

# *Buddhism and the Sciences: Historical Background, Contemporary Developments*

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# Buddhism and the Sciences: Historical Background, Contemporary Developments

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## Abstract

While discourse on the relation between Christianity and science has a long history, it has only been in the last century that Buddhists and Buddhist scholars have begun to consider the relation between their own religious tradition and the promises and challenges of modern science. This does not mean that there has not been a long history of a relation between Buddhism and the sciences. However, rarely has that relation been conceived of in terms of “discourse on religion and science” as such. As a result, much of the recent work done in the area of science and religion, though significant in its own right, inadequately considers many core Buddhist concerns. Originally published in 1993, this version has been updated with a preface surveying developments over the last three decades.

**Technology** Scientific method · Science as social institution · Interpretation · Secularizing · Buddhist thought

## Preface to “Buddhism and the Sciences”

**Introduction: Enduring Issues** The essay below was written in hopes of contributing to a more productive dialogue between Buddhism and science, and the conviction that a more productive dialogue could be achieved by adding clarity to key ideas in the rhetoric. Dividing the essay into two sections, contemporary developments and historical background, reflects the difference between a dialogue between Buddhism and science, and a dialogue about Buddhism and science. In both cases, distinctions were drawn that can make these dialogues more fruitful.

Clarifying the dialogue between Buddhism and science, the contemporary discourse, calls for three different sets of distinctions. First is the distinction between “Science” as an abstraction, and “the sciences” as specific epistemological projects. Second, there

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are four different rhetorical uses of the term “science.” And third, a distinction between different kinds of materialism.

The first distinction actually seeks to set aside vague generalities about “Science” as an undifferentiated whole by shifting the focus to specific sciences. Each of the sciences has their own set of concepts, categories, and concerns, as well as unique histories, methods, and theories. An additional distinction within the sciences is between experimental and observational. This distinction serves to displace the common presumption that the category “science” only properly means experimental sciences. Second, the four different rhetorical uses of the term science point to distinctions that all too often are not made. When we say “science”, it can mean a body of authoritative knowledge, the method for producing such knowledge, a social institution, and a set of practices (on this last, see Latour 1986). The third distinction is between methodological materialism, metaphysical materialism, and materialistic values. The methodological commitment to only consider physical phenomena when theorizing is, although perhaps logically more fundamental, no different from other methodological commitments. That is different from a metaphysical materialism, which is the idea that only material phenomena actually exist. Materialistic values are often seen as being informed by a metaphysical materialism, making it important to distinguish from a methodological materialism as a commitment within the scientific method.

The typology of historical relations between Buddhism and science discussed in the original essay can also continue to serve as a means of clarifying the differing questions about the relation between the two in the past, and provide a way of thinking about those relations in the present and future. Those three are supportive, integral, and consequential. Buddhist projects of various kinds have supported the development and cross-cultural borrowing of scientific and technological knowledge. Historically, a wide variety of scientific knowledge was an integral part of Buddhist thought. And in some cases, scientific concerns are seen as having been a consequence of Buddhist thought.

### Three Decades On

In the three decades intervening between when this essay was written and its present republication, the topic of Buddhism and science has continued to be an important one, both for the scholarly community and in a different way for the Buddhist community of practitioners. While these two communities—scholarly and practitioner—do overlap, developments in the discourse remain divided into these two categories. That overlap contributes to an analysis of the discourse into three categories: scholarly inquiries into the complexity of Buddhist thought beyond the “religious,” practitioner discussions that often remain committed to a naïve Baconian idea that science is adequately considered simply a matter of observation and generalization, and attempts to either integrate studies of Buddhist practice into the cognitive sciences, or interpret Buddhist thought in light of the cognitive sciences.

### Historical Background and Contemporary Developments

The original twofold division between historical background and contemporary developments remains relevant, though there are differences in each from where they stood three decades ago. The historical study of Buddhism has been transformed by a radical

change in the conception of the object of study, while contemporary developments have been increasingly influenced by an explicitly secularizing trend in popular Buddhism. This addendum does not attempt to be a comprehensive review of research completed since the early 90s, and studies mentioned in each section below are only exemplary, pointing toward important instances of research. Following a discussion of the developments in the historical and contemporary study of Buddhism, the essay closes with an examination of the importance of examining the rhetoric employed in the Buddhism and science discourse.

### Changing the Object of Study

The conception of Buddhism as the object of academic study has changed significantly in the last three decades. The scholarly heritage of religious studies from the mid-nineteenth century, when Buddhist studies was first formulated as a field for European and American scholarship, defined Buddhism as a religion. In turn, the category of religion was created by sublating liberal Protestant theology. Most importantly, doctrine was privileged as what it was important to know about Buddhism, and the doctrinal portions of texts were selectively treated as providing the essential understanding of Buddhism. This background is well-known, having been examined by many authors (Masuzawa 2005). It is relevant here in that conceiving of Buddhism as a religion meant that not only was it understood as a system of doctrines but that it was also oriented toward the spiritual instead of the material, toward the transcendent rather than the worldly, toward the timeless absolute rather than the impermanent conventional. These preconceptions endure in popular religious culture, and continue to mould the reception of Buddhism. More sophisticated analyses that problematize the two terms of what is usually treated as an opposition, “Is Buddhist Scientific or Religious,” are being made accessible to popular audiences by Buddhist scholars (Dunne 2019; for a more extended and historical treatment see Crosby 2021).

Academically, however, Buddhism has increasingly come to be understood as an institution, with its own history and an identity autonomous from the defining framework of liberal Protestant theology, and from the constraints of being a “religion.” Thus, Buddhism is now increasingly studied as a complex intellectual culture having many dimensions that link it to scientific knowledge. These include embryology and medicine, environmental science, astrology and calendrics, and logic.

### Medicine and Embryology

Two of the areas that have become much more adequately conceptualized as elements of Buddhist thought are medicine and embryology. Since the time of James Sanford’s “Wind, Waters, Stupas, Mandalas” (Sanford 1997), several scholars have published works on embryology. Frances Garrett (2008) places embryology in the wider perspective of medicine in Tibet, and Anna Andreeva and Dominic Steanu have edited a collection on embryology covering East Asia (2015). Janet Gyatso (2015) explores the interaction between medical and religious knowledge in the early modern period of Tibet, particularly in terms of the epistemic transformation involved. (See also Yoeli-Tlalim 2020.) C. Pierce Salguero, who describes himself as a “transdisciplinary medical

humanities scholar,” has produced several significant works in the area of medicine and Buddhism, both as sole author (2014, 2016 [2007]) and as editor (2017, 2019).

## Environmental Science

Looking at the historical relation between Buddhism and the environment is a new field established by the groundbreaking work of Johan Elverskog. Study of the Buddhist institution as an environmental force has long been hampered by an apologetic representation of Buddhism, “eco-Buddhism” (Elverskog 2020, x–xi). Critiques of eco-Buddhism have questioned the contemporary representation, but historical study is very recent.

## Calendrics, Astrology

Edward Henning (2007) examined the calendrics of the Kālacakra tantra, one of its key elements for determining the timing of battles against barbaric hordes, which is one of the motifs organizing the Kālacakra. This is taken symbolically now to mean doing metaphoric battle with one’s own obscurations, and is now therefore employed to determine the appropriate timing for practice, rituals, initiations, and other important events (Berzin *nd*). In addition to the astrological calendrics of the Kālacakra, astrology played an important role throughout Buddhist history. In particular, consider the several publications by Jeffrey Kotyk (2018a, b, and others), which extend across Indian, Chinese, and Japanese Buddhist history. Also contributing to a deeper understanding of the history of astrology is Bill M. Mak (for instance Mak 2018).

In many cases, these expansions to the understanding of Buddhism as the object of study have been conducted for their own sake, rather than as a part of a dialogue between Buddhism and science. There are important exceptions, however, including Janet Gyatso’s work on Tibetan Buddhist medicine. Gyatso notes that her “project ponders key issues for the history of science, including the disjunctions—and conjunctions—between scientific approaches to knowledge and religious ones” (Gyatso 2015, 1).

Research in these areas have highlighted the difficulty of trying to fit the rich intellectual history of Buddhism developed over two and a half millennia and across several different linguistic and religious cultures into the category of “religion,” as that is usually deployed in academia. If we allow such a limited view of Buddhism as that seen through the window of “spiritual,” then understanding of the whole of the tradition and its possible ways of relating to science is disastrously distorted.

## Contemporary Developments

### The Secularizing Impulse

One of the trends in popular Buddhism that has emerged over the last three decades is the movement to secularize Buddhism. Central to much of modern thought regarding religion was the expectation that, as an irrational and superstitious vestige of the premodern, religion would gradually vanish away—a triumphalist secularism (Hefner

2011, 152). This sense of a teleological progress toward greater rationality and rejection of superstition characterizes some of the secularizing discourse, thus a motivating force for secularizing Buddhism is the desire to bring it into accord with modern thought, and particularly with modern science. In some cases, this means interpreting various Buddhist doctrines so as to bring them into accord with modern science, but in other cases it means actively expunging aspects of the tradition considered superstitious and in contravention to modern science.

### Purifying Buddhism

The strategy of expunging aspects of Buddhist not in accord with modern conceptions of science and reason is evident in popular treatments such as Robert Wright's (2017). By selecting only those parts of Buddhism that accord with Darwinian evolutionary theory, Wright creates a representation of Buddhism which he judges to be "true" because it accords with Darwinian evolutionary theory (and yes, this is how circular his argument is). Karma and rebirth are in particular the kinds of themes that are rejected, while Wright recognizes the centrality of the teaching of anātman, he finds it so contrary to his own Western conceptions of the self that he simply abandons it as incomprehensible.

While different secularizing authors may select different aspects of Buddhist thought to expunge, they generally follow the same kind of reasoning as does Wright. They take their own, modern conceptions of the truth as given, and then eliminate those parts of Buddhism that do not meet that standard. In doing so, they will often have recourse to the claim that this is what the Buddha told his adherents to do, such as in the Kalama Sutta. As Bhikkhu Bodhi as noted, however, "On the basis of a single passage, quoted out of context, the Buddha has been made out to be a pragmatic empiricist who dismisses all doctrine and faith, and whose Dhamma is simply a freethinker's kit to truth which invites each one to accept and reject whatever he likes" (1998). While expunging teachings that are not comfortable with modern scientific preconceptions is one strategy, some contemporary thinkers work to reinterpret teachings so as to better accord with present views.

### Interpreting Buddhism Naturalistically

Gil Fronsdal is a contemporary teacher whose orientation is naturalistic. That is, he is effectively agnostic about those aspects of Buddhist thought that do not have immediate relevance to human existence. In his view, this means "Buddhist teachings that rely on what can be observed in this very life through our natural senses. It does not require any beliefs, agency, entities or experiences that are supernatural, that is, that fall outside of the laws of nature as we know them or outside of what we can know for ourselves through our ordinary, natural senses" (Fronsdal [in press](#)).

A different though equally naturalistic strategy is that of interpreting apparently supernatural aspects of Buddhist teachings as having psychological symbolism. Thus, for example, the six realms of rebirth may be interpreted not as representing six actual different postmortem states, but rather six different emotional conditions. Although no longer a popular figure in contemporary Buddhism, this strategy is exemplified in the work of Alan Watts (1975). Similarly naturalistic but much more philosophically



sophisticated are Dale Wright's two works (2011, and 2016). These two are deeply informed by Dale Wright's decades of studying Zen.

### **Making Buddhism Practical**

Stephen Batchelor has been a singularly influential figure in the development of a secularized Buddhism. A consistent theme in his recent work has been to interpret Buddhism as a kind of pragmatism, a teaching that is not concerned with metaphysical doctrines or with the truth of such claims. In this regard he cites the well-worn allegory of the man shot with an arrow who needs to have the arrow removed as quickly as possible rather than understanding what the arrow is made of and where it came from (Batchelor 2015a, 23–24). In place of understanding Buddhism as a project oriented toward truth, Batchelor (2015b) proposes understanding Buddhism as task oriented.

Interpreted in this fashion what Buddhism provides is a framework of ethics as behaviours that are conducive toward awakening, but awakening is not to be understood as a matter of correct knowledge or correct understanding. Thus, the Four Noble Truths are recast as the Four Great Tasks.

Batchelor's view of Buddhism as pragmatic moves away from questions of truth, and at the same time participates in the rejection of anything supernatural, similar to, although distinct from, Robert Wright's approach. At the same time, portraying the core of original Buddhist teachings as naturalistic is similar to, although distinct from, Gil Fronsdal's approach. Moving away from questions of truth, however, places Buddhism in an entirely separate category from science, and would seemingly preclude any productive dialogue. At the same time, it also effectively forecloses any questions as to whether Batchelor's representation of Buddhism is true.

### **Buddhist Thought, Cognitive Sciences, and Modern Continental Philosophy**

The 1990s were officially designated the "Decade of the Brain." Increased public awareness, and greater funding for research led to many advances in the study of neurocognition, and rise of "cognitive science" as an interdisciplinary project involving linguistics, computer science, neural anatomy and physiology, and psychology. The research finding perhaps most consequential for the dialogue between Buddhism and science was neural plasticity. Up to this point, it was thought that the brain was static after final development in late adolescence, and after that time was only subject to gradual decline. The discovery that the brain continued to change and develop throughout life came as an exciting surprise.

Almost immediately, this new understanding came to be applied to the study of meditation. In 1998, James H. Austin began a series of publications on the relation between neurology and Zen meditation. Greater public attention and more research publications have, however, been directed to the secularized form of mindfulness meditation initiated by Jon Kabat-Zinn (Wilson 2014, 75–104). Many such studies, however, have been short-term—both in terms of the experience of the meditators and the duration across which the effects are studied. Alan Wallace has called for long-term studies of deeply experienced meditators as a means of understanding the effects of meditation more accurately, and at the same time has argued for a shift away from



third-person models of research, validating first-person reports by experienced meditators (Wallace 2000).

As noted in the original essay, the late Francisco Varela played a key role in constructing the interface between Buddhist thought, cognitive science, and Continental philosophy. In a brief note from 1999, he discussed the importance of the change that made consciousness a legitimate object of scientific inquiry. Writing at the end of the Decade of the Brain, he noted that “As a result of this research frontier, science has been gradually waking up to what, until very recently, seemed ‘un-scientific’: consciousness itself” (Varela 2010). Probably, the most influential institution in the development of is the Mind and Life Institute which Varela co-founded. For decades, Evan Thompson collaborated with Varela, and has also been an active participant in the Mind and Life Institute. While *The Embodied Mind* had brought attention to the potential value of phenomenology, specifically Merleau-Ponty, as an approach to the study of mind and consciousness, Thompson has since gone on to consider the contributions of the founder of phenomenology, Edmund Husserl (Thompson 2010). More recently, he has continued to develop a conception of the self as “an experiential process that is subject to constant change. We enact a self in the process of awareness, and this self comes and goes depending on how we are aware” (Thompson 2016, 927). The last decade or so has seen this line of inquiry further developed by Buddhist scholars working on a model of cross-cultural philosophy (Garfield and Edelglass, 2011). As important as these studies are, they are explicitly philosophical in nature. Thus, while they may make reference to cognitive science in the context of their discussions of consciousness, they are only tangentially related to issues in the Buddhism and science dialogue per se.

Another long-standing participant in the Mind and Life Institute has been Willoughby Britton, along with colleagues including Jared Lindahl, who has been studying the negative effect that some people experience as a consequence of meditation practice (Rocha 2014). This research opens up a dimension of experiences often ignored by apologetic presentations that emphasize the positive effects of meditation. This kind of experience is not only documented by this contemporary research but is also recorded across the spectrum of Buddhist literatures. This reinforces the frequently repeated advice of working with an experienced teacher. Contrary to simplistic representations of meditation as a kind of mental technology that has uniform effects, meditation appears to be more complex, and potentially more powerful than some modern advocates have countenanced.

## Rhetoric in the Buddhism and Science Discourse

Many of the positions regarding the relation between Buddhism and science identified in the original paper remain active in the present discourse as well. These include claims regarding the identity or congruity of Buddhist concepts and scientific ones, and the assertion that this demonstrates either the truth of Buddhism, or that the Buddha already knew these truths. It is important to attend to this kind of rhetorical presentation of Buddhism because simple word usages are vastly consequential.

The last claim, that the Buddha already knew the truths of modern science, is suggestive of the pressures converging Buddhist thought with the hegemony of

Christian ideas in Western popular religious culture. Classically in Christian theology, the attribute of omniscience, along with omnipotence and omnipresence, has been claimed to characterize God. And equally classically, Buddhist thought has attributed the characteristic of *sarvajñatā* to the Buddha. In a simple, literal fashion, this can be rendered as “all knowing,” and taken to mean that the Buddha is omniscient in the same way that God is—consciously aware of every event, action, and thought throughout the entire universe. However, in the context of Buddhist thought, the term *sarvajñatā* has significantly different implications. Pointing to the *Abhisamayālaṅkāra* (attributed to Maitreyañātha, c. 350 CE), Buswell and Lopez (2014) summarize this complex term as meaning

the knowledge of a *śravaka* [auditor] or *pratyekabuddha* [solitary awakened one], in contrast to the buddha’s knowledge of all aspects (*sarvākārajñatā*), which is reached by cultivating a bodhisattva’s knowledge of the paths (*margajñatā*). The “all” (*sarva*) means all the grounds (*vastu*) of the knowledge of defiled (*saṃkṛṣṭa*) and pure (*viśuddha*. . .) dharmas systematized in the four noble truths (779).

We also learn that the term is used negatively to “identify the absence of skillful means (*upāya*) and the lack of the total absence of subject–object conceptualization (*grāhyagrāhakavikalpa*) in *śrāvakas*, in order to point clearly to the superiority of the bodhisattva path” (779). The psychologized character of contemporary popular Buddhist discourse finds this expressed in pious claims that the Buddha was the world’s first/greatest psychologist/psychotherapist.

Another way of looking at this is to see convergence as an instance of overdetermination. There are aspects in both Buddhism and popular religious culture that appear to be the same, and so the interpretation of Buddhist concepts as variants of those found in the dominant culture is overdetermined. That is, a particular interpretation follows from the apparent similarity—even when the similarity is not consciously reflected upon. Although not using the specific term, Gyatso notes this when she comments about the tendency to read the Western history of conflict between religion and science onto Buddhism. “Those instances where Tibetan theorists argued that medicine falls squarely within the Buddha’s dispensation are not to be equated with nineteenth– and twentieth–century apologetics that maintain that Buddhism has always been scientific, or that Buddhism goes further than modern science and has much to teach it” (Gyatso 2015, 16–17). Geoffrey Samuel has also addressed several of these issues, with the intention of moving away from apologetics and toward real dialogue (Samuel 2014). Equally foundational are Donald S. Lopez, Jr.’s two publications, one an historical overview of the dialogue (2008), and the other on the modernist image of the “scientific Buddha” (2012).

The last 30 years have seen the dialogue on Buddhism and science become increasingly recognized as an important area of study and research. We have now moved past the presumptions of European exceptionalism that informed the foundational work by Joseph Needham and his colleagues, opening to a broader understanding of science as systematic knowledge and its importance in the history of Buddhist praxis. Secularizing trends have often maintained a simplistic, Baconian conception of science as observation and generalization, as well as participating in the latest iteration of

the “science proves Buddhism is true” rhetoric. The rise of popular interest in meditation has in turn led to the development of programs of research into the nature of mind and consciousness that are likewise drawing on cognitive science, phenomenology, and Buddhist thought.

## **Buddhism and the Sciences: Historical Background, Contemporary Developments**

While discourse on the relation between Christianity and science has a long history, it has only been in the last century that Buddhists and Buddhist scholars have begun to consider the relation between their own religious tradition and the promises and challenges of modern science. This does not mean that there has not been a long history of a relation between Buddhism and the sciences. However, rarely has that relation been conceived of in terms of “discourse on religion and science” as such. As a result, much of the recent work done in the area of science and religion, though significant in its own right, inadequately considers many core Buddhist concerns.

That much of the discourse on science and religion is structured according to assumptions and concerns particular to the theistic traditions generally, and Christian theology specifically, is understandable. Discourse on the sometimes-conflicted relationship between science and religion originates in a theistic context. This relation has at times been a conflicted one, at least since the Renaissance. However, the fundamental concerns of Buddhist thought differ substantially from those of Christianity and other theistic traditions. While Buddhist scholars can learn from the models of discourse developed in the relationship between Christianity and modern science, in order for them to enter fully into constructive dialogue with science, basic presuppositions about the nature of science-religion interaction will need to be revisited.

What might this re-visitation look like? In this chapter, I propose three steps. First, in order to bring fundamental Buddhist concerns into conversation with science, it is necessary to clear the intellectual ground upon which dialogue between science and Buddhism will be established. The first portion of this chapter concerns itself with this task. This ground clearing will involve the clarification of several key issues, assumptions, and terminology involved in discussing the relation between Buddhism and science.

Having cleared some of the intellectual ground, the second step in the process of building constructive dialogue between Buddhism and science involves asking the question: what is it about the Buddhist tradition that appears to be amenable or open to dialogue with the sciences? The second section of this chapter takes up this question, which can be answered by considering various instances of constructive interaction throughout the history of Buddhism. This examination is organized so as to develop a typology of relations. This typology, outlining ways in which Buddhism seems open to discourse with the sciences, should provide a foundation upon which dialogue can be established.

The third step in establishing constructive dialogue involves assessing how contemporary scholars have begun to re-envision discourse between science and religion so as to more adequately consider fundamental Buddhist concerns. The final section of this chapter takes that step. A significant area of work for contemporary scholars is the

dialogue between Buddhism and the cognitive sciences, philosophy of mind, and psychology. Much popular literature has concerned itself with similarities between varieties of Asian religious thought and certain theories from physics. These claims of similarity, however, appear to be grounded on little more than an inadequately nuanced analogy, that is Buddhist doctrine is portrayed so as to appear fully consonant with theories from contemporary physics. These analogies depend heavily upon particular ways of expressing Buddhist doctrines, entailing selective interpretations, which heighten the appearance of similarity. Moreover, these articulations frequently remove doctrine from its own intellectual context. The result is that genuine dialogue between Buddhism as it is practiced and science is compromised. In contrast, recent developments in Buddhism and cognitive science, for example, are more sensitively conceived, and, significantly, remain in keeping with the priorities of Buddhist thought itself.

A final introductory note should be made concerning the difficulty of representing the Buddhist tradition. There is no 'orthodox' interpretation of Buddhist thought. Hence, there can be no single authoritative Buddhism. The Buddhism that anyone describes cannot be anything other than Buddhism as that person understands it. Given this, the reader needs to take into consideration that throughout this chapter, when I speak of "Buddhism," it is a shorthand way of referring to "Buddhism as I understand it." My reading of Buddhism is not intended to be either normative or essentialist. In other words, it should not be taken as a claim regarding what Buddhism should be, or as a claim regarding what the essence of Buddhism is. Moreover, I do not intend for the description of Buddhism that follows to arbitrate what is or is not Buddhism, nor do I presume that everyone who identifies him/herself as a Buddhist would necessarily agree with the entirety of what I have to say. The object "Buddhism" differs greatly depending upon one's mode of engagement with the tradition. Having made these qualifications, it will be enough that many of those who identify themselves as Buddhists would at least be able to recognize a significant similarity between what follows and their own religious commitments.

## Clearing the Ground

Because dialogue between religion and science has involved Buddhism less frequently than some other traditions, it is important to clear the intellectual ground, gaining a better sense of the terrain, before beginning constructive work. This process of ground clearing involves (1) reviewing ways in which the landscape has been misunderstood and consequently misrepresented—mistakes which inhibit solid construction; (2) removing this rubble of misunderstanding by defining terms, allowing us to survey the ground more effectively; and (3) noting several key landmarks on the Buddhist terrain that will need to be incorporated into our construction plans.

## Reviewing the Landscape: Neither Apologetics nor Polemics

Any claim that an entire religious tradition either supports or impedes science is generally nothing more than a simple rhetorical strategy designed for apologetics or polemics. This chapter is neither. Such unambiguous claims tend to be a-historical, assuming some unchanging essence as characterizing both religion and science, and

then selectively drawing upon historical evidence to support the position taken. Beginning from an essentialized view of the tradition, rather than examining what the relations actually have been, the apologetic or polemic position builds an argument about what the consequences of that essential nature must be. Such arguments are referred to as *a priori* or as *retrodictive*.

An example in which this essentializing is evident is Joseph Needham's famous series of studies on *Science and Civilization in China*. His is a polemic argument that the failure of China to achieve a "scientific revolution" was due to the "inhibitory influence" of the supposedly otherworldly tendencies of Buddhism. He asserts that the doctrine that the world is illusory (the teaching of *maya*) precludes Buddhists from actively engaging in empirical research, and that the otherworldliness of the goal of nirvana (the cessation of suffering) precludes Buddhists from engaging in technological projects which seek to improve the human condition in this world.

In the background of this argument are the British colonialist representations of Indian religions as contributing to a culture of passivity, a representation that was used to justify both evangelism and imperialism. More specifically, Needham represents Buddhism as reducible to a single, unchanging essence: the doctrines of *maya* and nirvana. Thus, Buddhism is represented as teaching that all of existence is an illusion from which one must escape without any reference to the vastly different forms Buddhism has taken over its history. This latter failure makes his representation of Buddhism a-historic, and thus untenable. Not only is it problematic to represent Buddhism as essentially a teaching of illusion and escape but Needham also fails to ask whether the interpretations of the concepts of *maya* and nirvana which he employs are accurate. At the same time, he does not establish that these concepts were of central importance in the history of Chinese Buddhism, or that they actually played any role at key moments in the history of the Chinese sciences. Rather, he presents Buddhism as *essentially* this negative worldview, and then deduces from that dubious premise the conclusion that Buddhism must have impeded scientific development in China.

Finally, the argument seems to assume that the intellectual cultures of all societies ought to develop in such a fashion as to culminate in experimental science, and that if a society did not develop that way, then something must have deleteriously impeded that development. From that conclusion, he looks backwards for the cause, retrodictively examining various aspects of Buddhism in his attempt to identify the culprit. This is a conception of cultural progress as a unilinear development, itself a historically untenable view.

Although Needham's polemic evaluation of Buddhism portrays a negative relation to science, much the same kinds of problems would also be found with apologetic attempts to assert that Buddhism has an unambiguously positive relation with science. Such arguments might assert that:

- Buddhism is conducive to science
- Buddhism is in agreement with science
- Buddhism has already discovered what science only now has learned, sometimes called "the ancient wisdom argument"

These arguments tend to select particular doctrinal views to represent the entirety of the tradition, simplifying them, and treating them as true of the entire tradition throughout its history. Arguments of this kind, based on essentialized, de-contextualized, and a-historical portrayals of the religious tradition, can only serve rhetorical ends. They cannot provide the basis for an historical study of the actual relations between a religious tradition and the sciences.

### Removing the Rubble: Definitions, Distinctions, and Clarifications

For our discussion of science and Buddhism, it is important to clear the ground of misconceptions by defining key terms and making key distinctions. First, we need to distinguish between *Science* and *the sciences*. The idea of Science as a single, unitary entity would seem to be the product of late nineteenth and early twentieth century positivism, which envisioned a single, unified scientific realm in which all explanations could, at least in principle, be reduced to physics. When religious authors reject scientific explanations as reductionist, it is quite often this positivist conception of science—this idea that physical explanations are the only legitimate explanations—which they have in mind.

In contrast to Science, there is what one might refer to as the sciences. These are specific fields of study with organized bodies of knowledge, recognized procedures for adding to that knowledge, shared criteria for evaluating such knowledge, and usually having a distinct terminology. Note that when conceived of as a single, unified entity, Science is something other than the cumulative total of the sciences.

In addition to the distinction between the sciences and Science, the sciences are to be divided into observational sciences and experimental sciences. While much of the discussion regarding science and religion has tended to focus on experimental sciences (also sometimes referred to as modern or hard sciences), in order to engage core Buddhist concerns, one should also consider the observational sciences (traditional or soft sciences), systematic forms of knowledge developed through observation rather than experimentation. This distinction expands the scope of discussion to allow for consideration of the traditional sciences, such as those developed in India and China, which were not experimental in character, but did accrue extensive bodies of systematic knowledge. The assumption that science necessarily means experimental science is not universal. The equivalents of “science” in various European languages, e.g. *Wissenschaft* (German), *science* (French), *scienza* (Italian), *ciencia* (Spanish), and *nauk* (Russian), do not refer to experimental science as such, but include a broader range of systematic forms of knowledge.

The so-called experimental sciences are subject to two kinds of limitations: cultural and practical. The cultural limitation is that there are social mores concerning experimentation on human beings. Increasingly these mores are strictly codified into what are sometimes called ‘human subjects protocols.’ Such constraints limit certain forms of experimentation in fields such as medicine, psychology, sociology and anthropology. There are also several sciences in which the constraint on experimentation is practical. Meteorology, economics and astronomy are examples of such observational sciences. Being an observational science does not preclude making predictions and waiting to see if these are confirmed. However, in such a situation one is not actively controlling an experimental situation, attempting to hold all variables except one steady. Thus,



observational sciences can also be ones that engage in theory formation and hypothesis testing, but the method for testing hypotheses is not experimental in nature. However, both experimental and observational sciences are equally committed to systematic and reliable explanation.

We should note here, however, that the characterization of science as theory formation and hypothesis testing is itself not uncontested. On the one hand, studies have sought to discern the social and cultural dimensions of scientific practice. On the other, there are instances in which competing theories are equally confirmed by experimental results. These different uses are reflected in different uses of the term science itself. Many fruitless disagreements about the relation between Buddhism and science can be avoided by a further set of distinctions with regard to the definition of the term science. Science can be understood to mean several things:

- Science as a body of authoritative knowledge,
- Science as method producing authoritative knowledge,
- Science as a social institution, and
- Science as a set of practices.

Each of these is sometimes meant when reference is made to science. Without clarifying which definition or combination of definitions is intended, only confusion can result. These four categories overlap, making clarity all that much more important. ‘Scientific knowledge’ is one of the most common usages for the term science, and is often used—quite mistakenly—to mean that which is unquestionably true, irrefutable knowledge. This colloquial reference to science as “that which is assuredly the case,” pervades contemporary American culture. Ironically, this rhetorical use misrepresents the strength of scientific knowledge, which, at its best, remains open to doubt, question, reconsideration, and reexamination. Such knowledge is distinct from but closely tied to the question of the methods used to create it, i.e. the scientific method. Although commonly equated with experimentation, scientific knowledge is more appropriately identified with this method—theory formation and hypothesis testing, employing empirical information, with results that are publicly verifiable.

The definition of science and scientific knowledge also needs to be distinguished from its social institutions. As a social entity, the institutional organization and societal support for science affects its pursuit of knowledge. In contemporary American society, institutional location of science has increasingly shifted from governmentally supported research institutions in universities to privately supported, business-based research. It is this social institution that is meant when people blame science for such ills of contemporary society as air pollution, or atomic weapons. Finally, science as a set of practices points to the interlocking sets of ways in which science is conducted, such as the organization of laboratories and communication of scientific knowledge through professional associations.

Finally, in removing the rubble to make room for a Buddhist dialogue with science, methodological materialism must be distinguished from metaphysical materialism. It is often popularly assumed that science necessarily entails a materialist metaphysics. Both laypeople and scientists alike share this assumption. While, as a systematic means of producing knowledge, science may be methodologically or even epistemologically



materialist in its presuppositions, that methodological commitment should be distinguished from any particular metaphysical commitment.

Having made some distinctions in what we mean by science, a second set of clarifications is needed. Discourse between Buddhism and science is encumbered by caricatures of Buddhism. Authentic exchange cannot take place until these misconceptions are cleared from the field of dialogue.

The first misconception that must be dealt with is the idea that Buddhism is exclusively concerned with “the other world” or “liberation from the world of phenomena” (seen above in relation to Needham’s claim that Buddhist other-worldliness was responsible for inhibiting science in China). This view, which was current at the time Needham was writing, continues to be found in much of the literature on Buddhism. However, since Needham’s time, this view has been critically reexamined. This representation of Buddhism results from a confused understanding of two assertions: (1) that there is no permanent, independently existing essence (or “self,” *atman*), and (2) that awakening involves extinction (“blowing out,” nirvana). It has been wrongly assumed that this has meant that awakening results from the extinction of the self. This appears to have been in large part the result of a failure to discriminate between Buddhist and certain Hindu conceptions of liberation. A close examination of the tradition, however, shows that awakening is the extinction of mistaken conceptions and misplaced affections, and not the extinction of the self. While not unrelated, this description of the path to awakening is distinct from the ontological claim that there are no independently existing essences.

A second contemporary caricature of Buddhism is the assertion that it makes claims effectively identical to those of science, or that Buddhism is perfectly compatible with science. This version of Buddhism grows out of the movements beginning in the second half of the nineteenth century now known collectively under the title of “Buddhist modernism.” Buddhist modernists emphasized the rational character of Buddhism and the human character of Shakyamuni Buddha, Buddhism’s historical founder. Buddhism here is presented as primarily a philosophy of life, a path to achieving the full potential of human existence. This humanistic portrayal of Buddhism facilitates simplistic claims concerning the relationship between Buddhism and modern science.

A third, less common caricature, one that was once prevalent in academic circles and still can be found in popular discussions of Buddhism, portrays Buddhism as an Oriental version of Occidental idealism. Here, complex philosophical positions within Buddhism are misinterpreted because they are assumed to be unproblematically the same as those within Occidental philosophy. The category of idealism, with its emphasis upon a correlative relationship between ‘observing mind’ and the ‘external world’, is falsely seen as corresponding to Buddhist descriptions of the workings consciousness as central to the quest for awakening. This correspondence leads to the superficial appearance that Buddhism has a relationship to science that parallels the relationship of idealism to science. One of the most important schools of Indian Buddhist thought is sometimes described as the “mind only” school, an overly literal translation of its name (*Vijñaptimatrata*). This formulation, “mind only,” was then mistakenly taken to mean that the school taught a doctrine that only the mind exists, i.e. classic European idealism. The doctrinal claims of the school, however, are more accurately described as asserting the necessary concomitance of mind with all

perception and knowledge of objective existence—a theme we will come back to in considering contemporary developments in the relation between Buddhism and the sciences.

### **Differing Landscapes: Buddhist and Christian**

In the discourse on religion and science, religion is almost invariably equated with theistic religion, if not explicitly with Christianity. Furthermore, much current scholarship actually focuses on the relation between theology and science. For the three Western monotheisms, and even for the theistic strains within Hinduism, this is not particularly problematic. However, the fundamental conceptions of Buddhist thought differ substantially from those of the theistic traditions. Without essentializing Buddhism, there do seem to be some basic landmarks, which, if not permanent fixtures on the landscape of Buddhist history, do seem present through much of its historical and cultural reshaping. The difference in conceptual landscapes is not adequately recognized by a science and religion dialogue that is based on the theistic traditions. As such, dialogue between science and Buddhism must take time to point them out.

Buddhism differs from Christianity in at least three important ways, which affect the way in which Buddhism relates to science. First, Buddhism does not have a history of antagonism with science. While the historical background to the contemporary dialogue between Christianity and science includes much consonance, it has, particularly in the last century, been marked by moments of conflict.

Second, the path toward awakening, central to Buddhism, is understood very differently from Christian soteriology, or the study of salvation. The path to awakening is not based on faith in an external, transcendent deity. Nor is it a salvation that comes through external intervention in history. Rather, the path to awakening is a praxiological process of overcoming ignorance about the way the world actually is.

Third, the mythic background of Buddhism does not involve the Creation, a vision of natural history that gives priority of concern to questions of origin. The absence of emphasis on creation means that dialogue between Buddhism and science does not give priority to cosmology, then astrophysics, then chemistry, and then biology. Rather, Buddhism begins with the awakening of the Buddha, which involves insight into the workings of his own mind. Thus, the priorities in the religion and science discourse for Buddhism are psychology, cognitive science and the philosophy of mind. Rather than being based on the idea that the world was created, for Buddhist cosmology, the universe as it is has simply always been this way “from beginningless time.” Within traditional Buddhist cosmology, there are living beings which are superhuman (gods and titans), as well as living beings which are subhuman (animals, hungry ghosts, and those dwelling in the hells). However, all of these, not only humans, animals, hungry ghosts and hell beings but also gods and titans are subject to the same natural processes. Central to the Buddhist conception of these natural processes is the idea of karma, meaning action, which identifies a conception that one’s actions produce results, which effect both others and oneself.

There are debates, both historically and within the contemporary interpretation of Buddhist thought, as to which actions are consequential. One interpretation is that it is only those that might be called ethical which constitute karma. Others maintain that all actions have consequences and that the category of “ethical” is itself a social creation rather than a natural category. Under either interpretation, however, there is no creator god who, in

the beginning, establishes the ethical order and who then also serves as judge of individuals within that ethical order. These fundamental distinctions between Buddhism and theistic religious traditions produce differences of orientation within a discourse with science.

A last task of ground clearing is needed before moving to a survey of the ways in which Buddhism, through its history, may be seen to be amenable to discourse with science. This task involves distinguishing the major divisions of contemporary Buddhism: Theravada, Mahayana, and Vajrayana, also known as tantric Buddhism. In the contemporary world, these are generally described in terms of geographic divisions. Theravada Buddhism is found in the countries of South and Southeast Asia: Sri Lanka, Thailand, Burma. Mahayana Buddhism is that found in China, Japan, Korea, and Vietnam. Vajrayana Buddhism is generally identified with Tibet and Mongolia. These geographic identifications are overly simplistic and hence of very limited utility. For example, there are Vajrayana lineages in China and Japan. Similarly, the Buddhism of Tibet and Mongolia is strongly Mahayana. The situation is further complicated by the fact that many Mahayana monks take the same vows as part of their initiatory process as do Theravadin monks. The typical characterizations of these divisions are as much a result of historical accident resulting from what caught the attention of different writers at different times as they are reflections of the actual situation. An additional problem with the geographic conceptions of divisions within Buddhism is that they implicitly reinforce the mistaken conception that contemporary nation states are in some sense natural entities having unique religious cultures. While it is unavoidable to speak of “Chinese Buddhism,” or “Tibetan Buddhism,” it should be noted that the reference here is to religious cultures, which have always interacted with one another, and not to modern nation states.

During a history extending over two and a half millennia and across so many linguistic and religious cultures, there cannot possibly be a single relation between Buddhism and science. The historical background to the relation between Buddhism and science extends across the two dominant intellectual cultures of Asia, i.e. Indian and Chinese, as well as in the other, less influential intellectual cultures, such as Tibetan, Korean, and Japanese. This historical background bears on how Buddhism is portrayed in its relationship to science. The introduction of Buddhism into East Asia, for example, needs to be understood not solely in terms of religion as we understand that category in contemporary society, but also as a spreading of Indian culture into East Asia. When and if a more comprehensive history of Buddhism and science is written, it will need to reflect deeply on the specific kinds of relations existing at different times and in different places within Buddhism itself. The following section will outline three basic kinds of relations that can be identified within those historically and geographically conditioned relations. This outline will attempt to answer the question, “what evidence is there within its history that might suggest models for relating Buddhism and science?” in terms of a threefold typology. It is my hope that this typology adequately reflects Buddhism’s wide and diverse tradition of relating to the various sciences.

### **(Preliminary) Typological Foundations: Historical Evidence for the Possibility of Constructive Relations Between Buddhism and the Sciences**

Having cleared some of the intellectual ground which might encumber discourse, the second step in the process of building constructive dialogue between Buddhism and

science involves posing the question: what is it about the Buddhist tradition that appears to be amenable or open to dialogue with the sciences? As suggested above, the relationship between Buddhism and the sciences should not be founded on the unambiguous claims of polemical or apologetic writings. In building a solid foundation for dialogue between Buddhism and the sciences, we should consider various models for the possibility of constructive interaction throughout the history of Buddhism. This history suggests that Buddhism is open to at least three types of relationship with science: *supportive*, *integral*, and *consequential*. The supportive relation is where existing science and technology has been used in support of Buddhist projects of one kind or another. In such cases, the Buddhist projects may either stimulate further development or involve the import of science and technology across cultural boundaries. The integral is characterized by the many scientific and technological assumptions and understandings actively maintained within Buddhism itself. Finally, the consequential relation is that in which Buddhist teachings and values are the impetus for scientific or technological undertakings.

### **Supportive: Buddhist Projects, Science and Technology**

Throughout its history one can find examples both of Buddhist projects that were supported by the science and technology of their time, and of instances in which science and technology were stimulated by Buddhist projects. In the mid-eighth century, when the temple of Todaiji was built in capital city of Nara in central Japan, scientific and technological efforts in Japan were greatly stimulated. The temple building itself is the largest wooden structure in the world, and the Great Buddha Vairocana, which is housed within, is the largest bronze statue. In addition to engineering and metalworking, this also stimulated mining in Japan, as construction of the statue and ornamentation of the building drew on copper, gold, mercury, and silver mines from various locations around Japan.

Another instance of how a Buddhist project affected the science and technology of its day can be seen in the life of the priest Kukai (774 to 835), founder of the school of esoteric Buddhism in Japan known as Shingon. During his studies in China, he acquired not only the ritual and doctrinal knowledge of esoteric Buddhism but also many requisite practical skills. These included linguistics, particularly Sanskrit, brushmaking, metalworking, architecture, and other technologies. These technologies were necessary for the transmission of new doctrinal and ritual texts, and for the performance of esoteric Buddhist ritual practices that require special ritual implements and altar fittings of various kinds.

### **Integral: Science and Technology as a Part of the Buddhist Institution**

Buddhist monastic education in India included study of five fields of knowledge: linguistics, logic, speculative philosophy, medicine, and creative arts. The presence of linguistics, logic, and medicine in this curriculum indicates that Buddhism did not have an oppositional relation to the sciences. This distinguishes Buddhist monastic education from the education provided to Brahmins, which appears to have disdained secular training. One can speculate that the origin of this monastic curriculum may be the consequence of the Buddhist rejection of the caste system with its attendant division

of labor according to differing social groups. This same pattern of monastic education continued in the Tibetan Buddhist context as well.

One of the central issues in any reflection on the nature of science as a source of knowledge is causality. Causality has been a central concern of Buddhism from its very inception. This concern is expressed in the foundational teachings of the four noble truths and conditioned co-arising. The four noble truths are that all things are dissatisfying, that dissatisfaction has a cause, that having a cause dissatisfaction can be extinguished, and the path to such extinction. Conditioned co-arising is the assertion that nothing exists independently of all other things, but rather arises along with all other things as the result of causes and conditions. The concern with causality is found throughout almost every form of Indian Buddhist thought. For example, the *abhidharma*—the classic scholastic system of speculative philosophy and psychology which provides the basis for all later Buddhist thought—has in its extensive literature several discussions and theories of causality. For example, Vasubandhu's *Abhidharma verses and autocommentary*, which is considered by many to be the most important medieval compendium of *abhidharma* thought, identify six kinds of causal relations.

Later in medieval India, the concern with epistemology, which characterizes so much of Indian religious thought, developed into a semiformal analysis of inference in the work of Dignaga and Dharmakirti. In common with much of Buddhist thought, these thinkers asserted the existence of only two valid sources of knowledge—perception and inference. Another source, testimony (or what we would call the appeal to authority), is also one which is discussed extensively by other Buddhist thinkers.

The inferential schemes of medieval Indian philosophy grew out of the debate tradition, rather than the mathematical tradition as was the case in Greece. Debate was an important function in the medieval Indian religious milieu since the religious affiliation of kingdoms at times depended upon the outcome of a debate. The debate tradition of medieval India continues into present-day Tibetan and Japanese Buddhism. One of the fundamental distinctions that Dignaga makes is between an argument intended to convince another, and an argument intended to determine the truth of a claim for oneself. This distinction evidences the debate background for the formation of Buddhist logic.

An argument for others has five parts, called “limbs” in Sanskrit. One of the most common examples of a five part argument is the following:

Proposal: There is fire on the mountain,

Reason: because there is smoke on the mountain.

Justification: Wherever there is smoke, there is fire, as for example in a kitchen.

Application: Because there is smoke on the mountain,

Conclusion: there is fire on the mountain.

Upon examination, one can see that the final two parts are a restatement of the proposal and reason. It is these two parts that Dignaga eliminates as unnecessary when one is creating an inference for oneself. In the instance given here, the justification is a positive one. It was also recognized that one could infer on the basis of a negative justification, such as: Where there is no fire, there is no smoke, as in a lake. Dignaga pointed out that where one has both a positive and a negative warrants, one has a more convincing argument.

This openness to logic and reason reveals a disposition within Buddhism that one can tentatively conclude suggests an amenability to dialogue with contemporary science.

### **Consequential: Science and Technology as the Result of Buddhist Teachings and Values**

Belief in reincarnation has been considered one of the central teachings of Buddhism throughout its entire history. The desire to understand the processes of rebirth led to a concern with embryology. This concern is evidenced, for example in both the Tibetan and Japanese traditions. Typically, the process of rebirth was divided into two periods: the period between death and conception, and the period from conception to birth. The treatment of these concerns most familiar in the West is the so-called *Tibetan Book of the Dead*, which focuses most of its attention on the period from death to conception. However, it is far from being the only Buddhist text to discuss the processes of rebirth. For example, Gampopa's *Jewel Ornament of Liberation* gives greater attention to the gestation period itself. In addition to works such as these where the intent is primarily religious, other works were more explicitly medical in character. Several similar works are also found in the Japanese esoteric Buddhist tradition of Shingon. While the Tibetan works largely assume a negative view of the cycle of rebirth (samsara) as unremittingly marked by suffering, the Japanese works more consistently operate from a nondual conception of the cycle of rebirth as identical with the awakened condition in which the sources of suffering are extinguished (nirvana). These Japanese works generally employ a five or an eight stage developmental sequence. This is usually an 8-week long period, covering the time of conception to the time when the fetus is fully formed, i.e. a tiny human being, and not to birth as such. A key religious concept for the Shingon discussions of embryology is that of awakening in this body (sokushin jobutsu). This is the idea that one is already inherently awakened and can become aware of that inherent purity of mind through practice, in one's present body, rather than over the course of countless lifetimes of practice. The emphasis on embodiment provided a way of giving positive religious value to conception and birth.

One of the central values for the Mahayana tradition is that of compassionate action. The ideal figure for the Mahayana is called a "bodhisattva," or one who is committed to attaining full awakening. Bodhisattvas are characterized by both wisdom and compassion. While wisdom is seen as passive insight into the absence of any metaphysical absolute in either persons or objects, compassion is the resulting activity which arises from wisdom.

Thang-stong rGyal-po (1361 to 1485), a fifteenth century Tibetan visionary and lineage founder, is a culture hero celebrated for the construction of iron chain suspension bridges in several locations in central and eastern Tibet. Travel in Tibet is very difficult as the country is marked by a large number of narrow river valleys. Even if there was a ferry across a river, passage could be subject to the whims of the ferryman. In addition, the countryside was troubled by bandits who preyed upon travellers. As a consequence of his bodhisattva compassion, Thang-stong both established monasteries and temples in locales made dangerous by bandits, and also built many iron chain suspension bridges across rivers. He is said to have discovered a mine of iron ore, which then made it possible to create the links necessary for the construction of his bridges. Here we see the Buddhist value of compassion motivating mining, iron smithing, and bridge construction.



Similarly, in the summer of 820, the priest Kukai, mentioned above, was put in charge of the reconstruction of a reservoir in his home island of Shikoku. Originally constructed almost a century before, this reservoir was needed by farmers for irrigation. Although several prior reconstruction efforts had failed, Kukai was able to complete the project within about 3 months. While the reservoir has needed further repairs in the intervening 1100 years, it continues to provide water control services to this day.

Another instance of scientific and technological work being motivated by Buddhist values is the construction of an armillary sphere and an astronomical clock in eighth century China. This was motivated by the traditional Buddhist conception that the effectiveness of the Buddhist teachings would decline in three stages, and that eventually after the end of the last stage, another Buddha would be born into this world. These ideas created a concern with calculating the temporal distance from the death of Shakyamuni Buddha in order to determine what stage one was in, and to calculate how long before the next Buddha would appear. Buddhist messianism was combined with Chinese utopianism, the goal of achieving a stable, harmonious, peaceful, and prosperous social order under the direction of an Emperor whose actions are guided by being harmoniously integrated into the order of nature. Yixing (673 to 727) was one of the most important Buddhist monks of the Tang dynasty, and has been recognized not only for his extensive translation work and doctrinal studies but also as one of the greatest mathematicians and astronomers of his time. While the clock that Yixing constructed drew on earlier clocks, his is the first definitely known to have employed an escapement.

An interesting side note here involving the construction of clocks in China in the late seventh and early eighth centuries addresses one of the preconceptions regarding the effect of religion on science—the belief that a linear conception of time characteristic of Western culture was necessary for the creation of clocks. Buddhist conceptions of time, which may be described as cyclic, did not preclude a concern with time and its accurate measurement.

The entire construction within which the armillary sphere existed included as one of its main elements a five-story pagoda housing an immense statue of the Buddha. While this alone indicates Buddhist piety as one of the motivating factors, the close link between the tower and the armillary sphere is critical. A stereotype frequently repeated is that religion is concerned with “the timeless” or with “eternal truths.” This fundamentally Neo-Platonic view of religion has been uncritically projected onto Indian religions in their entirety, including Buddhism. The implication of this projection is that religions of Indian origin are unconcerned with a more ‘scientific’ conception of time. Buddhist science of time belies this uncritical assessment.

These three models of the historical relationship between Buddhism and science and technology—supportive, integral, and consequential—suggest that Buddhism is indeed open to contemporary discourse with science. With these models serving as conceptual background, we will assess the work of current scholars working to establish constructive dialogue between Buddhism and the sciences.

## Contemporary Constructions

The foundations of Buddhist thought rest on the awakening of Shakyamuni Buddha. In the context of Indian religious culture, that awakening is itself understood as the cessation of mistaken conceptions and misplaced affections that keep us from living



in the world as it actually is, i.e. as impermanent. Thus, the primary focus for Buddhism, which shapes its interaction with the sciences, concerns issues of epistemology and the nature of consciousness. The path to awakening is primarily concerned with developing an understanding of how the mind works so as to no longer be misled by our mistaken belief that permanent satisfaction is possible. It is for this reason that despite the popular fascination with possible similarities between contemporary physics (e.g. chaos theory, folded universes, black holes) and Asian religious traditions, it is neuroscience, psychology, the cognitive sciences, and philosophy of mind that I would suggest ought to have the highest priority for the discourse between Buddhism and science.

As mentioned above, in late nineteenth and early twentieth century scholarship, the Buddhist critique of the idea of an independently existing mind was understood in terms of the Western philosophical tradition of idealism—both the idealism of Berkeley and of Hegel. More recently, however, especially in light of some of the contemporary work in neuroscience, cognitive science, and psychology, these critiques are being reinterpreted in terms drawn from Husserlian phenomenology. For example, the phenomenological category of intentionality, i.e. the necessary relation between subject and object (not to be confused with the common usage, meaning purposeful), provides a way of talking about Buddhist conceptions of the relation between subject and object without falling either into idealism or into the now long-discredited introspectionism. This is a theme that B. Alan Wallace has recently developed as part of a general critique of materialism and objectivity as necessary presuppositions concerning the nature of scientific knowledge.

From the Buddhist perspective developed by Wallace, the necessarily concomitant relation between the mind and the world it apprehends addresses both naive realism and scientific realism. Naive realism is the ordinary, unreflective conception that objects exist independently of our perception or knowledge of them. Scientific realism extends this to include the independent existence of unobservable, theoretical objects. In this way, reflections on the nature of mind motivated by the Buddhist priorities do speak directly to the philosophical presuppositions underpinning much of contemporary science.

Phenomenology, particularly that of Maurice Merleau-Ponty, has also contributed to the interface between Buddhism and cognitive science in the work of Varela, Thompson and Rosch. They have emphasized the importance of embodiment in any understanding of consciousness. Much contemporary discussion in cognitive science concerns the question of conscious awareness. The Buddhist view that all existing things arise as the result of certain causes and conditions is congruent with many contemporary approaches to consciousness that view consciousness as the result of complex physiological interactions arising as the human body has evolved within the natural world of which it is an integral part.

Reflections such as Wallace's on the philosophy of science explore how materialist and realist metaphysical views have come to influence our own contemporary preconceptions about the nature of science and with it the nature of nature itself. At the same time, this kind of reflection has also been directed toward cultural preconceptions concerning religion and how those have influenced our apprehension of the Buddhist tradition. One of the surprising outcomes of such reflection is that positivist understandings of science and Romantic conceptions of religion, two schools of thought that, on the surface, may appear to be antithetical to one another, share much more than is

usually recognized. Recently, Dale Wright has noted that the conception of unmediated experience as the ground of religion is analogous to the notion that one can get at ‘the facts’ as irreducible items of information, or, in other words, that it is possible to allow the data to speak for itself without interpretation. In both cases the knowing subject is understood as existing separately from the object of knowledge, and that the process of coming to know has little or no effect on the object known. The assumption Wright identifies as being shared by both positivism and Romanticism—that the mind exists independently of the objects of which it is aware—is fundamentally different from Buddhist conceptions of the mind and how it works, and descriptions of the path to awakening, both of which emphasize the interdependence of all existence.

## Conclusion

The relation between Buddhism and the sciences has largely been overlooked in modern, Western Buddhist Studies. Why is this? Perhaps, one important factor in the image of Buddhism as having not been involved in scientific thought results from the background training and concurrent interests of those who study Buddhism. Neither philological nor religious study approaches to Buddhism necessarily lend themselves to examinations of those texts and traditions that contain information about the history of Buddhism and the sciences. Moreover, the presentation of Buddhism in the West by apologists and polemicists has misrepresented the relationship of Buddhism and science. Challenged by Christian missionaries in their homelands, Buddhist advocates focused, in their interactions with Western intellectual traditions, on the most immediate kinds of questions being raised, that is religious questions. Challenged by a Western imperialism that deployed science and technology to its own benefit, many Buddhist apologists attempted to appropriate the prestige of science in their own rhetorical claims of superiority to Christianity.

How might discourse between science and religion be reconceived to more adequately consider core Buddhist concerns, and, in turn attract the interest of Buddhist scholars? In this chapter, I have suggested that this re-conception should include at least three steps. First, we need to clear the intellectual ground upon which discourse will be established. Much of the recent work done in the area of science and religion, because of its roots in theistic traditions, fails to address Buddhist concerns. Much popular work that has addressed the relationship between science and Asian religious traditions has misrepresented Buddhist concerns as well. Hence, the establishment of solid discourse between Buddhism and contemporary science begins with a process of defining terms, making distinctions, and finding clarification.

The second step in re-conceiving dialogue to more appropriately account for Buddhist concerns involves surveying models of discourse throughout Buddhist history. In posing the question, “In what ways has Buddhism been amenable to discourse with science and technology?” this chapter has articulated a threefold typology of relations: supportive, integral, and consequential.

Finally, the third step in re-conceiving dialogue involves assessing current developments in Buddhism-science scholarship. This assessment reminds us that discourse between science and Buddhism remains most true to the central concerns of Buddhism when that discourse begins with questions of epistemology and the nature of consciousness, drawing on neuroscience, the cognitive sciences, psychology, and the philosophy of mind.

As noted in the introduction, that much of the contemporary discourse on science and religion is structured according to assumptions and concerns particular to the theistic traditions generally and Christian theology specifically, is understandable. This discourse finds its origins in a theistic context. However, because the fundamental concerns of Buddhist thought differ substantially from those of Christianity and other theistic traditions, basic presuppositions about the nature of science-religion interaction need to be revisited if Buddhist scholars are to be more fully involved in the future of this discourse.

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