Mind and Life Institute presents

Mind and Life XVIII

Dialogues between Buddhism and the Sciences

# Attention, Memory and Mind

## A Synergy of Psychological, Neuroscientific, and Contemplative Perspectives

with

His Holiness
the Dalai Lama

Dharamsala, India • April 6–10, 2009

## The Mind and Life Dialogues and the Mind and Life Institute

Beginning in the twentieth century, science has become the dominant paradigm for understanding the natural world by way of objective, quantitative measurements, using the instruments of technology. The integration of scientific knowledge and technology has vastly contributed to our understanding of the physical world and to improving the human standard of living. Furthermore, over a much longer time period spanning the past 2,500 years, Buddhism has emerged in multiple cultures throughout Asia as the dominant paradigm for understanding the natural world by way of subjective, qualitative observations by way of highly sophisticated meditative training. The integration of Buddhist theories and practices has revealed many important insights into the nature of the mind and its role in nature, while radically transforming and enriching its host societies and improving the quality of life of its adherents. In many ways, the methods and goals of scientific and contemplative inquiry are profoundly complementary, with each of them having enormous potential for enriching the other.

In 1987, recognizing that there was no official orderly way for science and Buddhism to share their findings, and convinced that a rigorous scientific dialogue and collaboration between these two impressive traditions would be beneficial for humanity, neuroscientist Francisco Varela and entrepreneur Adam Engle started the Mind and Life Dialogues with His Holiness, the Dalai Lama. Since then, the Mind and Life meetings have focused on a broad set of themes ranging from the mind sciences and biology to physics and cosmology. This present meeting on attention, memory, and the phenomenological study of the mind is the eighteenth such Mind and Life dialogue.

What sets the Mind and Life dialogues apart from other meetings between science and Buddhism is the focus on in-depth, cross-cultural dialogue. In this meeting, the morning presentations by cognitive scientists will be 60-90 minutes in duration, followed by up to 90 minutes of discussion; and the afternoon sessions by cognitive scientists and Buddhist scholars and contemplatives will be 30-45 minutes in duration, with the rest of the two hours devoted to discussion. These discussions have always been the central focus of each Mind and Life meeting, and in this conference they will play a more predominant role than ever before.

In addition to the Mind and Life dialogues and publications, the Mind and Life Institute has two other programs to advance our mission:

- **The Mind and Life Summer Research Institute** is an annual week-long "Science Retreat" specifically for scientists, scholars, contemplative practitioners and philosophers to advance the fields of collaborative research in neuroscience, clinical science and education.
- **The Mind and Life Education Research Network** is a multi-disciplinary research network investigating how to most effectively bring the benefits of contemplative practice to children early in their lives, especially in an educational setting.

For more information about our previous Mind and Life dialogues, publications, and research networks, please visit our web site: **www.mindandlife.org.**

# Attention, Memory, and the Mind: A Synergy of Psychological, Neuroscientific, and Contemplative Perspectives

The topics of Mind and Life XVIII are human attention, memory, and the mind considered from phenomenological (including contemplative), psychological, and neurobiological perspectives. While the relation between attention, memory, and the mind is a fascinating area of research in psychological science and neuroscience, it is also of particular interest and investigation in Buddhism, because it is through the contemplative refinement of attention and mindfulness that one explores the distinctive characteristics, origins, and potentials of human awareness, of suffering, and of genuine happiness. In short, the contemplative training known as "shamatha" (meditative quiescence) deals with the development and refinement of attention; and this is the basis for "vipashyana" (contemplative insight), which entails methods for experientially exploring the nature of the mind and its relation to the world at large.

Furthermore, sustained voluntary attention (*samadhi*) is closely related to memory, because in order to deliberately sustain one's attention upon a chosen object, one must continue to remember to do so from moment to moment, faithfully returning back to refocus on that object whenever the mind wanders away from it. Likewise, in Buddhism, the faculty of "mindfulness" (*smrti*) refers not only to moment-to-moment awareness of present events. Instead, the primary connotation of this Sanskrit term (and its corresponding Pali term *sati*) is recollection. This includes long-term, short-term, and working memory, non-forgetful, present-centered awareness, and also prospective memory, i.e., remembering to be aware of something or to do something at a designated time in the future. In these ways, from a contemplative perspective, memory is critically linked to attention, and both of these mental faculties have important ramifications for the experiential and phenomenological study of the mind, its training, and potential optimization.

The discussions during Mind and Life XVIII will primarily focus on the subjective phenomenology, information-processing operations, and neural mechanisms of attention, memory, and conscious awareness from both scientific and Buddhist perspectives. We expect that participants in these dialogues, coming from the various disciplines of philosophy, psychology, neuroscience, and Buddhist scholarship and contemplative practice will especially work toward understanding and incorporating the broad range of each others' ideas and views about the topics of this meeting. Special attention will be focused on the distinctive characteristics and interactions of attention, memory, and metacognition as seen from diverse viewpoints, including the possibility of multiple dimensions of awareness (not limiting the discussion to the familiar categories of the conscious and subconscious mind), and the relationship between the entire spectrum of human information processing, awareness, and the world of experience (*Lebenswelt*) as a whole. We anticipate that this exploration will lead to further systematic plans for ground-breaking empirical and theoretical research on meditation and contemplative practice at the interface between science and Buddhism. Participants will be prepared to interact collaboratively toward developing such an exciting research agenda.

# PARTICIPANTS

## Participants

**Tenzin Gyatso, His Holiness, the XIV Dalai Lama**

**Adele Diamond, Ph.D.,** Professor of Developmental Cognitive Neuroscience, University of British Columbia, Vancouver, BC, Canada

**Shaun Gallagher, Ph.D.,** Professor of Philosophy and Cognitive Science, University of Central Florida

**Rupert Gethin, Ph.D.,** Director of the Centre for Buddhist Studies, University of Bristol, UK

**Amishi Jha, Ph.D.,** Assistant Professor of Psychology, University of Pennsylvania

**David E. Meyer, Ph.D.,** Professor of Psychology, University of Michigan

**Elizabeth Phelps, Ph.D.,** Professor of Psychology, New York University

**Clifford Saron, Ph.D.,** Assistant Research Scientist, Center for Mind and Brain, University of California, Davis

**Anne Treisman, Ph.D.,** Professor of Psychology, Princeton University

**B. Alan Wallace, Ph.D.,** President, Santa Barbara Institute for Consciousness Studies

## Interpreters

**Geshe Thupten Jinpa, Ph.D.,** President of the Institute of Tibetan Classics in Montreal

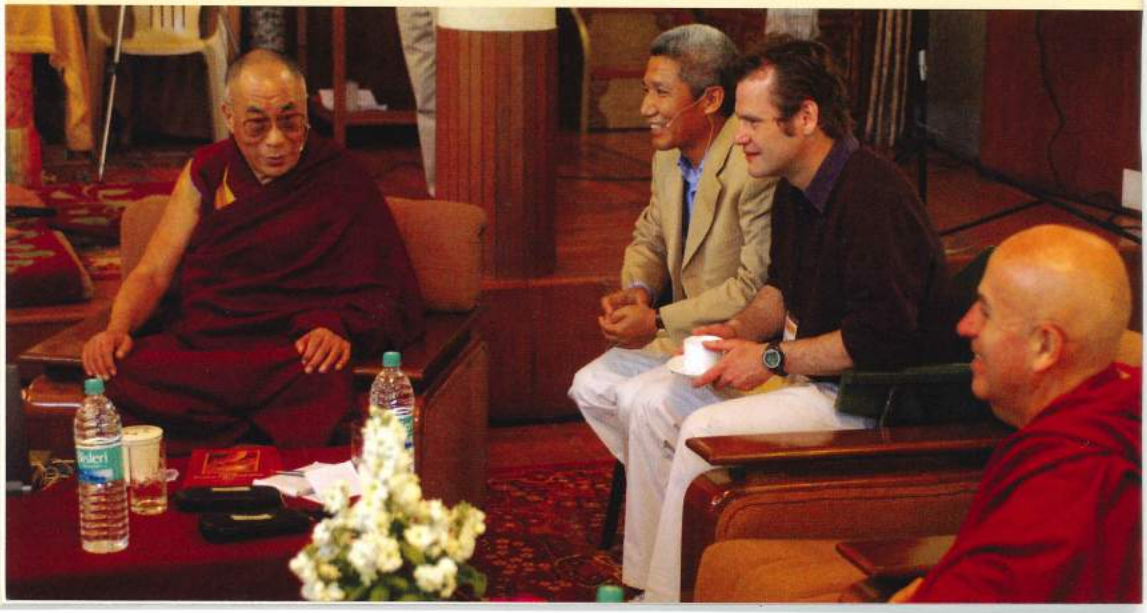
**B. Alan Wallace, Ph.D.,** President of the Santa Barbara Institute for Consciousness Studies

## Conference Coordinators

**David E. Meyer, Ph.D.,** Scientific coordinator

**B. Alan Wallace, Ph.D.,** Buddhist coordinator

His Holiness the Dalai Lama, Thupten Jinpa, John Dunne and Matthieu Ricard discuss "The Universe in a Single Atom" at Mind and Life XIV in Dharamsala, India, in April of 2007



# Day One

## Monday, April 6 – Part I:
## Multi-tasking, Meditation, and Contemplative Practice

### *Dialogue Leader: David Meyer*

The subjective phenomena commonly experienced by novice and intermediate practitioners during Shamatha meditation and other related types of contemplative practice suggest that they may be understood in terms of theoretical concepts and empirical results drawn from scientific studies of human multi-tasking. Perhaps practitioners routinely engage in multi-tasking during their meditative sessions; while one of their tasks involves doing the meditation itself, another probably involves performing "the task of life", which is perpetually underway and entails many on-going mental activities such as retrospecting, evaluating, imagining, planning, day dreaming, self monitoring, and so forth. Becoming a skilled practitioner who is better able to maintain focused attention, to dispel the fog of mind wandering, and to transcend mental distractions would then depend on developing new task-scheduling strategies and mechanisms of cognitive control whereby meditation evolves to be a primary task and "the task of life" ceases to be even a background secondary task.

What have cognitive psychologists and neuroscientists discovered about the nature of multi-tasking relevant to these considerations and prospects? Specifically we will consider the inefficiencies of multi-tasking, the components of human information processing that underlie them, the roles played by alternative types of scheduling strategies, the contributions due to various types of working memory, and the sources of individual differences in these related realms. It will be explained how this analysis may dovetail closely with some classical Buddhist accounts concerning stages of skill acquisition in Shamatha meditation, and with principles of optimal "cross-training" in a variety of contemplative practices to maximize the rate at which meditative skill is attained. Questions to be discussed include: do any Buddhist sutras or other scriptures discuss the topic of multi-tasking? If so, what do they say about it? Do any of the major traditional types of Tibetan Buddhist meditation require or encourage multi-tasking while they are being practiced? Can certain types of meditation enable people to become better at multi-tasking? If so, in what ways?

## Part II:
## The Buddhist Contribution to First-Person Cognitive Science

### *Dialogue leader: B. Alan Wallace*

The primary methods of the modern cognitive sciences for investigating the mind are interrogation of others concerning their subjective experience, behavioral studies, and brain research. All these methods are indirect methods for understanding the mind by way of its verbal and behavioral expressions and neural correlates. Although the direct observation of mental states and processes was prevalent in late 19th-century psychology, introspection has been marginalized since the early 20th century. Nevertheless, without relying on first-person report, studies of behavior and the brain alone would yield little if any insight into the nature of mental phenomena. While Buddhism lacks any quantitative behavioral science or neuroscience, it has developed highly sophisticated methods of introspective inquiry based on the refinement of attention and metacognitive skills. These methods allegedly result in reliable, replicable observations regarding the origins, nature, and potentials of consciousness, as well as the inner causes of mental suffering and genuine happiness. There is

therefore a potential for these methods of refining and utilizing introspection to be integrated into the scientific study of the mind in ways that may enrich both Buddhism and modern science. Questions to be discussed include: can introspectionism complement more "third-person" views in the science of meditation? What are some of the challenges and promises of such an integration?

# Day Two

## Tuesday, April 7 – Part I: Mental Processes Underlying Attention, Visual Perception, and Cognitive Control

### *Dialogue Leader: Anne Treisman*

Attention is a fuzzy concept that we try to capture in a variety of forms to study it in the lab. The main meaning is the selection of relevant information when the mind is overloaded or distracted. One dimension along which attention can vary is from sharply focused to broadly spread. Each setting may yield different information, from the detailed structure of an object with focused attention to the gist of a scene with more global attention. One set of experimental findings suggest a conclusion that is not easily available to introspection: this is that focused attention plays a role in binding features (like shape, color, or motion) to form integrated objects in visual perception. It prevents mistakes like seeing a blue shirt when the person is actually wearing a green shirt and blue pants. A similar function may be shown in higher level conceptual thinking, where attention is needed to create and hold more complex ideas in mind and in working forms of memory.

Is the role of attention limited to conscious perception and thought, leaving a whole complex set of implicit processes unaffected, or are there limits and controls also on what goes on unconsciously? Many recent studies of both normal people and patients with brain damage, for instance, have shown that our behavior and brains can be affected by cues in the environment of which we are quite unaware. Can access to unconscious information become easier through training in meditation? What other effects can meditation training have on attention? We took some standard tests from Western psychology and made some preliminary studies of experienced meditators, testing whether meditation could change the breadth of focus, the efficiency of focus, the overall capacity of attention, or the ability to move between different levels of processing. Our preliminary results suggest that the significant effects have been mainly on the higher levels of perception, where there is more flexibility. We found little evidence that meditation changed access to earlier sensory levels. Do these results accord well with what the outcomes of these meditation practices are?

## Part II: Paying Attention to Awareness: "Attention" (*manasikārā*), "Mindfulness" (*sati*) and "Clear Comprehension" (*samapajañña*)

### *Dialogue leader: Rupert Gethin*

One of the distinctive features of Theravāda systematic thought (*abhidhamma*) is the detailed account it provides of the processes in which the mind becomes aware of and handles "objects" (classified as sense-data, the mind itself and abstract concepts). According to this account consciousness is the functioning, or simply assemblage, of

complex and fast moving mental events and processes in which numerous discrete "mental qualities" (*cetasika*) – encompassing both the basic functions and emotions of the mind – interact at various stages to create our experience of the world. Within this synthetic process particular mental qualities are highlighted as performing very specific functions such as attention, categorizing, and also mindfulness, but always in simultaneous association with other mental qualities. The way the mind handles and pays attention to the various objects of consciousness at the basic level of awareness is considered crucial in this endeavour. This means that much of Buddhist contemplative practice involves a kind of meta-awareness: self-monitoring the processes by which the mind is aware of and pays attention to objects of consciousness. Questions to be discussed include: how do such Buddhist accounts of these faculties relate to contemporary definitions of "mindfulness" in scientific studies? How can we understand the relation between attention and memory in the practice of mindfulness?

# Day Three

## Wednesday, April 8 – Part I: Mental Processes for Attention and Cognitive Control in Children and Adolescents

### *Dialogue leader: Adele Diamond*

Attentional control, self-regulation, and inhibitory control are not immutable. They can be improved even in children as young as 4–5 years, in regular classrooms, with regular teachers, without special equipment. First we will explore why inhibitory control is so critically important, especially during development. A child may know what he or she should do, and want to do, but still not be able to act accordingly because of insufficient inhibitory control. Adults may not appreciate how inordinately difficult inhibition is for young children because it is so much less taxing for us. The educational practices that improve attentional control and self-regulation not only lead to better academic outcomes, but they will also reduce the incidence and severity of mental health disorders where poor self-regulation is at the core (such as ADHD and addiction). Many issues are not simply education issues or health issues; they are both. Activities that often get squeezed out of school curricula, including the arts and physical exercise, are excellent for developing attentional control, self-regulation, and inhibitory control, and thus can be critical for success in school and in life. Improvement of critical skills need not be painful; indeed the evidence shows that children who spend more time in supervised play at school perform better on objective academic outcome measures than those who spend more time receiving direct academic instruction. Questions to be discussed are: what are traditional Tibetan Buddhist insights about training attentional control in young people? What are the main modalities for doing this? Is there any sense of a "developmentally appropriate" set of contemplative activities for children and adolescents in the traditions?

### Part II:
### The Utility of Improving Attention and Working Memory with Mindfulness-Based Training

***Dialogue leader: Amishi Jha***

Attention is the ability to select information that is important for present-moment goals while being undistracted by irrelevant information. Working memory is the ability to maintain and use selected information over time. Individuals vary in their capacity to engage attention and working memory which is quite limited and prone to fatigue over time. Two features of this capacity, in addition to its fragile nature are that: 1) An individual's attention and working memory capacity changes over the lifespan getting better from childhood to adulthood and then degrading with advancing age. 2) Those with more capacity are better able to control their emotions and manage internal and external turbulence better than those with less capacity.

Is it possible to improve attention and working memory capacity to buffer against normal decline in functioning with advancing age? In our studies investigating mindfulness-training we find that both long-term and intensive practice in a retreat context, provide older adults (mean age= 52 years) with a protective 'reserve' in their capacity so that their performance is very similar to that of younger adults with no mindfulness-training. Does improving attention and working memory have broader benefits? That is, how might improving working memory capacity help or interact with the cultivation of virtuous qualities such as patience, nonreactivity, emotional balance, and compassion? We have found that there is a direct relationship between the amount of time in which one engages in mindfulness-exercises and the degree of improvement in working memory capacity. This improvement in capacity then determines the degree of reduction in negative mood over the course of training. These results suggest that improvements in attention and working memory that result from mindfulness-training may not only be useful in and of themselves (e.g., to protect against normal aging), but they may be critical stepping stones for broader benefits such as improving mood. Questions for discussion include: are improvements in attention and memory discussed as part of the meditation training tradition in Tibetan Buddhism. What is the role of memory in contemplative development? Is there evidence in the tradition of elders showing extremely good memory given years of practice?

## Day Four

### Thursday, April 9 – Part I:
### Attention-Emotion Interface

***Dialogue leader: Elizabeth Phelps***

A primary function of emotion is to highlight events in the environment that are potentially important for adaptive function and future survival. Given this, it is not surprising that cognitive processes are tuned to give priority to events that elicit emotional reactions. We will discuss how attention, perception and memory are changed by emotion, both the psychological phenomenon and the neural underpinnings. We will also discuss research outlining how our thoughts can alter our emotions and will speculate about how strategies to regulate emotions may change our memories. Comparing and contrasting insights into how different strategies may aid in the regulation of attention and emotion will be discussed. Questions for

discussion include: are there specific practices for training emotion in Tibetan Buddhism? What is the relation of attention to such practices? Do any teachings exist on the role of emotion in relation to attention and memory in the Buddhist traditions? Can meditation practice increase our capacity to understand the primary role of emotion in cognition and attention?

## Part II:
## Results of the Shamatha Project

### *Dialogue leader: Clifford Saron*

Contemplative practices often aim to cultivate the refining of attention and emotional regulation. Within the fields of psychology and neuroscience, keen interest in attention and emotion has resulted in robust theoretical frameworks and solid experimental paradigms that aim to determine how these processes work and how they might be modified through training. Thus, there is strong common ground between meditative and research traditions. We will explore recent findings from our work at this interface between contemplative and research traditions. Together with Alan Wallace and three-dozen collaborating researchers, we are investigating how attentional, emotional and physiological processes change over the course of three months of intensive training in meditative quiescence and emotional balance, in a study known as "The Shamatha Project." Scientific measures include established paradigms in cognitive and affective neuroscience, stress and affiliation-related biomarkers, EEG, autonomic physiology, facial expressions of emotion, self report, daily journaling, and structured interviews. Our initial findings demonstrate improvements in adaptive psychological attributes, perceptual and attention-related skills, improvements in inhibiting habitual responses, decreased mind-wandering, changes in the emotional response to the perception of human suffering, and changes in biomarkers associated with cellular repair. Together, these findings demonstrate wide-ranging benefits of the retreat experience. Questions for discussion will include: What is the role of "world view" on the effects on contemplative practice? That is – does one's belief system and/or cosmological perspective, be it Tibetan Buddhist, Christian, secular or other, limit or facilitate the fruits of meditation practice? From the Buddhist point of view is there a concept or basic tenet that captures something so central about inner life that our longevity might depend on it? What is most deleterious to health? His Holiness the Dalai Lama has said that to help others we should practice compassion; to help ourselves, we should practice compassion. In our research we see that compassion practice likely decreases spontaneous expression of some negative emotions. In the Buddhist tradition what is the breadth of effects on the practitioner due to the practice of compassion?

# Day Five

## Friday, April 10 – Part I
## Embodiment and Intersubjectivity: Empirical and Phenomenological Approaches

### *Dialogue leader: Shaun Gallagher*

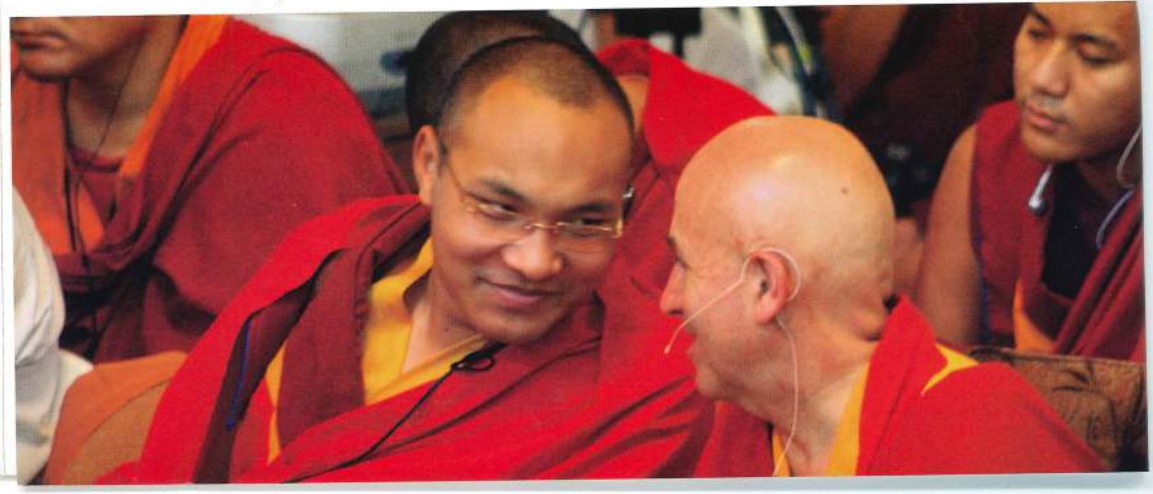
Two themes that have become prominent in studies of consciousness and cognition: embodiment and intersubjectivity. We will begin by discussing recent work in embodied cognition, informed by both science and philosophical phenomenology. These studies show that embodied processes connected with posture, movement, and extra-neural processing have an effect on attention, judgment, and perception. We will also review recent scientific and philosophical studies of interpersonal relations (intersubjectivity, social cognition). How do our interactions with others shape the way we perceive the world or attend to things, as well as act? How does shared attention modulate other attentional processes?

Considerations of embodiment and intersubjectivity raise interesting questions about meditation practice and whether experience is different if meditation is done alone or with others. For instance, in phenomenological analyses of normal movement and action emphasis is placed on the idea that in habitual or practiced bodily movement, one is not usually aware of what one's body is doing (in contrast to some pathological cases). Becoming too aware of one's body interferes with performance, when playing tennis, for example. Does proficiency in meditation involve body consciousness (a focus on the body or bodily processes – e.g., breathing) or an ability to move beyond awareness of body? Is meditation different when others are practicing it with you? Is there something like shared meditation? In working with a teacher, how does shared attention to specific meditation practices become something other than shared attention (does it get transformed into a specific kind of attention, or a specific kind of inattention) – and what changes (what is lost or gained) when it ceases to be shared attention?

## Part II:
## Education, Application, Buddhism, and Technology

Group discussion among all the speakers and audience will focus on future lines of research and collaboration in psychological, neurobiological, and phenomenological studies of meditation and contemplative practice.

His Holiness the 17th Gyalwang Karmapa with Matthieu Ricard of Shechen Monastery at Mind and Life XIV, Dharamsala, India, April 2007



# PARTICIPANT BIOGRAPHIES

**Tenzin Gyatso, the XIVth Dalai Lama,** is the leader of Tibetan Buddhism, the head of the Tibetan government-in-exile, and a spiritual leader revered worldwide. He was born on July 6, 1935 in a small village called Taktser in northeastern Tibet. Born to a peasant family, he was recognized at the age of two, in accordance with Tibetan tradition, as the reincarnation of his predecessor, the XIIIth Dalai Lama. The Dalai Lamas are manifestations of the Buddha of Compassion, who choose to reincarnate for the purpose of serving human beings. Winner of the Nobel Prize for Peace in 1989, he is universally respected as a spokesman for the compassionate and peaceful resolution of human conflict.

He has traveled extensively, speaking on subjects including universal responsibility, love, compassion and kindness. Less well known is his intense personal interest in the sciences; he has said that if he were not a monk, he would have liked to be an engineer. As a youth in Lhasa it was he who was called on to fix broken machinery in the Potola Palace, be it a clock or a car. He has a vigorous interest in learning the newest developments in science, and brings to bear both a voice for the humanistic implications of the findings, and a high degree of intuitive methodological sophistication.

**Adele Diamond, Ph.D.,** is the Canada Research Chair Professor of Developmental Cognitive Neuroscience in the Department of Psychiatry at the University of British Columbia. She is both a developmental psychologist (PhD, Harvard) and a cognitive neuroscientist (postdoctoral fellow in Neuroanatomy, Yale) and one of the pioneers of the field of "developmental cognitive neuroscience." Prof. Diamond's work integrates developmental, cognitive, neuroscience and molecular genetic approaches to examine fundamental questions about the development of the cognitive control abilities ("executive functions," such as attentional control, working memory, inhibitory control, and cognitive flexibility) that rely on the prefrontal cortex of the brain, their modulation by genes and by the environment, how they become derailed in disorders, and effective treatments for preventing or ameliorating those disorders. Her earlier work changed medical practice worldwide for the treatment of PKU (phenylketonuria), improving children's lives, and her recent work on early educational practices that improve executive functions, including a paper in the journal *Science* last year is affecting school curricula around the world.

**Shaun Gallagher, Ph.D.** is Professor of Philosophy, and IST Senior Researcher, at the University of Central Florida (USA), and Research Professor of Philosophy and Cognitive Science at the University of Hertfordshire (UK). He received his Ph.D. in Philosophy from Bryn Mawr College and an M.A. in Economics at the State University of New York (Buffalo). He is author of *Brainstorming: Views and Interviews on the Mind* (Imprint Academic, 2008), *The Phenomenological Mind* (with Dan Zahavi, Routledge 2008), *How the Body Shapes the Mind* (Oxford University Press 2005), *The Inordinance of Time* (Northwestern University Press, 1998), and *Hermeneutics and Education* (SUNY Press, 1992). Gallagher has held visiting positions at the Medical Research Council's Cognition and Brain Science Unit, Cambridge University (1994); at the University of Copenhagen (2004-06), at the Ecole Normale Supériure, Lyon (2007), and most recently at the Zentrum für Literatur- und Kulturforschung (ZfL) in Berlin (2008). He is editor-in-chief of the journal *Phenomenology and the Cognitive Sciences,* which he co-founded with Francisco Varela and Natalie Depraz.

# PARTICIPANT BIOGRAPHIES

**Rupert Gethin, Ph.D.,** is Reader in Buddhist Studies and Co-Director of the Centre for Buddhist Studies at the University of Bristol; since 2003 he has been President of the Pali Text Society. He completed a BA in the Department of Comparative Religion at the University of Manchester in 1980. After a brief period in Sri Lanka with the Buddhist Publication Society he returned to Manchester to complete an MA in Buddhist Studies (1982) and undertake doctoral research on the theory of meditation in the Pali Nikāyas and Buddhist systematic thought. After completing his PhD in 1987 he moved to Bristol where he continues to teach courses in Indian religions, Pali and Sanskrit. In 2008 he was Numata Visiting Professor of Buddhist Studies at UC Berkeley. A revised version of his doctoral thesis was published under the title *The Buddhist Path to Awakening: a study of the Bodhipakkhiyā Dhammā in the Nikāyas and Abhidhamma* in 1992. In addition he has published a number of chapters and articles focusing on various aspects of Pali literature and also on the psychology and philosophy of especially Theravādin systematic thought (*abhidhamma*). Other publications include the first English translation (with R. P. Wijeratne) of a classic twelfth century Pali commentary to the traditional textbook of Abhidhamma, *Abhidhammatthhasangaha* (2002), as well as a widely used university level introduction to Buddhist thought and practice, The Foundations of Buddhism (1998) and an anthology of translated texts from the Pali Nikāyas, *Sayings of the Buddha* (2008).

**Amishi Jha, Ph.D.,** was born in Ahmedabad India and raised and educated in the United States receiving her B.S from the Dept of Psychology at the University of Michigan, her Ph.D from the Center for Neuroscience at UC-Davis, and her post-doctoral training at Duke University's Brain Imaging and Analysis Center. She is currently an Assistant Professor of Psychology at the Center for Cognitive Neuroscience at the University of Pennsylvania. She received the Charles Ludwig Distinguished Teaching award in 2007 at the University of Pennsylvania for her courses on the cognitive neuroscience of meditation. She investigates the neural bases of attention and working memory using functional MRI, electroencephalography (EEG), and behavioral measures. Her active research projects examine how mental load, social-emotional contexts, and mindfulness-training may alter attention's efficiency throughout the course of the lifespan. Recently, she has also begun to explore if mindfulness-training may benefit those who suffer form emotional and attentional difficulties due to high-stress experiences (such as military duty) or medical conditions such as ADHD. In addition, she is conducting a multi-year National Institutes of Health (NIH) project to investigate if attention training may lead to improvements in attentional tuning and working memory.

**Thupten Jinpa, Ph.D.,** was trained as a monk at the Shartse College of Ganden Monastic University, South India, where he received the Geshe Lharam degree. In addition Jinpa holds B.A. Honors in philosophy and Ph.D. in religious studies, both from Cambridge University. He taught for five years at Ganden and worked also as a research fellow in Eastern religions at Girton College, Cambridge University. Jinpa has been a principal English translator to H.H. the Dalai Lama for nearly two decades and has translated and edited numerous books by the Dalai Lama including *Ethics for the New Millennium, Transforming the Mind,* and *The World of Tibetan Buddhism.* His own publications include works in both Tibetan and English, the most recent book being *Self, Reality and Reason in Tibetan Philosophy.*

Jinpa teaches as an adjunct professor at the Faculty of Religious Studies at McGill University, Montreal. He is currently the president of the Institute of Tibetan Classics and heads its project of critical editing, translation and publication of key classical Tibetan texts aimed at creating a definitive reference series entitled The Library of Tibetan Classics.

# PARTICIPANT BIOGRAPHIES

**David Meyer, Ph.D.,** is a faculty member of the Cognition and Perception Program in the Department of Psychology at the University of Michigan, Ann Arbor. A mathematical psychologist and cognitive scientist, he received his Ph.D. from Michigan and subsequently worked for almost a decade as a Member of Technical Staff in the Human Information Processing Research Department at the Bell Telephone Laboratories before returning to academe. His teaching and research – sponsored by the National Science Foundation, National Institute of Mental Health, and Office of Naval Research – have dealt with fundamental aspects of human perception, attention, learning, memory, language, movement production, multitasking, executive mental control, human-computer interaction, personality and cognitive style, cognitive aging, cognitive neuroscience, mathematical models, and unified computational theories. Numerous reports of this research have appeared in books and journals such as *Science, the Psychological Review, Cognitive Psychology, Memory & Cognition, Journal of Experimental Psychology, Journal of Memory and Language,* and *volumes of the Attention and Performance* symposium series.

For his diverse scientific contributions, Prof. Meyer has been elected as a Fellow in the Society of Experimental Psychologists, American Psychological Society, American Psychological Association, and American Association for The Advancement of Science. The American Psychological Association has honored him with its Distinguished Scientific Contribution Award. His professional activities have also included extensive service on journal editorial boards, government review panels, and international administrative committees. More information about Professor Meyer may be obtained at his laboratory website, www.umich.edu/~bcalab.

**Elizabeth Phelps, Ph.D.,** received her PhD from Princeton University in 1989, served on the faculty of Yale University until 1999, and is currently Silver Professor of Psychology and Neural Science at New York University. Her laboratory has earned widespread acclaim for its groundbreaking research on how the human brain processes emotion, particularly as it relates to learning, memory and decision making. Dr. Phelps is the recipient of the 21st Century Scientist Award from the James S. McDonnell Foundation and a fellow of the American Association for the Advancement of Science. She has served on the Board of Directors of the Association for Psychological Science and the Society for Neuroethics, was the President of the Society for Neuroeconomics and is the current editor of the APA journal *Emotion.*

**Cliff Saron, Ph.D.,** is currently an Assistant Research Scientist at the Center for Mind and Brain at the University of California at Davis (http://mindbrain.ucdavis.edu), and faculty member of the UC Davis M.I.N.D. Institute. He received his Ph.D. in Neuroscience from the Albert Einstein College of Medicine in 1999 studying interhemispheric visuomotor integration under the direction of Herbert Vaughan, Jr. Dr. Saron has had a long-standing interest in brain and behavioral effects of meditation practice and has been faculty at the Mind and Life Summer Institute for the past three years. In the early 1990's he was centrally involved in a field research project investigating Tibetan Buddhist mind training in collaboration with Jose Cabezón, Richard Davidson, Francisco Varela, Alan Wallace and others under the auspices of the Private Office of H.H. the Dalai Lama and the Mind and Life Institute. Currently, in collaboration with Buddhist scholar Alan Wallace and a consortium of scientists at UC Davis and elsewhere, he is Principal Investigator of The Shamatha Project, a unique longitudinal study of the effects of intensive meditation training based on the practice of meditative quiescence (shamatha) and cultivation of the four immeasureables (loving kindness, compassion, empathetic joy, and equanimity) on attention-related skills and emotion regulation. The Shamatha Project is the most

comprehensive and multimethod study to date regarding the potential effects of long-term intensive meditation practice on basic mental and physical processes related to cognition, emotion, and motivation. His other primary research interest focuses on investigating brain and behavioral correlates of sensory processing and multisensory integration in children on the autistic spectrum.

**Anne Treisman, Ph.D.,** is the James S. McDonnell Professor of Psychology at Princeton University. She received her BA from Cambridge University and her D.Phil. from the University of Oxford. She has previously held positions at Oxford University, the University of British Columbia, a Fellowship at the Canadian Institute for Advanced Research, a position at the University of California, Berkeley, and visiting positions at Bell Laboratories, at the Center for Advanced Study in the Behavioral Sciences, Stanford and at the Russell Sage Foundation, New York. She is a Fellow of the Royal Society, London, a member of the National Academy of Sciences, US, of the American Academy of Arts and Sciences, of the American Philosophical Society, and a William James Fellow of the Association for Psychological Science. She received a number of prizes and honors including the Howard Crosby Warren award of the Society for Experimental Psychology, the Distinguished Scientific Contribution Award of the American Psychological Association, the George A. Miller Award from the Cognitive Neuroscience Society, and honorary degrees from the University of British Columbia and University College London. She has published many papers on attention and visual memory, starting with selective listening and filter theory, and continuing with the binding problem in vision, and with studies of visual memory, both implicit and explicit.

**B. Alan Wallace, Ph.D.,** is president of the Santa Barbara Institute for Consciousness Studies. Trained for many years as a monk in Buddhist monasteries in India, Sri Lanka, and Switzerland, he has taught Buddhist theory and practice worldwide since 1976 and has served as interpreter for numerous Tibetan scholars and contemplatives, including His Holiness the Dalai Lama. After graduating summa cum laude from Amherst College, where he studied physics and the philosophy of science, he earned his Ph.D. in religious studies at Stanford University. He has edited, translated, authored, and contributed to more than thirty books on Tibetan Buddhism, medicine, language, and culture, and the interface between science and religion.

His published works include *Choosing Reality: A Buddhist View of Physics and the Mind* (Snow Lion, 1996), *The Taboo of Subjectivity: Toward a New Science of Consciousness*(Oxford, 2000), *Buddhism and Science: Breaking New Ground, ed.* (Columbia University Press, 2003), *Genuine Happiness: Meditation as the Path to Fulfillment* (John Wiley & Sons, 2005), *The Attention Revolution: Unlocking the Power of the Focused Mind* (Wisdom, 2006), *Contemplative Science: Where Buddhism and Neuroscience Converge* (Columbia University, 2007), *Hidden Dimensions: The Unification of Physics and Consciousness* (Columbia University, 2007), *Embracing Mind: The Common Ground of Science and Spirituality,* co-authored with Brian Hodel (Shambhala, 2008), *and Mind in the Balance: Meditation in Science, Buddhism, and Christianity* (Columbia University, 2009).

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