both sides of the Atlantic Ocean. For it was a Herculean achievement. As DNA sequencing now becomes so common as to be used even in law courts, it will become progressively more difficult to remember how audacious and technically challenging the human genome project was when it was first proposed. Nevertheless, the acclaim was misplaced in a very important respect.

What was wrong with the acclaim was not any misjudgment of the scientific and technical achievement. That achievement was fundamental. It was rather the promises that were made as we were told that, at last, we could read the 'book of life'. Cures for diseases would come tumbling out of the reading

of that book. At last, molecular biology would deliver on its promise to reveal the secrets of life. Francis Crick was even bold enough to claim that it would solve the great riddles of consciousness and the nature of the self. "You, your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules" (Crick, 1994). Two decades earlier, another prophet of the molecular genetic revolution, Richard Dawkins, had also claimed that "They [genes] created us body and mind" (Dawkins, 1976, 2006). All these claims are false.

First, the genome is not a book (Noble, 2010). It is not even a program, despite the colorful metaphor of "le programme génétique" introduced by Jacob and Monod (1961). It is a quite simply a database, used by the organism as a whole. It needs the highly-complex eukaryotic egg cell to read it and to even begin to make sense of it. Focusing on it as containing the secret of life is almost as misguided as focusing on the bar code of a product in a supermarket. It is to mistake the, possibly contingent, coding for the system itself.

Second, the level of the "nerve cells and associated molecules" is simply too low for attributes like personal identity, intentions and similar attributes of a person even to be comprehensible. The astonishing thing about the title of Francis Crick's book, *The Astonishing Hypothesis*, is that it could ever have been seriously formulated by a highly intelligent scientist.

Third, as Dawkins himself acknowledges elsewhere in his later books "genes" simply "aren't us" (Dawkins, 2003).

It is therefore re-assuring to find that the architects of the human genome sequencing project are vastly more cautious. In his fascinating biography, Craig Venter writes, "One of the most profound discoveries I have made in all my research is that you cannot define a human life or any life based on DNA alone……". Why? Because "An organism's environment is ultimately as unique as its genetic code" (Venter, 2007). Precisely so and, one should add, the environment is an open system.

Sir John Sulston, who led the UK sequencing team, is also cautious: "The complexity of control, overlaid by the unique experience of each individual, means that we must continue to treat every human as unique and special, and not imagine that we can predict the course of a human life other than in broad terms" (Sulston and Ferry, 2002). Sulston also emphasized the immensity of the combinatorial explosion that occurs when one considers the number of possible interactions between 25,000 genes. As he says, "just a few dozen genes…… can provide an immense amount of additional complexity". Even more mind-boggling, "there wouldn't be enough material in the whole universe for nature to have tried out all the possible interactions, even over the long period of billions of years of the evolutionary process" (Noble, 2006).

Sequencing the human genome has therefore brought us right up against the problem of complexity in biological systems. This is the challenge that 21st century biology faces. Its foundations must therefore be built on how to integrate our knowledge, rather than simply follow a reductive mode. Having broken life down into its molecular components, the greater problem is going to be how to put those components back together again and to understand the logic of life at all

the various biological levels. This raises difficult questions. Could there be a general theory of biology at a systems level? (Capra and Luisi, 2014; Longo and Montevil, 2014) Or are living systems so 'history-dependent' as evolution has careered through its billions of years on earth that there will always be a contingent, unpredictable aspect to life? (Gould, 2002) This is one of the reasons I referred earlier to DNA as a kind of 'bar code'. I admit though that we do not yet know how necessary or contingent the development of that code might have been.[3] There are indications though that evolutionary changes in the genome are not random and that the process might be predictable (Shapiro, 2011; Stern and Orgogozo, 2009).

To address these questions, we cannot rely on 'next step' science. We need some bold re-assessments of where we are going. I suggest that these re-assessments will be of at least two kinds. The first kind will be philosophical and linguistic. We need to identify and neutralize the misuse of metaphorical language that has for too long paraded as the truth in biological science. I have attempted to do this in several recent articles (Noble, 2011b; Noble, 2015). The second kind will be heuristic. Integrative approaches will be needed, and they must be at least as rigorous as the successful reductive approaches that characterized the second half of the 20th century. My belief is that this means that the integrative approaches must necessarily be mathematical (Noble, 2010; Noble, 2012).

[3] I thought a lot about the use of the word 'code' here. Of course, there is no code as usually understood as a system of communicating between a sender and a receiver. But the word is so deeply embedded in modern molecular biology that, as with the word 'program', it is longwinded to try to eliminate it. In the context of this discussion it simply means that the DNA acts as a template for the production of proteins and RNAs and that we now know the relationship between the DNA sequences and the amino acid sequences.

Biological functionality is multi-level

In order to characterize the philosophy necessary for such research we need to clarify the principles of systems biology (Noble, 2008a). The first principle is that "Biological functionality is multi-level".

It is impossible to conceive biology without making reference to the concept of level. Between the molecular level of genes and proteins, and the level of the whole organism, we can distinguish between at least eight levels. From the reductionist viewpoint, the causal chain looks like this:

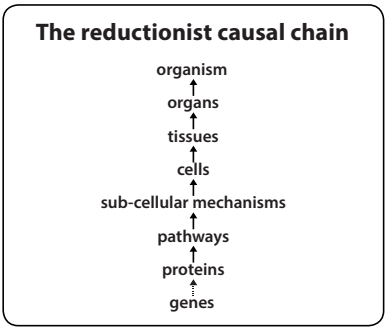

Figure 1. The reductionist causal chain

The chain runs upwards. It is a 'one-way' system, from the genes to the organism. The idea is that, if we knew all about the lowest level elements, genes and proteins, then everything about the organism would be clear to us. We could work out what happens at the higher levels, and explain it completely, in terms of our low-level knowledge. We could reconstruct the whole organism from the bottom up. The DNA sequences would be much more than bar codes. They would form a meaningful map of the entire organism — a 'book of life' indeed.

But this project is impossible (Noble, 2011a). The molecular biologist and Nobel laureate, Sydney Brenner, has beautifully

expressed this impossibility. "I know one approach that will fail, which is to start with genes, make proteins from them and to try to build things bottom-up" (in Novartis_Foundation, 2001 page 51)

Downward causation

The second principle is the existence of downward causation. Downward causation exists between all the levels between which there are feedbacks. Events at higher levels can trigger cell signaling, all the levels are involved in the control of gene expression, it is protein machinery that reads genes to ensure their expression, and all levels can determine epigenetic marking. This marking is very important. It consists of another level of information and control superimposed on the DNA: a kind of chemical pattern carried by the DNA and which differs according to the cell type. It is this marking that ensures the correct gene expression patterns are transmitted from generation to generation in the tissues of the body in multicellular organisms. There are many forms of downward causation.

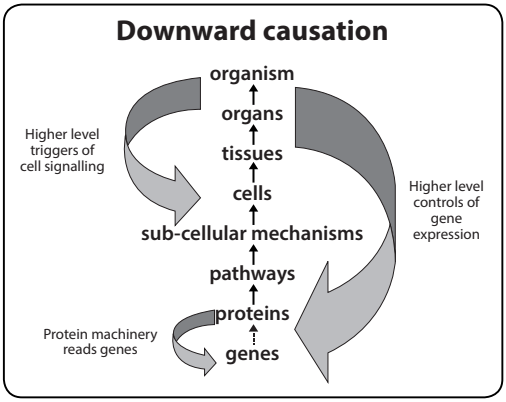

Figure 2.
Downward causation

Inheritance is not determined by DNA alone

The third principle is that DNA is not the sole transmitter of inheritance.

DNA does not come to us in a 'pure', unalloyed form. It must necessarily be inherited together with a complete egg cell. From the viewpoint of systems biology, the genome is incomprehensible as a 'book of life' unless it is read and translated into physiological functions by cellular mechanisms, beginning with the egg cell. I maintain that this functionality is not to be found at the level of genes. It is impossible because genes are 'blind' to what they do, just as are the proteins and higher-level structures such as cells, tissues and organs.

To these I want now to add two more important points. Proteins are not the only molecules in biological systems that determine function. Function is also dependent on the properties of water, lipids and many other molecules that are not coded for by genes. The lipids are essential for the construction of membranes and intracellular structures like mitochondria, ribosomes, the nucleus, the reticulum.

Moreover, a lot of what their products, the proteins, do is not dependent on instructions from the genes. It is dependent on the poorly understood chemistry of self-assembling complex systems (Capra and Luisi, 2014; Longo and Montevil, 2014). It is as though the genes specify the components of a computer, but not how they should be put together. They just do this by doing what is chemically natural to them.

No privileged level of causality

The fourth principle is that there is no privileged level of causality. This is necessarily true in systems with multiple levels and feedbacks downward and upward between the levels.

The fundamental point is that, to the extent that all the levels can be the point of departure for a causal chain, any level can be used as the starting point for a simulation. In biological systems there is no privileged level that dictates the behaviour of the rest of the system. I sometimes call this principle a theory of biological relativity: a relativity of causation (Noble, 2008c; Noble, 2012). I find that there are interesting parallels of this idea in some Buddhist commentaries (e.g. Sahn_Master_Seung_Sahn, 1997 page 91). Some relativity theorists have also pointed this out (Nottale, 2000 page 111). In this context, it is worth acknowledging the ideas developed by Auffray and Nottale (Auffray and Nottale, 2008; Nottale and Auffray, 2008) on the relation between a particular form of relativity theory (scale relativity) and a possible theoretical basis for systems biology.

Gene ontology requires higher-level insight

The fifth principle is that gene ontology will fail without higher-level insight.

The majority of genes (and the modules of DNA that form them) are very ancient. Genes are a little like linguistic metaphors. Evolution repeatedly re-uses them for new functions. The genetic codes also share another aspect in common with languages. Even if, originally, the modules had simple functions (what we call meaning in languages), the system as

a whole is far from simple. In fact, when one tries to unravel it, the first impression is that of a form of chaos. Evolution: that is the problem. As the genomes (or languages) have evolved, the functions (meanings) have changed. And they have often changed along routes that have little connection with their original functions (meanings). Half the genes found in a simple sea squirt correspond to ones that we humans have. But we have functions served by those genes that the sea squirt does not know about. 500 million years of evolution are responsible for these differences.

The genome is not a program of life

The sixth principle is that the genome is not a program that determines life.

It must be admitted that the idea of a genetic program, introduced by Monod and Jacob in the 1960s, has been very powerful. At that time computers were machines that could not keep all the programs in their memory. One had to write the programs on paper tape, or later on punched cards that were inserted into the reader of the machine each time one wished to do a calculation. So, the programs were a series of instructions completely separate from the machine itself.

But there is no reason at all why nature should have developed separate programs if this wasn't necessary. As Enrico Coen, the distinguished plant geneticist, put it in his lovely book, *The Art of Genes*, "Organisms are not simply manufactured according to a set of instructions. There is no easy way to separate instructions from the process of carrying them out, to distinguish plan from execution" (Coen, 1999).

There are no programs of life

The seventh principle is that there are no programs at any other level. Living systems are not Turing machines, they are interaction systems (Neuman, 2008; Noble, 2008b). Even the word 'machine' is inappropriate.

My book, *The Music of Life*, was written a little like a detective novel. If the genome itself is not a program, where then is the program of life? Is there really a program, or are there programs, located somewhere in organisms? I lead the reader through all the levels. I hesitate a little at the level of the cell. Sydney Brenner said at a Conference in Columbia University in 2003, "I believe very strongly that the fundamental unit, the correct level of abstraction, is the cell and not the genome." But even at this level, so important, particularly in evolution, the reason for its importance is that many functions are integrated at the cellular level, and this is the level at which transmission occurs between the generations. But, the concept of a programw is superfluous. The cellular networks of interactions are themselves the biological functions necessary for life. Effectively, the 'music of life' functions without a conductor. Everything emerges by itself. The grand composer, evolution, was even more blind than Beethoven was deaf!

No programs in the brain

The eighth principle is that there are no programs (or representations), even in the brain, and with this principle I begin, at last, to approach the central question of this paper: how does Systems Biology help us with questions of the self and free will?

I hesitated a little at the level of the cell. But some of my readers will already have concluded that there is an obvious answer to the question 'what controls the processes of the body?' Yes, the nervous system is certainly a central integrator and controller of some kind. The question is what kind. Must we go along with Crick, and many other biologists, in looking for a place in the brain where it all, as it were, comes together in a central consciousness? Could a bit of the brain, or any other part, do this? For example, the claustrum, as Francis Crick proposed (see later).

And, if so, how does this conscious centre see what it sees, hear what it hears, feel what it feels? Does the nervous system serve up our sensations to it in a special form, converting the light, sound and pressure waves into special qualitative phenomena (some philosophers and scientists call them sense data or qualia) that exist inside our heads? This is an area where biology and philosophy strongly interact and, some would say, overlap. So how do biologists and philosophers think that we perceive the world?

My arguments against these ideas are difficult to explain briefly in an article like this. They depend on philosophical ideas developed during the 20th century, particularly by philosophers like Wittgenstein. In chapter 9 of my book (Noble, 2006) I try to explain these ideas in relatively simple language by using dialogues and little stories. The essence of the argument is that biological interpretations that suppose the existence of a part of the brain responsible for central control resemble the mistake to which I have already referred, i.e. of imagining that there must be programs that determine functions in the body. There are no such programs, because the only networks that could correspond to such programs *are*

themselves the biological function. If I play a piece of guitar, for example, neural networks are activated, of course, but these are not programs that *determine* how I play the music. These networks, and the movements of my fingers, are *me* (well, *part* of me)[4] playing the guitar.

The self is not a neural object

This insight leads to the ninth principle which is that the self is not a neural object. If it is anything at all, it is an integrative process (Noble et al., 2014). It is the highest *process* of the body. The all-singing, all-dancing, ninth symphony of systems biology!

The mind is not a separate object. It seems to me that the idea that it is was based on an error that greatly resembles Descartes' error. Bennett and Hacker, in their book *The Philosophical Foundations of Neuroscience* (2003), use the term "mereological fallacy" to describe this kind of problem, which consists in attributing to a part of an object a property which cannot be ascribed other than to the whole of the object. At the level of the brain, the self is more a process than an object. And the brain contains only part of the processes involved.

Despite these philosophical problems, many biologists look in the brain to find the self, or consciousness. Thus, Ramachandran refers to a conversation with Francis Crick: "I think the secret of consciousness lies in the claustrum — don't you? Why else would this one tiny structure be connected

[4] And that is, partly, the point being made here.

to so many areas in the brain?" And as I have already noted, Crick himself wrote, "You, your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules" (Crick, 1994).

The activities of the self, such as intentional actions, cannot be understood on the basis of neural activity alone without taking into account the social context in which intentionality can have any meaning. I tell a story to illustrate this problem in chapter 9 of *The Music of Life*.

Comparisons with the Buddhist tradition

While it is important to recognize and acknowledge the resemblances between my conclusions as a systems biologist and the conclusions of the Buddhist tradition, from its very beginning, it is important to note a very important difference in the way in which the conclusions have been derived. My route to these insights has come from long reflection on the nature of biological science. I started my biological research as a rather naïve reductionist as I analyzed some of the lowest-level components of biological systems, the proteins that form ion channels in the heart (Noble, 2004a). I developed my view of a systems approach through many years of interactions with philosophers and other scientists. I have been constrained in my thinking to abandon the reductionist approach as the only means by which we can analyze living systems by the very nature of biological science as I think it is developing.

The Buddhist tradition has used a completely different route: that of direct personal experience through meditation. As

I understand it, *anātman*, the idea of no-self, is seen by many Buddhists as an *experiential* fact, though it is also a conceptual insight as I explain later. Ultimately, however, our understanding of science and our direct experiences of ourselves must coincide. Whether we have reached that point of coincidence with the development of systems biology is a fascinating question.

Moreover, the difference is not complete. Buddhist insights through personal experience have, time and again, been complemented by philosophical enquiry into the nature of the world, the person and of experience itself.

When I wrote chapter 9 of *The Music of Life*, on the brain, I was reflecting on how to apply the systems approach to neuroscience. Some of my previous articles (Noble, 1989a; Noble, 1989b; Noble, 1990; Noble, 2004b; Noble and Vincent, 1997) had already developed the idea that the self is a construct, a useful one of course, but not one to be identified either with an immaterial substance or simply with the brain. The way I express this in chapter 9 is to say that it is better regarded as a process than as an object. Just as it doesn't make sense to talk about heart rhythm at the level of genes and proteins, it doesn't make sense to talk of the self at the level of neurons or hormones. At those levels, it is as though there is no self at all. The idea of no-self (*anātman* in Sanskrit, an = no, *ātman* = self) is, of course, precisely that of Buddhism.

Or is it? It has taken me several years to try to answer that question. The original insight 2500 years ago may have been part of the general non-metaphysical stance of the historical Buddha, Siddhartha Gautama (Batchelor, 2010), but it is hard to decide precisely what this insight was. We live in such a

different world from that of Gautama and it is all too easy, as Gombrich (2009) has warned, to take his words out of context. I started out thinking that it was an empirical discovery. Perhaps, during meditation, he looked for the self, the I, the soul, and simply didn't find it, rather as David Hume famously examined his thoughts and perceptions two millennia later and came to the conclusion that none of them could be identified as 'the self', that in that sense such a thing did not exist.

But, to say that something doesn't exist, we do at least need to know what it would mean for it to exist, how we would recognize it if we tried to find it. And, of course, we don't know how to recognize it. I recognize you, the reader, as a person, as having a sense of self, and we know what words like 'yourself', 'myself', 'himself', mean. To indicate these, we would point at you, me or him as the case may be. You can also point at yourself to indicate yourself. But, if we had your brain out on a dish, as it were, how could we possibly say that this is you? The brain is necessary to you, but it is not sufficient. That is the basis of my story of 'the frozen brain' in chapter 9 of *The Music of Life*.

Looking at the question this way, we are forced to say that the concept of no-self is, just that, a conceptual truth not an empirical one. No scientific, or meditative, experiment is necessary to establish such a truth. To return to the quotation from Crick earlier in this paper, looking for such things at the level of neurons and molecules is a conceptual mistake. These ideas have been explored further in Noble et al. (2014)

In chapter 10 of *The Music of Life* I used the famous Oxherder parable (Wada, 2002) from the Chinese Buddhist tradition as a way of explaining the object of meditation to, as it were,

subdue the self. One of the ten pictures is just of an empty circle, as though the self (the ox in the story) has disappeared. I no longer think of it this way. I now think of it rather as a parable about how to subdue *selfishness*, not the self. Buddhist meditation has, as one of its aims, to remove selfish, greedy and angry attitudes — the causes of suffering, and one of the central aims of any ethical practice.

So, there are two kinds of 'discovery' here. The first is the conceptual truth that it doesn't make sense to talk of the self as an object in the sense in which our brains are objects. The second is that, through meditative techniques we can subdue selfishness. But doing that is not equivalent to some conjuring trick of 'making the self disappear'. I am reinforced in that conviction by the idea that what the Buddha was arguing against was not so much the self, as usually conceived when we refer to 'himself', 'myself', but rather against the idea that it was an unchanging thing (Gombrich, 2009). That idea fits well with the concept of the self as a process, as Gombrich also argues.

Does that mean that our experience, e.g. of meditation, is irrelevant? I don't think so. Experience can lead us to a conceptual truth even when it is not itself necessary to that truth. It was seeing the images of gravitational lensing produced by the Hubble telescope that led me to take the idea of the bending of space by huge gravitational fields seriously. Yet the theory of general relativity does not require me to have that experience in order for it to be a valid theory of the structure of the universe.

I hesitated about writing chapters 9 and 10 of *The Music of Life*. They were the most difficult to write. The book could have

finished on evolution in chapter 8. But that would have cut its head off. You can't ask a question as audacious as 'what is life' and not deal with questions of the brain and the self.[5]

Reflections on the Buddhist Philosophy of Won Hyo.

In a previous article on Buddhism and science (Noble, 2008d) I drew attention to a remarkable discovery that I made in the work of the Korean monk, Won Hyo 元晓 (원효) (617-686). The text below comes from the Kŭmgang sammaegyŏng ron 金刚三昧经论 (quoted in Kim, 2004 : 119) where he uses a seed and the fruit to illustrate the application of four-cornered logic (derived I believe from Nāgārjuna) to illuminate the concept of being/non-being.

> "The fruit and the seed are not the same,
> for they have different shape.
> However, they are not different.
> Besides the seed and the fruit are not annihilable,
> for the fruit is produced from the seed.
> However, they are not eternal,
> for there is no seed when it is in the state of the fruit.
> The seed did not enter into the fruit,
> for the seed does not exist when it is in the state of the fruit.
> The fruit does not extinguish the seed,
> for the fruit does not exist when it is in the state of the seed.
> Since it neither enters nor is extinguished,
> there is no arising.
> Since it is neither eternal nor annihilable,
> there is no ceasing.

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[5] Relevant videos on this part of my article are on https://www.youtube.com/watch?v=hS6PDOcJwY8&list=PLnqQJI0EhuwwdoH18CnKcOC6j4qaU_yXI&index=7 andhttps://www.youtube.com/watch?v=mj3_J19rqTw&feature=youtu.be

> Since there is no ceasing, non-being cannot be proclaimed.
> Since there is no arising, being cannot be proclaimed.
> Since it is free from the two extremes [being and non-being],
> it cannot be stated as both being and non-being.
> Since it does not correspond to the middle,
> it cannot be stated as neither being nor non-being.
> Therefore it is stated that it is free from the four perspectives
> and cut off from verbal expression.
> As such the *amala* fruit transcends language."[6]

This can be seen as a version of the main point made in this paper on the interaction between genotype and phenotype. To illustrate this, in the second version below I have replaced 'seed' with 'genotype' and 'fruit' with 'phenotype'.

> "The phenotype and the genotype are not the same,
> for they have different shape.
> However, they are not different.
> Besides the genotype and the phenotype are not annihilable,
> for the phenotype is produced from the genotype.
> However, they are not eternal,
> for there is no genotype when it is in the state of the
> phenotype.
> The genotype did not enter into the phenotype,
> for the genotype does not exist when it is in the state of

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[6] Won Hyo actually represents this text as 8-cornered, a clear sequence **次明** of 8 negations **八不**. The original is much tighter than any English translation can be. 'Same" could also be 'one', 'shape' could be 'form' – translation inevitably destroys some of the clarity. Here is the original text in Chinese characters:

"次明八不. 非直法尔 唯前四不 亦乃具绝一异等八.
所以然者 果种不一 其相不同故.
而亦不异 离种无果故. 又种果不断 果续种生故.
而亦不常 果生种灭故. 种不入果 果时无种故.
果不出种 种时无果故.
不入不出故不生. 不常不断故不灭. 不灭故不可说无. 不生故不可说有.
远离二边故 可说为亦有亦无. 不当一中故 不可说非有非无.
故言离诸四傍 言语道断. 阿摩勒果 如是绝言.
法忍之心 亦不异此. 故言无生心性 亦如是等也."

the phenotype.
The phenotype does not extinguish the genotype,
for the phenotype does not exist when it is in the state of the genotype.
Since it neither enters nor is extinguished,……."

In this form, his text could appear almost as a modern text of systems biology. Anyone who understands this text will see that a strict distinction between the replicator (the genome) and the vehicle (the phenotype), which is the fundamental basis of the Selfish Gene idea, disappears since they are totally interdependent (Noble, 2011b).

It is important not to misunderstand this historical comparison. Of course, I am not saying that Won Hyo and people who thought like him over a millennium ago were systems biologists before their time, even less that the Buddha was such a biologist. I am simply saying that the Buddhist stance uses ideas that resemble those of systems biology, just as we can also identify ideas in the Buddhist tradition that resemble relativity theory. The word 'stance' captures the idea here. What is common is a thought system that distances itself from what are perceived to be misunderstandings in the way in which language is used. I think that this is the sense of the reference to the fruit 'transcending language'. The four-cornered logic approach encapsulates this stance, which can then be seen as a form of philosophical ground-clearing. I don't think this last line should be interpreted as a form of mysticism, still less as obscurantist. I would translate the last line 言语道断 simply as 'can't say in words', meaning that our words, 'seed' and 'fruit', lead us to think we are talking of completely separate objects, which is not the case.

The same kind of idea (but not exactly the same of course) applies to 'mind' and 'body'. The mistake is to see the mind as an object in the same sense as the body or, even worse, to think it is to be found or identified as part of the body.

Conclusions

In conclusion, systems biology is very different, both from a philosophical and from a heuristic point of view, from molecular biology, even though it greatly profits from the results of molecular biology. Reduction and integration are both necessary (Kohl and Noble, 2009) as tools to develop a good biological reply to the question "what is life?" Systems Biology requires a revolution in the way in which we study life. One of the important results of this revolution is that we cannot understand living beings on the basis of DNA alone, or the proteins for which it forms a template. It is necessary to understand more than the molecular components. We must understand also how these components act in processes at the higher levels. The highest such process is the self, which should be analysed as a process that depends, like all other functions in living beings, on the environment, including particularly the social environment in this case.

But, finally, I want to express an important hesitation. In the last chapter of *The Music of Life* I advise readers to throw my metaphors away. They are simply ladders to a better form of understanding. Describing the self as a process is better than describing it as a thing, but processes can also be reified in ways that confuse. We should avoid even that. I believe that the concept of *anātman* requires nothing less if we are to succeed in distancing ourselves from the misuse of language.

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[7] See http://www.voicesfromoxford.org/news/buddhism-and-science-video-list/337

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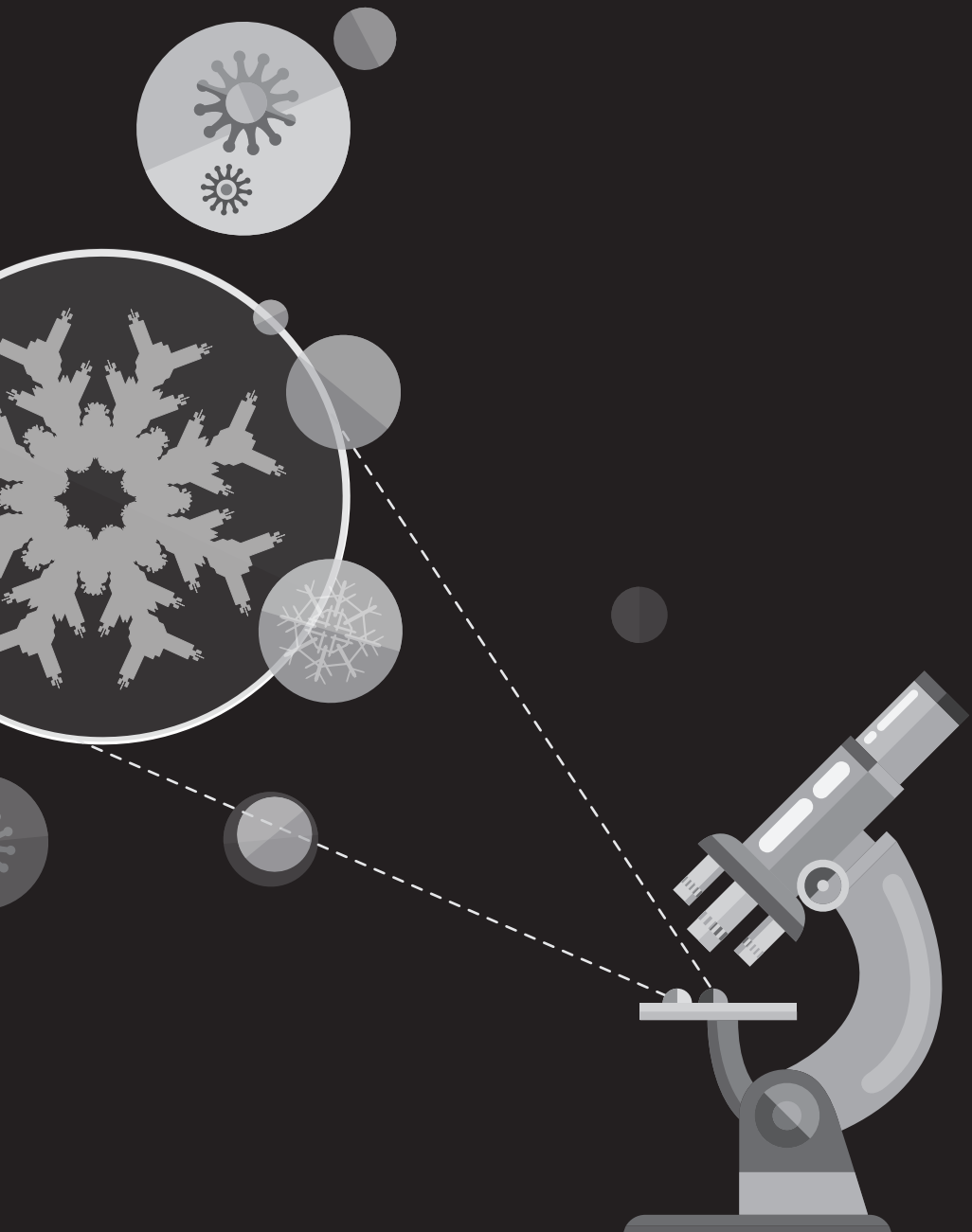
CONCLUSION



Buddhist Modernity and the Sciences

William S. Waldron

The world's religious traditions are all facing a variety of challenges in the modern age. Some of these come from the skeptical attitudes incumbent upon modern science, some from the secularizing tendencies inherent in democratic politics, and some from the relativizing effects accompanying our pluralistic world. This is no less true for Indian Buddhism and the traditions that derive from them in other parts of South, Southeast and East Asia. Like everyone else, they are compelled to participate in our modern world in all its confusing and challenging complexity. The question is how they will do so. Will Buddhists attempt to turn their back on modern science and pluralistic democracy, on the grounds that these are not relevant to their higher spiritual aims of awakening all beings and alleviating their suffering? Or will they engage the modern world as the only arena where such aims and activities take place? The answers to these questions will, no doubt, be as diverse as the modern world itself.

In this essay, I will outline one approach to these challenges, arguing that Buddhists need to fully engage the modern world not only to keep their own traditions relevant in a new era — as historically they have always done —but also because this is the best way of pursuing the traditional aims of alleviating suffering and liberating sentient beings. I will, per force, focus on the relation between Buddhist thought and science and the role that science could possibly play in engaging Buddhism more fully with modernity. I do this confident that the richness of Indian philosophical traditions in general, and of Buddhist traditions in particular, have much to contribute to the modern world.

I intend to make only a few general points based on the conviction, first, that science provides an understanding of how the world works that, perhaps paradoxically, reinforces more than it challenges traditional Buddhist views (although most Buddhists don't know this!), and, second, that a scientific education is absolutely necessary for enabling both Buddhist individuals and the various Buddhist traditions to engage the modern world in a creative and constructive manner. This is my concern here: that Buddhist cultures and traditions find ways to engage the entire modern world —including science — just as they have previously engaged, and transformed, the traditional cultures of Asia.

As many know, throughout its history, Buddhist teachers and thinkers have vigorously participated in the religious, intellectual and artistic cultures around them. They have both been enriched by and have themselves deeply enriched these various cultures and in this way Buddhist traditions have become important parts of the cultures of modern-day India, Nepal, Bhutan, Tibet, Mongolia, Sri Lanka, Thailand, Burma,

Cambodia, Laos, Vietnam, China, Korea and Japan —in effect, all of Asia.

Buddhists have been able to do this precisely because they have been deeply engaged in these surrounding cultures, and because they found ways to express their particular insights and sensibilities in ways that were appropriate to the time and place. This is why we can now speak of Newari Buddhism, or Singhalese Buddhism or Japanese Buddhism as distinctive forms of Buddhism.

My point is that now is not the time for Buddhists to stop this process. We live in a time of great promise and challenge. We live in a radically pluralistic age, in which we can all access every major culture in the world. And we live a radically fragmented age, one in which modern science and technology not only influence, but also challenge, all our previous assumptions about how the world works.

In my view, Buddhists (and all serious religious thinkers for that matter) need to engage this modern world, in all its pain and glory, with all its achievements and its deep, deep shadows. But, even more, I think the modern world needs the kinds of perspectives that Indian thought in general and Buddhist thought in particular provides. And Buddhists cannot provide this if they do not have a modern scientific education.

In the widest sense, education is a transformative process. Children start with little specific knowledge about the world and they end up understanding a great deal, not just the details of this or that field, like physics or history or literature, but about how the world works in a more general way. And it is this last point I want to dwell on: modern science as a

foundation for a deeper understanding of how the world works and the reasons why modern Buddhists should be actively involved in it. I want to make two specific points, first in brief and then at more length.

First and foremost, traditional Buddhists should find much to embrace in science education, since it accords so well with their general theories of causality. Modern science —at least the way I see it —is one long lesson in dependent arising, the central Buddhist notion that phenomena in the world only occur through various causes and conditions. We learn in one field after another that we can only understand how the world works if we analyze it in terms of regular patterns of causal interaction. What I mean by this last phrase is that each discipline develops a particular set of terms and concepts to analyze the phenomena, the events, they are interested in and then describes how these phenomena occur in terms of the regular, recurrent relationships between these concepts.

The sciences thus teach about cause and effect in the natural world in a way that not only basically accords with the Buddhist idea of dependent arising, but that also implies that causality only works if there are, as Buddhists have long contended, no unchanging essences, no *svabhāva*. This is implicit in all the sciences and modern Buddhists should see it as an affirmation of their basic worldview.

Second, Buddhists insights also agree with some of the most difficult problems of the modern world: the problems caused by the quest for self-identity *(ātma-graha)*. All the social sciences teach that personal and group identities are social constructions, or social agreements. And some of them recognize that creating and protecting these constructed

identities often leads to social and political conflicts. The core Buddhist insight is that the quest for such an identity eventually leads to more suffering. This insight needs to become one of the bases for our understanding of modern life. Otherwise, I fear, we have only a future of conflict and bloodshed.

In sum, I want to make two general points: one about causality and non-essentialism, and the other about self-identity and suffering.

Causality

Modern Buddhists have much deeper reasons to study science than the obvious reason that scientifically illiterate people will be left in the dust-heap of history, as the adage goes. More than any of the other great religions, to my knowledge, Buddhist philosophy has deep similarities with the scientific approach, similarities which can and should be part of every modern Buddhist's education.

Specifically, both science and Buddhist thought focus on questions of causality, of how things come to be rather than what they are. This is a crucial point that is easily overlooked and under-estimated. What I mean here is that science does not ask what things are *in their essence*, it looks for the causes and conditions that bring things about. For example, scientists look for the causes of tropical storms, or the causes of a disease, like tuberculosis or leprosy. They do this in order to predict or prevent their occurrence and thereby reduce human suffering. Amelioration of suffering is an important dimension of science as a human endeavor.

Scientists are not interested in what the unchanging essence of a storm or a disease might or might not be, since an *unchanging* essence is not something that comes about. It is at best a working definition, a way to define a problem or event whose causal conditions will then be investigated. According to Karl Popper, one of the great philosophers of science in the 20th century, "essentialism is mistaken in suggesting that definitions can add to our *knowledge of facts*" (1974, 20). As he further explains (1952, 14):

> The scientific use of definitions... may be called its *nominalist* interpretation, as opposed to its Aristotelian or *essentialist* interpretation. In modern science, only nominalist definitions occur, that is to say, shorthand symbols or labels are introduced in order to cut a long story short.

This well accords with Buddhist views. Long ago, Buddhist philosophy came to the conclusion that definitions are merely conventional designations (*prajñapti*) for what are in principle an unlimited set of causes and conditions.

It is well-known that Buddhist thought also emphasizes causality and for similar reasons: an understanding of *how things come to be* allows us to control, prevent or even reverse their occurrence. As the Buddha said, "Whatever is subject to origination is all subject to cessation" (*Saṃyutta Nikāya* V 424). And —this is crucial— whatever is subject to causes and conditions cannot have or be an unchanging essence. This follows, of course, the definition of essence or Being found in much of traditional Hindu thought. An essence is by definition that which is independent and unchanging. But discovering the essence of something —if indeed there were

one —does not in and of itself reveal how it works, how it occurs and ceases. We don't need to know what the 'essence' of tuberculosis is, we need to prevent it from occurring in people and cure it when it does.

The Buddha took a similar approach to the problem of life. He was looking for the etiology —the causes —of the disease of the human condition, in order to bring about its cure, freedom from suffering, for which he prescribed an appropriate antidote, the practice of Dharma. Since he defined the problem in terms of what arises —i.e. the experience of *duḥkha* —the solution is defined in terms of what ceases. Our suffering arises, he says, from two closely related causes: first, from the misconception that we or any part of us is actually an unchanging or uncaused unity, and, second, based on this, from the various actions that we perform, the karma, in our attempts to permanently secure our impermanent existence. Since we cannot make the impermanent permanent, we will continue suffering until we realize the futility of these attempts and give them up. A proper understanding of causality, then —both identifying the cause of suffering as well as acknowledging the causal nature of phenomena themselves —is as central to the Buddhist scheme of things as it is to science.

My point here is not only that a basic scientific education is necessary for all modern people, regardless of their cultural or religious background, which I think is true, but that the actual details of different scientific fields reaffirm, over and over again, these basic Buddhist views on causality and its concomitant notion, a lack of unchanging essence. Let me give a few examples to illustrate this.

Evolutionary Perspectives

The modern theory of evolution through natural selection states that the physical forms and behavioral characteristics of a given species have come about as a result of the various actions of its ancestors in interaction with their natural and social environments, specifically, those actions that led to greater reproductive success. Generally speaking, those actions were motivated by the desire to preserve their own existence, the desire for activities that led to reproduction, and the desire to protect and secure whatever facilitated these two. That is, self-preservation, sensual desire and protective aggression have been instrumental — not accidental — in bringing about the life forms we see today. In this view, species are, in effect, created by their own actions. They are not created by the will of God, they are not completely determined beforehand, nor are they caused by the actions of a single, unchanging self. Rather, they — and this includes us human beings as well — are the results of innumerable, and accumulating, transformations over very long periods of time in a complex and interactive causal process.

And since each species is continuously evolving due to ongoing causes and conditions, they do not have a single, fixed essence. Not only has "Darwinism… banished essentialism — the idea that species members instantiated immutable types," according to one historian of science (Richards 1987, 4), but the very notion of a species essence has actually obstructed scientific progress. As the eminent late philosopher of biology, Ernst Mayr (1988, 15f), argues:

> The ability to make the switch from essentialist thinking to population thinking is what made the theory of

> evolution through natural selection possible.... The genotype (genetic program) is the product of a history that goes back to the origin of life, and thus it incorporates the 'experiences' of all ancestors.... It is this which makes organisms historical phenomena.

That is, as the Buddhists would say, a given species is a dependently arisen phenomena which results from previous actions whose effects have accumulated over the course of countless generations. Contrary to philosophers and humanists the world over, there is no unchanging human essence, or rather, no essence that can be discerned by a causal analysis.

But the theory of evolution explains more than just the physical form of a species, it also addresses behavioral characteristics, including the dispositions to act in certain, species-specific ways. In other words, human beings have certain, specific human ways of acting and thinking that not only set us apart from other species but that are also influenced, to a large degree, by the results of the past actions of our ancestors. This includes the way we talk, the way we interact with each other, even the way we imagine 'selves' and 'others.' We are thus not only what we eat, but also —according to evolutionists —the result of what we, and all our ancestors, have thought and said and done.

As evolutionary biologist, David Barash (1979, 203), explains:

> If evolution by natural selection is the source of our mind's *a priori* structures, then in a sense these structures also derive from experience —not the immediate, short-term experience of any single developing organism, but rather

> the long-term experience of an evolving population.... Evolution, then, is the result of innumerable experiences, accumulated through an almost unimaginable length of time. The *a priori* human mind, seemingly preprogrammed and at least somewhat independent of personal experience, *is* actually nothing more than the embodiment of experience itself.

Buddhist philosophers have also emphasized that both the physical forms we embody today, as well as many of our most basic cognitive processes and dispositions, are the results of past actions that have been built up over countless lifetimes. And many of these actions have had similar drives: self-preservation and sensual desire, and their aggressive pursuit. One *sūtra* states that "the causes of living forms (*saṃskārā)* in the future are action, craving and ignorance." More specifically, as the great 5th century Buddhist philosopher, Vasubandhu, explains: "the world (*loka*) in its variety arises from action ([from] *karma*). [The effects of these] actions accumulate due to the power of the afflictive dispositions (*anuśaya*)" (*Abhidharmakośa-bhāṣya ad* V 1), that is, the dispositions toward a view of self-existence, toward sensual desire, and aggression and so on.

I am not pointing out these parallels as an exercise in Buddhist triumphalism, as if centuries ago Buddhists already knew all about evolution by natural selection. In fact, the two disagree profoundly about the specific mechanisms of causal transmission. Evolutionary biologists talk of gene pools and populations while Buddhists speak in terms of the karmic potential associated with individual "mindstreams" traversing across multiple lifetimes. These are important and likely irreconcilable differences.

Rather, I wish to point out that traditional Buddhists need not see the theory of evolution as a threat, as some people in some religious traditions do, but might see it as a thought-provoking parallel to their own models of causality driven by the actions of sentient beings. Vasubandhu, for example, constantly debated the leading Hindu philosophers of his time, and in doing so he developed and expanded the range and influence of Buddhist philosophy both in India and beyond. This tradition should continue today. To keep a tradition vibrant, intellectually and otherwise, it must continuously engage contemporary issues. Philosophy of biology is a ripe topic for such an exchange.

One More Important and Intriguing Example

Modern cognitive scientists investigate the brain in order to understand how mind works. Although many of them operate on materialist assumptions —that mind is simply a function of the brain —they nevertheless have enough in common with Buddhist analyses of mind to make a productive dialogue possible and desirable.

Specifically, cognitive scientists look for the causal patterns that underlie consciousness and other cognitive processes. One of their starting points is the assumption that consciousness is a process —or the result of multiple processes —which depends upon various causes and conditions that can —at least in principle —be discovered and understood by the scientific method. Consciousness, in this view, is not a Cartesian spirit or a substantial entity existing apart from, but somehow still controlling, our bodily processes. It is very much a phenomenon that arises through causes and conditions, as the Buddhists would say.

Cognitive scientists have therefore uniformly concluded, almost without exception, that our common notion of self as a substantial entity residing at the center of all our actions and experiences is simply unfounded; there is no scientific support for such a notion at all. As the important cognitive scientists, Lakoff and Johnson (1999, 268), declare:

> The very way that we normally conceptualize our inner lives is inconsistent with what we know scientifically about the nature of mind. In our system for conceptualizing our inner lives, there is always a Subject that is the locus of reason and that metaphorically has an existence independent of the body... this contradicts the fundamental findings of cognitive science.

This unwelcome but inescapable conclusion has caused considerable consternation in the scientific community: for scientists, like most other human beings, implicitly or explicitly hold such a notion of self. As neuroscientist, Marvin Minksy (1986, 306f), laments: "We each believe that we possess an Ego, Self or Final Center of Control... We're virtually forced to maintain that belief, even though we know it's false."

Michael Gazzaniga, world-famous for his research on the two hemispheres of the brain, depicts this predicament even more colorfully —and I quote (1998, 172):

> 'Goddamn it, I am me and I am in control.' Whatever it is that brain and mind scientists are finding out, there is no way they can take that feeling away from each and every one of us. Sure, life is a fiction, but it's our fiction and it feels good and we are in charge of it... This is the puzzle that brain scientists want to solve.... the gap between

> our understanding of the brain and the sensation of our conscious lives.

This 'explanatory gap,' as it's called —between our scientific understanding of the brain, which reveals no "Final Center of Control," and our nearly innate sense to the contrary, that we are indeed such an agent —is also the puzzle that Buddhist philosophers want to understand and resolve: why are we "virtually forced to maintain a belief [in self], even though we know it's false"? Even though it causes suffering to oneself and others? Modern science has some interesting, *Buddhistic*, answers to these questions as well.

First, we must discern how this sense of self comes about in the first place, in other words, understand its causes and conditions. Once again, it will be useful to turn to evolutionary theory. In his sweeping book, *The Symbolic Species: The Co-evolution of Language and the Brain*, Terrence Deacon argues that what distinguishes human beings is not so much the size of our brains as its special mode of organization: human brains support systems of symbolic reference, i.e. language.

These linguistic capabilities did not, of course, spring fully formed out of the head of Zeus. They are part of the accumulative, constructive and interactive processes of evolution. As symbolic communication 'dependently arose' in early hominid species it became a powerful evolutionary force in its own right, radically and irrevocably changing the structures and processes of the human brain. This momentous change centered on an increasingly enlarged prefrontal cortex, where such symbolizing processes are concentrated. As language use and this 'prefrontalization' —as it's called — mutually reinforced each other, the symbolic-linguistic mode

of cognition which is dependent upon them came to dominate other, more sensory, cognitive processes. "Brain-language coevolution has significantly restructured cognition from the top-down...," Deacon argues (1997, 417), such that "*its secondary effects have also ramified to influence the whole of human cognition...* even when our symbolic-linguistic abilities are uninvolved."[1] As a consequence, Deacon (416) continues, "We cannot help but see the world in symbolic categorical terms, dividing it up according to opposed features, and organizing our lives according to themes and narratives."

Foremost amongst these themes and narratives is, of course, our sense of self. "Self-representation... could not be attained without a means for symbolic representation." Deacon continues (451-52):

> It is a final irony, that it is the virtual, not actual, reference that [linguistic] symbols provide, which gives rise to this experience of self. The most undeniably real experience is a *virtual* reality.... its virtual nature notwithstanding, it is the symbolic realm of consciousness that we most identify with and from which our sense of agency and self-control originate.

Buddhist analyses of mind also connect reflexivity, and the linguistic categorizations associated with it, with cognitive processes (*vijñāna*) that have been built up through the accumulating cycles of dependent arising. These are closely

[1] The primatologist and child developmentalist, Michael Tomasello (1999, 215), concludes that "the uniquely human forms of thinking do not just depend on, but in fact derive from, perhaps even are constituted by, the interactive discourse that takes place through the medium of intersubjective and perspectival linguistic symbols, constructions, and discourse patterns."

associated with 'mental' cognitive awareness (*mano-vijñāna*), which occurs in relation to ideas and concepts, which are, of course, closely related to speech in classical Indian thought. Thus, the sense of self in early Buddhist thought is typically considered a linguistic phenomenon, and referred to as such in Sanskrit and Pāli: *asmi iti*, ('saying "I am"'), a phrase we find in Patañjali's *Yogasūtras* as well. This implies no ontological existence, however, it is merely a designation (*prajñapti*), a 'virtual reality,' as Deacon puts it, in which we are deeply enthralled.

One reason "we cannot help but see the world in such categorical terms," is that these linguistic influences are part of the neurological structures of a mature adult, and as such they occur automatically, without our awareness of them. In this sense, they are themselves constitutive conditions *for* human cognition rather than direct products *of* cognition. As cognitive scientists Lakoff and Johnson (1999, 18f) point out:

> Categorization is ... a consequence of how we are embodied.... We categorize as we do because we have the brains and bodies we have and because we interact in the world the way we do... Categorization is thus not a purely intellectual matter, occurring after the fact of experience. Rather, the formation and use of categories is the stuff of experience.

This, too, is paralleled in Buddhist thought, particularly Yogācāra Buddhism, my own area of research. Yogācārins pointed out long ago that such categorizations are an important influence on the content and structure of unconscious processes. The subliminal processes called *ālaya-vijñāna* occur in tandem with not only the material sense

faculties, but also the "predispositions toward conventional images, names, and concepts." And these in turn support and facilitate conscious cognitive processes (*pravṛtti-vijñāna*).

Amongst these conventional names and concepts is, of course, a sense of self, also recognized by Yogācārins as occurring unconsciously, i.e. a *kliṣṭa-manas*. This subliminal mode of mind is always "conceiving (*manyanā*) 'I-making' (*ahaṃkāra*), the conceit 'I am' (*asmimāna*), and always occurs simultaneously with the unconscious processes (*ālaya-vijñāna*)," thinking "I am this" (*asmīti*) and 'this is I" (*aham iti*). It is, as the scientists just quoted would readily recognize, a fully embodied, yet quite fictional sense of self that we "virtually forced to maintain a belief in," whether we know it or not, whether we want to or not.

My point here is that even more than the other sciences, Buddhists have much to contribute to cognitive science —as of course do other yogic traditions of India. Buddhists have been thinking and practicing in these terms —i.e. through an analysis of the patterned arising of consciousness — for many, many centuries. This is not to say that Buddhists have the last word on the subject, far from it. But they can provide interesting perspectives —and, I should add, willing subjects —for scientists to contemplate.

But Buddhists can only contribute to this work if they know about the basic methods and findings of cognitive science. And this requires modern education. To paraphrase an expression popular in America, what would Vasubandhu do?

Identity

This brings us to my second point, which will be shorter but less pleasant.

Buddhist thinkers need to know about the social sciences not only to be able to share their particular insights into the construction of self-identity, but even more importantly in order to help apply these insights to the problems that plague modern societies. This is an urgent and world-wide problem that requires a variety of perspectives to understand and address.

As suggested by the cognitive scientists above, modern scientists —and I include social scientists here —take it *as a matter of course* that our identities, our explicit or implicit sense of who and what we are, are a complex product of various causes and conditions. Specifically, they consider identities to be 'social constructions' that have developed over time through recurrent interaction with our families, friends, and communities. Such selves do not and cannot stand alone and they never have. This is one of the basic working assumptions in the social sciences and its parallels with Buddhist thinking should be obvious: Buddhist thinkers have long considered the notion of self to be just another designation (*prajñapti*) or false concept (*vikalpa*). As the Singhalese monk and scholar, Bhikkhu Ñāṇananda (1971, 11), notes, "The label 'I' thus superimposed on the complex contingent process, serves as a convenient fiction of thought or a short-hand device."

What is less obvious, though, is that both traditions also agree, first, that our sense of self-identity is continuously constructed as a defense against the anxiety created by the impermanence

and fragility of existence, and, second, that this quest for self-identity is not only futile — since it can never overcome impermanence — but also self-defeating — since it becomes a source of suffering in its own right. I quote two of the most eminent sociologists of the late 20th century.

British sociologist, Anthony Giddens (1991, 53), observes, "Self-identity... is not something that is just given... but has to be routinely created and sustained in the reflexive activities of the individual." "Self-identity is inherently fragile," he continues (185), because it "has to be created and more or less continually reordered against the backdrop of the shifting experiences of day-to-day life and the fragmenting tendencies of modern institutions." That is, impermanence and uncertainty.

But to grasp on to self-identity in this way creates even more problems. As Peter Berger, *et. al.* (Berger, Berger and Kellner 1973, 78) explain:

> On the one hand, modern identity is open-ended, transitory, liable to ongoing change. On the other hand, [this] subjective realm of identity is the individual's main foothold in reality. [The problem is that] something that is constantly changing is supposed to be [one's real being] *ens realissimum*. Consequently it should not be a surprise that modern man is afflicted with a *permanent identity crisis*.

In other words, our very attempt to grasp onto something as slippery as self-identity actually exacerbates our insecurity about identity. The cure is as bad as the disease — maybe worse.

These ideas, articulated by two of its major theorists, are central to mainstream sociology. The parallels and commonalities with Buddhist thought here are also obvious. The construction of self-identity is both driven by a misdirected attempt to escape impermanence and suffering, and a cause for further suffering. We are caught, in short, in a vicious circle —which is the basic sense of the term *saṃsāra*. But Buddhist thinkers need to know about this if they are going to meaningfully participate in this aspect of the modern world.

Even more importantly, I think Buddhists need to bring their voices to discussions about national and ethnic identity, as difficult and sensitive as these may be. For if the sociologists and Buddhists agree that self-identity is a construct that both reflects and reinforces the anxiety of modern life, they also agree that these constructions are strongly conducive to ethnic conflict and violence.

That is to say, that we typically not only imagine that individuals have true, unchanging, essential self-identities, but we also imagine that whole groups of people have such unchanging essences as well, which set them apart from one another by supposedly intrinsic and insurmountable differences. As anthropologist, Eric Wolf (1982, 6), warns:

> By endowing nations, societies or cultures with the qualities of internally homogeneous and externally distinctive and bounded objects, we create a model of the world as a global pool hall in which the entities spin off each other like so many hard and round billiard balls. Thus it becomes easy to sort the world into differently colored balls.

When we imagine that group identities are something intrinsic, real and unchanging, then we can easily sort the world into differently colored, differently cultured, and differently classified groups of people who appear hermetically sealed off from one another. They don't interact, mingle or merge; they merely bump into and bounce off each other with more or less friction as the case may be.

But while self-identities need our constant imagination to remain viable, no imagination is necessary to see the results of sorting people into intrinsically distinct groups set apart from each other: we read about communal, racial, and religious conflict every day in every newspaper in every country in the world.

Like intelligent and good-willed people the world over, modern Buddhists must address these public issues by—in terms of the traditional metaphor—unfolding their lotus flowers of clarity and compassion in the swamp of our confused and conflicted times. But they cannot fully do this unless they can also communicate, like Vasubandhu did, in the languages and concepts of the times—a large part of which are now the languages and concepts of the natural and social sciences.

If modern science, as I suggested earlier, is one long lesson in dependent arising, then it is also part and parcel of the perennial Buddhist quest to understand and alleviate suffering wherever and however it occurs. As Nāgārjuna famously put it (XXIV 40): "Whoever sees dependent arising also sees suffering and its arising and its cessation as well as the path." Modern science can and should be a means toward this altruistic aim.

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Better Than a Hundred Years[1]

Venerable Bhikkhu Bodhi

One day not too long ago I picked up on my shortwave radio an interview with an American futurist whose name I didn't catch. A futurist, as the word implies, is one whose job it is to predict the future. By collating a vast amount of information about developments presently taking place in various fields, he discovers the most prominent trends at work beneath the surface of events, and by projecting from these trends he constructs a picture of the future over increasingly longer time frames —over the coming decade, century, and millennium. Naturally, as temporal distance from the present increases, the picture he paints becomes proportionally more liable to error; but though an element of conjecture is unavoidable in all long-range forecasts, what the futurist holds is that

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his projections are based squarely on the trajectory we are traveling along today.

The questions the interviewer posed drew out from the futurist an astonishing picture of things to come. In his cheery view, the great perennial springs of human suffering are about to yield to the insistent pressure of our ingenuity and determination to create a better world. The next century will usher in an era of unprecedented progress, prosperity, and justice, with radical changes taking place even on the most primordial frontiers of biology. Couples who want children will no longer be dependent on natural processes vulnerable to chance and tragedy: they will be able to specify the precise features they would like their children to have and they'll get exactly what they want. Medical science will find cures for cancer, AIDS, and other dreaded illnesses, while virtually every vital organ will be replaceable by a synthetic counterpart. Biologists will discover how to halt the process of aging, enabling us to preserve our youthfulness and vitality well into our twilight years. By the end of the next century our life span itself will be extended to 140 years. And before the next millennium draws to a close, science will have found the key to immortality: "That's a hundred percent certain," he assured us.

While I listened to this intelligent, articulate man ramble on with such optimistic verve, I felt a sense of uneasiness gnawing away in my gut. "What's wrong with this picture?" I kept on asking myself, "What's missing? What's so troubling?" Here he was, depicting a world in which humanity would triumph over every ancient nemesis, perhaps even over death itself; and yet I felt that I just couldn't buy it, that I would prefer this wretched, fragile, vulnerable, existence nature has conferred on us by birth. Why?

For one thing, it seemed to me that his glowing picture of the future depended on some pretty big assumptions — assumptions which could only work by conveniently turning a blind eye to other present trends which are very far from comforting. He was presupposing that advances in technology will bring only benefits without entailing new problems just as formidable as those that taunt us today; that by sheer cleverness we will be able to rectify old blunders without having to curb the greed that caused those blunders in the first place; that people will spontaneously place the common good above the promptings of naked avarice; that the spread of material affluence will suffice to eliminate the suspicion, hatred, and cruelty that have bred so much misery throughout history.

But, as I continue to reflect, I realized that this was not all that was troubling me about the futurist's picture; I felt there was something still deeper scratching at the back of my mind. At its root, I came to see, my disquietude revolved around the issue of orientation. The picture he presented showed a future in which human beings are completely immersed in temporal concerns, absorbed in the battle against natural limitations, oriented entirely to the conditioned world. What was conspicuously absent from his picture was what might be called "the dimension of transcendence." There was no hint that human existence is not a self-enclosed circle from which it gains its meaning, that the quest for true fulfillment requires reference to a domain beyond everything finite and temporal.

By deleting all mention of a "dimension of transcendence" the futurist could portray a humanity pledged to the idea that the ultimate good is to be realized by gaining mastery over the external world rather than mastery over ourselves. Given

that life involves suffering, and that suffering arises from the clash between our desires and the nature of the world, we can deal with suffering either by changing the world so that it conforms to our desires or by changing ourselves so that our desires harmonize with the world. The picture drawn by the futurist showed a future in which the first alternative prevailed; but the Buddha, and all humanity's other great spiritual teachers as well, unanimously recommend the second route. For them our task is not so much to manipulate the outer conditions responsible for our discontent as it is to overcome the subjective roots of discontent, to vanquish our own selfishness, craving, and ignorance.

In preferring the more ancient approach I don't mean to suggest that we must passively submit to all the frailties to which human life is prone. Stoic resignation is certainly not the answer. We must strive to eliminate debilitating diseases, to promote economic and social justice, to fashion a world in which the basic amenities of health and happiness are as widely distributed as possible. But when the driving engine of civilization becomes sheer innovation in techniques we risk venturing into dangerous areas. To struggle with Promethean audacity to bend nature to our will so that all the objective causes of our suffering will be obliterated seems an exercise in hubris —in arrogance and presumption —and, as we know from Greek tragedy, hubris inevitably provokes the wrath of the gods.

Even if our reckless tinkering with the natural order does not unleash a cosmic cataclysm, we still risk a gradual descent into the trivialization and mechanization of human life. For by making technological ingenuity the criterion of progress we lose sight of the moral depth and elevation of character which

have always been the classical hallmarks of human greatness. We flatten out the vertical dimensions of our being, reducing ourselves to a purely horizontal plane in which all that matters is technical expertise and organizational efficiency. Thereby we veer closer to the situation described by T.S. Eliot, "The world ends not with a bang but a whimper."

While I reflected on the futurist's predictions, there came to mind a series of verses from the Dhammapada which offer a strikingly different picture of the challenge facing us in our lives. The verses occur in the "Chapter of the Thousands," vv.110-115. The first four stanzas tell us that it is not how long we live that really counts, but how we live, the qualities we embody in our innermost being: "Better than to live a hundred years immoral and unconcentrated is it to live a single day virtuous and meditative. Better than to live a hundred years foolish and unconcentrated is it to live a single day wise and meditative. Better than to live a hundred years lazy and dissipated is it to live a single day with energy firmly aroused. Better than to live a hundred years without seeing the rise and fall of things is it to live a single day seeing the rise and fall of things."

In these verses the Buddha tells us that our primary task, the task to which all others should be subordinate, is to master ourselves. The challenge he throws at us is not to remove all the thorns strewn over the earth, but to put on sandals, to vanquish the desires responsible for our suffering in the very place where they arise: in our own minds. As long as our lives are ruled by desire, there will never be an end to discontent, for the elimination of one obstacle will only give rise to a new one in a self-replicating cycle. What is essential is not to prolong life by readjusting biological processes so that they fulfill our

wildest dreams, but to ennoble life by sober mental training within the humble limits of our natural condition. And this is achieved, as the Buddha repeatedly stresses, by the triple discipline of moral restraint, meditation, and deep insight into the impermanence of all conditioned things.

The last two verses in this series introduce the end toward which this training points, which is also the goal toward which our lives should be steered: "Better than to live a hundred years without seeing the Deathless is it to live a single day seeing the Deathless. Better than to live a hundred years without seeing the Supreme Truth is it to live a single day seeing the Supreme Truth." If human progress is not to be reduced to a mere pageant of technological stunts aimed at pushing back our natural limits, we require some polestar toward which to steer our lives, something which enables us to transcend the boundaries of both life and death. For Buddhism that is Nibbāna, the Deathless, the Supreme Truth, the state beyond all limiting conditions. Without this transcendent element we might explore the distant galaxies and play cards with the genetic code, but our lives will remain vain and hollow. Fullness of meaning can come only from the source of meaning, from that which is transcendent and unconditioned. To strive for this goal is to find a depth of value and a peak of excellence that can never be equaled by brazen technological audacity. To realize this goal is to reach the end of suffering: to find deathlessness here and now, even in the midst of this imperfect world still subject, as always, to old age, illness, and death.

Buddhism and Science: Further Explorations

Venerable Chuan Sheng

> *The scientific method should operate on different levels. There are, first, the so-called physical sciences based on the six senses. Then there is the scientific study of thought processes. Beyond this there is the more profound science of direct intuitive acquaintance or enlightenment known only to a few choice souls who have seen through the nature of existence and have come to a consciousness of reality beyond all the illusions and distractions of life. This experience is attained by means of quiet abstraction and intuitive response to the universe. The Buddhist Hall of Meditation is the laboratory for this more advanced type of scientific research. And the materials for the experiment are none other than one's own bodily senses and his mind....*

So wrote Frank Millican in 1926 of Venerable Master Taixu's view on how science can become "more comprehensive" to better demonstrate the "harmony" between Buddhism and science (cited in Pittman 2001, 168-169). Taixu had likewise commented on another occasion: "If life, however, were founded on the six pāramitās —the six perfect virtues of the bodhisattvas —and these were realized to be in accordance with scientific research, then we might hope to enter into the pure realms of Buddha and emerge from the chaos of fire and brimstone into which we have fallen" (cited in Pittman 2001, 166).

The encounters between Buddhism and science have come a long way since the times of Taixu, encompassing what Taixu perceived to be physical sciences based on the six senses and the scientific study of thought processes. Whether they can develop into the more profound science of direct intuitive acquaintance or enlightenment, or demonstrate that the six paramitas are in accordance with scientific research, are interesting questions to ponder. This concluding chapter will recapitulate the main themes of the essays of this book, and present some recent scientific advances that have a bearing on Buddhism.

Further Exploring the Encounters between Buddhism and Science

The Age of Exploration and the Scientific Revolution had led to increasing encounters between religion and science from the sixteenth century onwards, beginning with Christian missionaries hailing science and showcasing Christianity as a modern religion. From the late-nineteenth to early twentieth centuries, the discourse on the "compatibility" of Buddhism and science emerged and developed in Western intellectual circle; Buddhist leaders also stressed this compatibility in their anti-imperialist struggles and efforts to rejuvenate Buddhism, and the close association between Buddhism and science has continued since.

In the biological sciences, the discussion on compatibility was first seen in Charles Darwin's theory of evolution and natural selection and the Buddhist doctrines of karma and rebirth, evident in the arguments of Thomas W. Rhys Davids, Thomas Huxley, Walter Evans-Wentz, and Sōen Shaku. Nonetheless,

Lopez has argued that there seems to be more differences than similarities between Darwinism and karma and rebirth when examining their interpretations of suffering and happiness, random mutations, sentience and non-sentience, beginning of consciousness or life, perpetuation of different species, and extinction (Lopez 2012, 47-80; Lopez 2008, 21-22; McMahan 2008, 64; the Dalai Lama 2005, 97-115).

In recent times, such scholars as Denis Noble, David Brasah, Ratnaprabha, and William S. Waldron have pointed to compatibility in other aspects. Noble has offered a systems biological interpretation of the concept of No-Self (*anātman*). Instead of stressing the "selfish" nature of genes and molecular biological components, Noble argues that genes do interact with each other and the environment; instead of a one-way "reductionist causal chain" from "the genes to the organism," he emphasizes a "downward causation" of "systems with multiple levels and feedbacks downward and upward between the levels." Noble sees the self as a construct and process, not "an immaterial substance" or the brain; he notes how similar his interpretation is with the "seed-and-fruit" "four-cornered logic" that the Korean monk, Won Hyo 元曉 (원효)(617-686), used to clarify the Buddhist understanding of "being/non-being."

Noble's systems approach resonates with recent trends in the biological sciences. In *Buddhist Biology: Ancient Eastern Wisdom Meets Modern Western Science* (2014), David P. Brasah likens the disciplines of Buddhism and biology to "a pair of powerful searchlights" in providing insights to the issues of life, and calls his interpretation "Existential Bio-Buddhism." Inspired by Vietnamese Zen Master Thích Nhất Hạnh who uses the term "interbeing" to refer to

the interdependence of all beings, an idea related to the "interpenetration" emphasized in Chinese Huayan Buddhism, Brasah stresses interconnectedness, together with "not-self" and impermanence, in his discussions on evolution, genetics, ecology, and neuroscience (Brasah 2014; Ratnaprabha n.d.).

Likewise, William S. Waldron, in his essay in the Introduction, has suggested how terms like river, tree, frog, and human can be used to illustrate such Buddhist concepts as dependent arising and non-self. In another essay, like Noble's downward causation, Waldron views human evolution as "a self-organizing, feedback process in which action and experience condition the construction of organismic forms and patterns, which themselves form the basis for new behaviors and experience, and so on, eventually giving rise to new emergent structures at each stage of development"; Waldron uses this "Middle Path—between the extremes of absolute determinism and absolute autonomy," to transcend the sterile nature-versus-nurture debate that has long featured in evolutionary biology (Waldron 2000, 3).

Ratnaprabha supports the position of Noble and Waldron, highlighting how genes operate in complex manners and how "events can switch genes on and off according to circumstances, and survival-enhancing features innovated by a parent can pass to its descendants without changes to the genetic sequence," in processes termed epigenetics (Ratnaprabha n.d.). The propositions of Noble, Brasah, Waldron and Ratnaprabha are similar in some ways to such recent theoretical paradigms as complexity theory and systems theory which "show the way to a more integrative, holistic understanding that reveals underlying connections between biological, psychological, social, and ecological systems" (McMahan 2008, 170).

Ratnaprabha further argues that the minds of animals and human beings can be understood to have evolved through "law-governed causal sequences." Analyses are given in his Dharma Training Course module, "Evolutionary Buddhism" (2009), and in his book, Robin Cooper (Ratnaprabha), *The Evolving Mind: Buddhism, Biology and Consciousness* (1996), which discusses how consciousness evolves "from the simplest organism, through the self-aware human being, to enlightenment," through a process of "perpetual self-transcendence." Likewise, Waldron considers the Buddhist doctrine of karma to be similar to evolutionary biology in that the present constitution of human life, its forms and structures, is the product of the activities of past immeasurable generations of beings (Waldron 2000, 7). This is further seen in how a living organism is understood to be a "stable organization of matter and energy through which both matter and energy flow"; as such, "[t]here is no unchanging identity in organisms, since all the actual molecules of one's body are continuously being exchanged, but neither is there absolute discontinuity, since the *pattern* of organization persists *by means of, not in spite of*, these continual flows of matter and energy" (Waldron 2000, 19-20). Ratnaprabha and Waldron therefore provide additional perspectives on the Darwinism-karma debate.

Ratnaprabha and Waldron also highlight the need to transcend scientific materialism, which privileges matter as the "one real substance that made up everything in the universe," and mind as "nothing but patterns of electrical and chemical processes in the brain" (Ratnaprabha n.d.). Building upon the work of such scholars as Humberto Maturana and Francisco Varela, John Tooby and Leda Cosmides, and Fritjof Capra, Waldron concludes: "If we —our genes, our bodies, our cognitive and

affective structures, our consciousness itself—are indeed primarily comprised of emergent capacities constructed by past (both phylogenetic and ontogenetic) interactions with our environment, then our minds and selves are not simply *analogous* to but are *fundamentally inseparable* from the natural world... The Buddhist parallels to this biological 'Mind-Only' theory, *mutatis mutandis*, are legion" (Waldron 2000, 20-22).

By highlighting how evolutionary biology and Buddhism can lead us to understand an interdependence that pervades all phenomena, doing away with the dualities of mind and matter, Waldron and Ratnaprabha are showing us how the discussion on Buddhism and science can be further explored.

In the physical sciences, the Buddhism and science discussion on compatibility was first seen in the observer-independent materialist/realist/essentialist interpretation of matter that views real atomic matter particles constituting the physical world. This was followed by the objective idealist interpretation that sees "arising material objective reality as unreal, a subjective apparition or illusion of a sober, sentient perceiving consciousness," and the centrist Middle Way interpretation of "objective relative and subjective ultimate" (Boaz; Boaz 2015a) which stresses the concept of "two truths" and "emptiness." Such a spectrum of views are seen in the essays of Ankur Barua, Shuichi Yamamoto and Victor F. Kuwahara, B. Alan Wallace and David Peter Boaz, with Wallace and Boaz advocating a noetic revolution.

A critique of the materialist approach, and arguments for the scientific credibility of the "double truth" Middle Way approach, are further presented in Graham P. Smetham's

2011 essay, in which he makes four interesting arguments. First, using the analogy made by Henry P. Stapp, Smetham explains that modern quantum theory maintains two levels of reality: quantum reality is "idealike" or "mindlike," an evolving "pool of potentiality for experiential existence" that allows the *apparent* reality of the material world to emerge when sentient beings "cognitively interact" with it (Smetham 2011, 5). Such an interpretation parallels the Buddhist two truths or two realities, as understood in the Cittamātra (Mind-Only) and Madhyamaka (Middle Way) structure of reality: ultimate reality and the illusion of the conventional reality of the everyday world. Because quantum physics has directed attention to the illusory reality of the material world, Victor Mansfield considers modern quantum physics as "experimental metaphysics" (Smetham 2011, 11-12).

Second, Smetham draws parallels between the Buddhist concept of "emptiness" and the notion of "quantum potentiality." He begins by noting the "paradoxical existential configuration of the state of the *Tathāgata* [Buddha] after death," as presented in the *Saṃyutta Nikāya* (SN 22.86 — Anurādha Sutta): "The Tathāgata exists after death, does not exist after death, both does & does not exist after death, neither exists nor does not exist after death." Smetham then shows how the "tetralemma" of Madhyamaka Buddhism that explicates "emptiness" (*shunyata*) or ultimate reality contains this configuration: "Neither existent, nor nonexistent, Nor both existent and nonexistent, nor neither." Smetham notes that this configuration matches J. Robert Oppenheimer's analysis of an electron (a quantum "particle") and hence the ground of quantum potentiality: "If we ask, for instance, whether the position of the electron remains the same, we must say 'no;' if we ask whether the electron's position changes with time, we

must say 'no;' if we ask whether the electron is at rest, we must say 'no;' if we ask whether it is in motion, we must say 'no.'" (Smetham 2011, 7).

Third, Smetham highlights similarities between the Buddhist concept of "emptiness" and the notion of "quantum weirdness" in explaining the working of the universe. Madhyamaka Buddhism characterizes "emptiness" as "a hovering between existence and non-existence," and sees it as necessary for all phenomena to function and for the world of experience to arise (Smetham 2011, 8). Marcus Chown posits the same function to this hovering and calls it "quantum weirdness"; Smetham explains it as the "ability of a quantum particle to be in two places at the same time, whilst still maintaining an identity as a single entity." Michio Kaku has similarly argued that the stability of molecules and the universe is possible because "electrons can exist in parallel states hovering between existence and non-existence." All these lead Smetham to assert that "quantum physics supports the Buddhist 'two truths' metaphysics, with 'emptiness'—the lack of inherent existence which 'hovers' between existence and non-existence—as the ultimate truth, in a remarkable fashion" (Smetham 2011, 22).

Fourth, Smetham draws parallels between the Buddhist concept of karma and the notion of "consciousness-observer." He begins by stressing the observer (consciousness)-dependent nature of the conventional world, as presented in both Buddhist thought and modern quantum theory, and proceeds to explain the "quantum measurement problem": because the particles of the conventional world can be perceived only when measured by human consciousness, they are the expression of how consciousness interact with

the ground of quantum potentiality. In other words, it is this "continuous measuring activity of consciousness" that gives rise to the illusory material world from the quantum ground of potentiality, and this conventional world is a collective illusion karmically created "over vast time scales through the perceptual activities of all sentient beings." Smetham reiterates John Wheeler's observation that: "The universe does not 'exist, out there,' independent of all acts of observation. Instead, it is in some strange sense a participatory universe," a "self-perceiving universe" (Smetham 2011, 17-20). As such, Smetham concludes that "karma and rebirth is *entirely coherent* with what we know about the deepest level of the functioning of reality... the preeminence of the karmic mechanism of cause and effect operating at the quantum level...." (Smetham 2011, 4).

Such an understanding of karma can further elucidate Bodhisattva Samantabhadra's reference to the countless world-systems and universes in the *Avataṃsaka Sūtra* (Flower Garland Sūtra/Flower Ornament Scripture):

> ... In the ten directions I see every place
> In all the worlds and universes
> Pervading the vast expense of space...
> Some worlds of pure light are [made],
> Suspended steadily in space...
> Some are shaped like flowers,
>
> Lamps adorned with jewels,
> Some are vast as the ocean,
> Spinning like a turning wheel...
> Some are slender, some are small,
> For they have countless forms —
> And spin in various ways...

Some worlds are round and others square,
Some lands are pure and some defiled,
Others joyful or distressing...
All were caused by karmas
Varied as the oceans...

Unfathomable are the countless worlds
In the totality of universes.
Many worlds are new or are decaying,
While many others will soon cease to be.
Like leaves in a forest,
Some flourish, others fall...
As different seeds give birth to different fruits,
Or magicians project conjurations with their spells,
So sentient beings by the power of [collective] karma
Make various world-systems that are incomprehensible...

As a painter draws many pictures,
A sentient being's Mind can also create
Infinite variations of world-systems....
(cited in Chang 1971, xxi-xxii; see also Davis 1984)

Hence, in the physical sciences, the discussion on Buddhism and science also highlights the need to further explore all phenomena beyond a scientific materialist perspective, to transcend all dualities in order to comprehend the nature of all phenomena.

In the cognitive sciences or sciences of the mind, the Buddhism and science discussion on compatibility was first displayed in the interest in meditation. In the nineteenth and early-twentieth centuries, Buddhist meditation found a place in Western society, in the midst of such spiritual currents as transcendentalism and Theosophy. It also fitted well with the

"subjective turn" of modernity, as this aspect of modernity stresses "interior life," personal experience and individualism, instead of "external authority" and institutions. As the pace of modernization and industrialization quickened, meditation came to be seen too as a way to relieve the pressure of hectic lives (McMahan 2008, 187-188). Mindfulness practice, which emphasizes constant awareness of bodily actions, feelings, thoughts, states of mind, and all aspects of life, also spread widely in these contexts to become the "mindful revolution." David L. McMahan further attributes the popularity of mindfulness practice to its attunement to "modernity's broad world-affirming attitude," to the trend of "modern literature's valorization of the details of everyday life," and to the "modern way of resacralizing the world without resort to the supernatural" (2008, 218).

Scientific investigation of meditation, which started in the 1960s with Japanese scientific research on Zen meditators, aims to track and understand how meditation affects bodily and mind functions. In recent decades, scientists from many countries have used a plethora of advanced technology to measure and evaluate how meditation and mindfulness practice affect "attention, perceptual sensitivity, anxiety, regulation of emotional states, neurophysiological responses to stressful stimuli, immune system functioning, central nervous system activity, and specific neurological structures," and how they can work to alleviate stress, manage pain, provide psychotherapy for mental ailments, assist recovery from illnesses, and bring about well-being and happiness (McMahan 2008, 204-205; Baer 2006). Recent discussion on neuroscientific evidence that support the health benefits of the various types of meditation is given in the essays of Piya Tan ("Grow Your Brain") and Rick Hanson. How mindfulness

practice has been used in psychotherapy and maintenance of well-being is presented in the essays of Gregor Lange, Ratmalane Somaloka, Lobsang Rapgay, Piya Tan (ACT and early Buddhism), and Wee Sin Tho.

Besides being an object of scientific investigation, meditation has also been perceived to be a type of science. This proposition could be traced to the spiritual environments of Western society in the nineteenth century, which regarded meditation and contemplative aspects of religions as an "interior science" on par with empirical science. It developed further in the twentieth century, with some scholars considering Buddhist meditation to be an "inner science," a "science of mind," or "radical empiricism"; Wallace, for instance, has discussed Buddhist radical empiricism in terms of Vaibashika's dualistic reductionism, Sautrāntika's pluralistic realism, Yogachara's philosophical idealism, and Madhyamaka's ontological relativism (McMahan 2008, 205-208; Wallace 2012, 62, 125-143).

Wallace and Boaz have also argued for the need of the cognitive sciences to now move toward a noetic revolution, by integrating hard cognitive sciences with soft contemplative science. Wallace, in his "Potential of Emptiness" essay, contends that when the "two great traditions of experiential [Buddhism] and rational inquiry [science] are integrated, we will see a Noetic Revolution that will be of enormous benefit for humanity." Boaz observes, in his "Realizing Human Happiness" essay, how this "noetic (subject/object unity)" perspective and the Buddhist concepts of two truths and emptiness can clarify "the ontological interdependence —the prior unity —of all arising phenomena with their primordial matrix source," and give rise to the understanding that there is "no *essential* separation, no

intrinsic duality of knowing subject and appearing objects," that "Mind and body, spirit and matter are an unbounded unified nondual whole (*mahabindu*)" (see also Wallace 2000; Boaz 2015b). Yet, why is it so important to understand the nature of consciousness? Wallace (2012, 157) explains:

> Because a world that truly understands the nature of consciousness becomes reoriented away from the hedonic treadmill of consumerism and toward the infinitely renewable source of happiness, cultivated by training the mind. People who truly understand the nature of consciousness may find themselves upholding ethics that are universal and empirically verifiable. In a civilization that truly understands the nature of consciousness, the world's great religions may discover their contemplative roots and reclaim their deep common ground.

In what other ways can the encounters between Buddhism and science be further explored?

In his Conclusion essay, "Buddhist Modernity and the Sciences," Waldron has suggested how Buddhism, through the examples of causality and non-essentialism, and self-identity and suffering, can work with the sciences to contribute to the modern world. McMahan, in seeing scientific Buddhism as one facet of how Buddhism has adapted and hybridized in modern times through the processes of "detraditionalization, demythologization, and psychologization," negotiating between "the rationalist imperative to avoid supernaturalism and the Romantic longing for the reenchantment of the world," has proposed several roles that Buddhist modernism can play in addressing the challenges of contemporary times (2008, 114-116, 239-241, 260):

> The Buddhist analysis of the relationship between craving (*tṛṣṇa*) and dissatisfaction (*duḥkha*), for example, as well as its ascetic tendencies, can be fashioned into a formidable critique of the very foundations of consumerism, materialism, and the pathological aspects of capitalism... Buddhism's sophisticated techniques of meditation combined with its vigorous ethical reflection offer forms of psychological and spiritual self-cultivation that can transcend the self-absorption and social irrelevance that has beset some modern psychotherapies and New Age spiritualities... Engaged Buddhism, furthermore, brings a unique perspective and a new vocabulary to the discourse of human rights, war and peace, environmentalism, and other pressing social and political concerns, expanding their conceptual resources.

In a similar vein, Venerable Bhikkhu Bodhi, in his essay in the Introduction, expresses the hope that:

> Buddhist thinkers and open-minded scientists, by sharing their insights and reflections, can show us an effective way to heal the rift between objective knowledge and spiritual wisdom and thus bring about a reconciliation between science and spirituality. In this way spiritual practice will become an integral part of the discipline aimed at knowledge, and spiritual practice and knowledge in combination will become the tools for achieving the highest good, enlightenment and spiritual freedom.

Hence, there are many positive ways in which the studies of Buddhism and science can proceed, and we look forward to such encouraging trends, to learning from such fascinating encounters of Buddhism and science.

At the same time, we should bear in mind how the above observations have also highlighted the importance of spiritual practice. As reiterated by the Dalai Lama (2005, 206): "From the Buddhist perspective, a full human understanding must not only offer a coherent account of reality, our means of apprehending it, and the place of consciousness but also include a clear awareness of how we should act." Here, the emphasis is on leading a life of ethical discipline, cultivating the mind through meditation, and practicing to realize wisdom, enlightenment. For Taixu (cited in Pittman 2001, 168):

> [Enlightenment] is the final stage of harmony in which one sees beyond the changing phenomena of existence and becomes conscious of reality —the reality in which there are no distinctions as this and that, good and evil, self and non-self... This stage of perfect Buddhahood... involves a belief in Buddha, the Law, and the Order; it involves true faith and a belief in the law of cause and effect. It further involves conformity to the ten rules of good conduct and the ability to rise above the things of desire which are the cause of suffering.

Venerable Bhikkhu Bodhi, in his essay in the Conclusion, further reminds us from the six stanzas in the "Chapter of the Thousands" of the Dhammapada, the centrality of practice:

> Better than to live a hundred years immoral and
> unconcentrated is it to live a
> single day virtuous and meditative.
>
> Better than to live a hundred years foolish and
> unconcentrated is it to live a
> single day wise and meditative.

> Better than to live a hundred years lazy and
> dissipated is it to live a
> single day with energy firmly aroused.
>
> Better than to live a hundred years without
> seeing the rise and fall of things is it to live a
> single day seeing the rise and fall of things.
>
> Better than to live a hundred years without
> seeing the Deathless is it to live a
> single day seeing the Deathless.
>
> Better than to live a hundred years without
> seeing the Supreme Truth is it to live a
> single day seeing the Supreme Truth.

Finally, we may also wish to embark on this most wondrous journey of exploration by emulating Bodhisattva Samantabhadra's vows in the *Avataṃsaka Sūtra* (Cleary 1993, 1516):

> ... Purifying oceans of lands,
> Liberating oceans of beings,
> Observing oceans of truths,
> Plumbing oceans of knowledge,
> Perfecting oceans of practices,
> Fulfilling oceans of vows,
> Serving oceans of buddhas,
> May I practice, untiring, for oceans of eons....
>
> The lofty vows of enlightenment practice
> Of the buddhas of past, present, and future
> May I fulfill completely,
> Practice what is good, and realize enlightenment.

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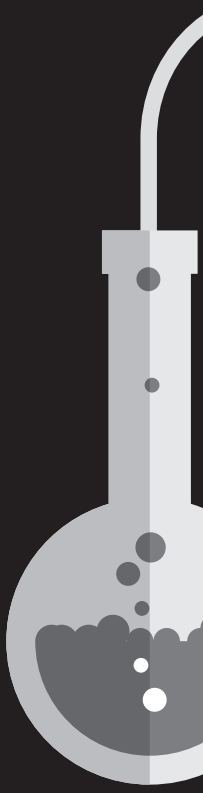

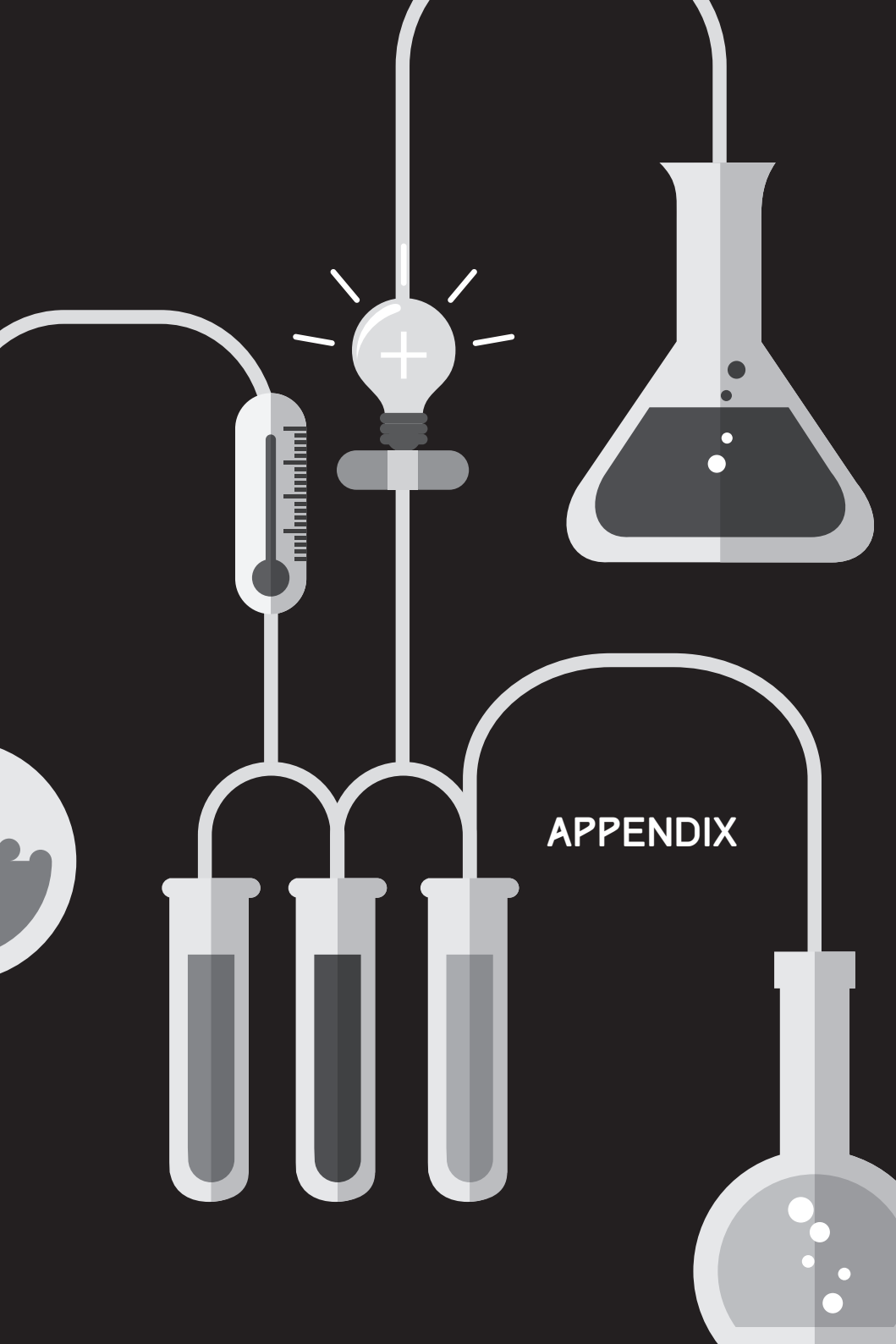
APPENDIX

An Introduction to Mindfulness Technique: A Taste of Mindfulness Practice[1]

Wee Sin Tho

Mindfulness empowers us to take charge of our own wellbeing

We all seek or long for enduring happiness or contentment. How many of us can confidently say that we have been successful? In our daily lives there are many occasions when we feel di..stress or anxiety, and on other times we feel sad, depressed or emotionally drained. If such instances are brief and infrequent they generally do not unsettle our overall sense of wellbeing and how we function in daily life. We overcome such episodes habitually by distracting ourselves or engaging in socializing, games, sports, exercise, entertainment, and for some of us bingeing or shopping. These activities do not provide enduring resolution to life's

[1] This is an updated version of an essay, "Mindfulness Practice," that first appeared in *Mental Healthcare of the Elderly: A Primer for Health Professionals*, edited by Kua Ee Heok and Rathi Mahendran, Singapore: Write Editions, 2014, pp. 107-113. We thank the publisher for granting permission to reproduce it.

trying challenges as they address only the symptoms, and not the underlying cause of our di..stress or anxiety. Moreover, when such episodes become frequent and prolonged, they can adversely affect our sense of happiness and contentment, and the quality of our relationships with our loved ones and others and daily functioning, especially if we suffer insomnia and become sleep deprived.

The habitual way out of di..stress and anxiety for some of us includes bingeing on food and/or indulging in alcoholic beverages. For the few of us who are unable to cope with di..stress and mood disorder, we resort to substance abuse. Others would consult a medical practitioner or psychiatrist and ask to be given sleeping pills, and anxiety and anti-depressive prescriptions. Depending on medication can result in addiction. When it comes to matters of the mind the answers can often be complex and not easily understood. If there is an alternative way to how we live our lives for more enduring wellbeing and happiness would we be open to give it a try?

There is now evidence-based research to suggest that mindfulness practice can provide "paths to the inner strengths and resources we all possess" (McBee 2008) and foster the best use of the potentiality of our bodily and mental faculties. Mindfulness practice helps "focus (our) mind to harness the power of attention to enhance (our) life and (our) relationships with others" (Hanson 2009).

A Secular Self-care Therapy

Mindfulness practice dates back to over twenty five hundred years ago. It is practiced in most major religious traditions. Meditation found interest as a secular practice in the US in the sixties through Maharishi Yogi. Mindfulness practice as

a meditation technique became more widespread when the Dalai Lama began in the early eighties engaging the scientific research community in a dialogue on how the practice can be of benefit to humankind.

Mindfulness practice aroused greater curiosity more recently when Dr. Richard Davidson, a neuroscientist, observed the impact of mindfulness practice on the brain, such as how the practice can result in our developing wellbeing skills, including learning happiness and compassion. In the eighties, Dr. Jon Kabat-Zinn, a molecular biologist, introduced mindfulness practice at his stress-reduction clinic to patients who suffered chronic pain. He systematized his approach to addressing a variety of health problems, including chronic disorders and diseases, and pain management, called Mindfulness-Based Stress Reduction ('MBSR'). MBSR combines mindfulness practice and yoga in promoting healing. Today, over three hundred medical centers and hospitals in the US offer MBSR to patients to better cope with chronic pain, pre- and post-operative procedures and the ravages of chronic diseases, including cancer. Dr. Kabat-Zinn's initiative, together with recent findings in neuroscience related to our mind and consciousness, sparked over a thousand research papers to-date on mindfulness practice and how it contributes to personal wellbeing and health.

A Mindfulness Practice for Peace of Mind and Mental Resilience

Mindfulness practice offers a systematic investigation and examination of our self and mind. It provides the skills for us to be with the present moment, and not reactive to life's experiences, a habitual tendency that comes with the baggage of our bias and prejudice.

The objective of developing a mindfulness practice is to bring awareness to a high level, and free our minds of all mental afflictions or emotional disturbances that bond us to our unhelpful habitual attitudes and tendencies. The realization of the true nature of experience fosters a change of our unhelpful habitual tendencies and can transform the way we live our lives.

We will share three mindfulness practices that will help develop attentional skills, which will enable us to become more mindful, and therefore aware of the experience of both our inner and outer worlds. There is nothing religious about the practice. We can bring our religion and faith into these practices.

Body Scan

This first practice involves a body scan that guides you to pay attention to your bodily sensations.

Find a quiet, comfortable corner at home and lay down an exercise mat. Gently notify the members of your household that you would need about thirty minutes of quality time to be by yourself. If you have babies or young children at home, the best time for you to perform this routine is the first thing in the morning when you wake up. After your shower, put on comfortable exercise clothes. Begin by lying on the exercise mat with your arms slightly away from your body and your feet about hip width apart. Close your eyes and set your aspiration. For example, your aspiration could be to have thirty minutes of quiet, quality time by yourself.

Lie on your back. Close your eyes and set your aspiration. This practice involves a body scan. Bring your awareness to

the soles of your feet and get a sense of what and how they feel. Gradually, bring your awareness to your ankles and progressively move your awareness slowly up your legs, and torso and finally to the crown of your head. This scan should take about five minutes. Then over the next five minutes reverse the sequence of the body scan. Start from the crown of your head and slowly bring your awareness down toward the soles of your feet, always maintaining vigilant attention on what and how you feel during the scanning. Whatever you sense or feel is what is. There is no need to form any judgment of what and how you should feel. During the body scan, breathe normally.

Next, bring your awareness to the rise and fall of your abdomen as you continue to breathe in and out normally. Maintain this awareness for another five minutes with vigilance and ease. After that, open your eyes and bring your awareness back to the general surrounding. Slowly roll over to your side and sit up. Maintain your mindfulness in the present moment, moment to moment, and slowly stand up. Sense what and how you feel for a couple of minutes and then take a few steps while paying close attention to the feeling of the soles of your feet. You can now get back to your daily affairs.

Try to make this practice a daily one. Another recommended time of day to engage in this mindfulness practice is after work or your daily chores, preferably after a shower, and before dinner. This practice is a wonderful way to relax your body.

Breath Sensations

When you are familiar with the body scan practice, try this breath sensations practice. This practice familiarizes you with the inter-connectedness of body and mind.

Find a quite space at home. Gently remind your family members that you would like thirty minutes of quiet, quality time to be by yourself. Sit on a cushion on the exercise mat and settle down crossed-legged in a posture most comfortable to you. If you find that posture uncomfortable, sit on a chair with your feet flat on the ground, keeping your back from resting on the chair. In either posture, keep your back upright but not rigid. Now, bring your awareness to the sensations of the in-and out-breath at the apertures of your nostrils. Use this awareness of the breath sensations as the chosen object of this mindfulness practice. In this routine, keep still and resist any temptation to fidget. Within a short while you will find that your mind will start to drift or be distracted by a thought, memory, emotion, discomfort, pain, or perhaps an itch. The moment you are aware of the distraction gently bring your awareness back to the chosen object of your mindfulness practice. Do this repeatedly and with practice you will become better at staying with your chosen object of mindfulness. In this practice, maintain your awareness on the quality of the sensations of the in-and out-breath. Continue to breathe normally, and do not force or regulate your breath. As you become more adept with this mindfulness practice, you will find that your mind becomes calm and lucid, and your ability to be present with the experience of the breath sensations becomes stronger. With practice you can use the beautiful breath as a tool to cultivate focused attention.

Open your eyes at the end of the mindfulness practice and bring your awareness back to your surrounding. Slowly move your limbs and body and do light, gentle stretching. Stand up slowly and walk a few steps while paying close attention to the sensations of the soles of your feet. Get back to your daily life and re-engage with your family members. Try to maintain

mindfulness of your every intention and action right up to bedtime. This practice is best done in the evening after work or your daily chores, preferably after a shower and before dinner. You can go for a thirty minutes brisk walk after the practice. Make this mindfulness practice a daily one.

"Breathing is the most natural thing in the world, the foundation of our lives. We do it without thinking about it, but by tapping into the power of this simple act, we can better manage stress and live happier lives" (Greenland 2010). You can learn a lot by paying attention to your breathing. It is "the swinging door between (our) inner and outer worlds" (Greenland 2010). And by paying attention to other people's breath, you can know how they are reacting to life's experiences.

Recalling an Emotional Episode

The third mindfulness practice involves your emotional experience.

Find a quiet space in your home and ask your household members to give you some quality time with yourself. Sit comfortably on an exercise mat with your legs crossed or sit upright on a chair with both feet placed on the ground keeping your back from resting on the chair. Maintain a distinguished but relaxed posture without any tightness. Breathe normally and bring your awareness to the sensations of the in-and out-breath without forcing or regulating your breath. When you settle into your breath, you will be able to maintain a good degree of attention to your breath sensations without being frequently distracted by thoughts or memories. Next, bring your attention to your torso, from the base of your abdomen to the neck zone. Get a sense of what and how your torso feels.

Now recall a recent difficult or disturbing emotional episode. Keep that recollection in mind. You do not want to re-live the episode for more than twenty seconds. During the twenty seconds, pay close attention to what and how you feel in your torso region. Some memories may trigger off a deep-seated traumatic emotion. Should that happen immediately bring your awareness back to the sensations associated with your in-and out-breath. Continue to breathe normally for another five minutes. Open your eyes, slowly and gently stretch your body and limbs. Slowly stand up, get a sense of the ground that you are standing on. Take a few slow steps and pay attention to how the soles of your feet feel. The entire routine should take no more than twenty minutes. Get back into your daily affairs. In daily life, when you are aware of the arising of a disturbing emotion, breathe slowly and deeply into your abdomen three times. Fill your abdomen fully with your breath and observe how you feel in your torso region.

This practice is best done in the evening after work or your daily chores, preferably after a bath. Maintain your awareness to all your intentions and actions right up to bedtime. You can also try this practice by recalling a joyful emotional episode.

Mindfulness Can Contribute To Our Wellbeing

We can all take charge of our own wellbeing and happiness. Mindfulness practice is a self-care strategy that is therapeutic of the mind. It has found its way into mainstream psychotherapy. Pay attention to the difference, if any, this mindfulness practice makes to the quality of your daily life and peace of mind. With regular practice, you should make good

progress in cultivating the qualities of relaxation, attention, and awareness associated with a mindfulness practice.

With diligence and perseverance, a sustained mindfulness practice, together with a healthy diet and regular exercise regime, can contribute to your wellbeing and happiness. Your confidence will grow and you will be adept at dealing with any life situation. If you find the practice helpful in addressing unhelpful tendencies that trigger your di..stress and anxiety in daily life you should register for a mindfulness workshop with a reputable instructor.

Most importantly, keep your mindfulness practice simple. As your practice develops, you will be able to sense that it is easier to be relaxed and at ease, your mind enjoys more calmness, and you will have greater clarity in your thinking. You will also notice that you exude calmness to your loved ones and the people around you.

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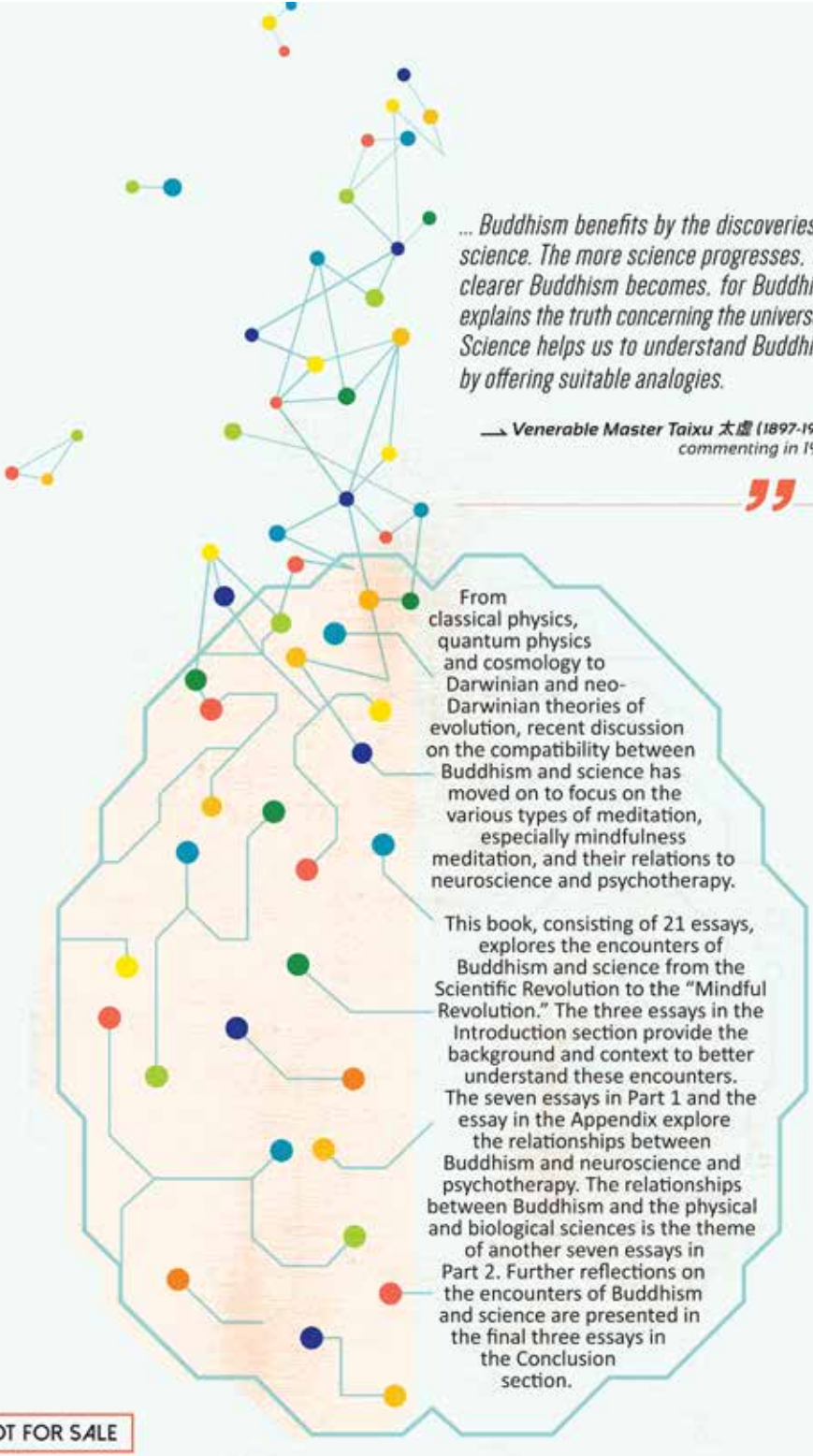

... Buddhism benefits by the discoveries of science. The more science progresses, the clearer Buddhism becomes, for Buddhism explains the truth concerning the universe... Science helps us to understand Buddhism by offering suitable analogies.

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This book, consisting of 21 essays, explores the encounters of Buddhism and science from the Scientific Revolution to the "Mindful Revolution." The three essays in the Introduction section provide the background and context to better understand these encounters. The seven essays in Part 1 and the essay in the Appendix explore the relationships between Buddhism and neuroscience and psychotherapy. The relationships between Buddhism and the physical and biological sciences is the theme of another seven essays in Part 2. Further reflections on the encounters of Buddhism and science are presented in the final three essays in the Conclusion section.

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