

A Clear & Knowing Mind



The second Mind & Its Potential conference held in Sydney, Australia in September 2006 was hosted by Vajrayana Institute, the team which initiated the first Australian-based conference in 2005, and also organized a Happiness & Its Causes conference in April 2006. The second Happiness & Its Causes conferences will be held in Sydney, June 14-15, 2007 and will be addressed by His Holiness the Dalai Lama. This essay by Tony Steel, director of Vajrayana Institute, highlights the growing interest in the science-Buddhism connection.

It was a defining moment of the [Mind & Its Potential] conference. The neuroscientist activated his laptop and the overhead screen sprang to life with a video image of an EEG recording the electrical pulses of an active brain. The neurocorrelates of consciousness, the tell-tale signatures of neurons firing and connecting to one another as the brain of the subject reacted to experience, were there to see. But this was not a human brain, the neuroscientist told us, this was a cockroach. "I don't stand on cockroaches either, because their neurons are just as good as ours!" he remarked.¹

This side-bar from a conference on the science of the mind provides a tantalizing insight into how advances in neuroscience are providing illuminating linkages to Buddhist conceptions of mind and the nature of sentient beings. It is

too early to suggest that neuroscience is validating Buddhist teachings, however, at the least, it is providing material that may prove useful to today's generation of Western Buddhists, who are well-schooled in the terminology of science. For example, the interchange with the scientist above showed scientific evidence for and acceptance that cockroaches have nervous systems, and thus perhaps minds, but there is still no agreement among scientists that cockroaches or any other animal for that matter have feelings.²

For neuroscience and Buddhism, humans have a special place in the realm of sentient beings. Humans are unique

¹ Professor Marcello Costa, Professor of Neurophysiology, Flinders University at the 2nd International Conference on Mind & Its Potential, Sydney, 2006.

² *Do Animals Have Feelings?*, Scientific American Mind, Feb/Mar 2006, Vol 17 Number 1, p24.

amongst all life on earth for their higher intelligence. Science points to a chain of evolution that leads to the complexity of the human brain. The brainstem at the base of the brain is said to be the oldest part of the brain – having evolved over 500 million years ago – and resembles the entire brain of present-day reptiles.³ This part of the brain regulates the vegetative processes of the body, such as breathing, heartbeat, and blood pressure.

Next in the chain of evolution was the limbic system, a small cluster of tubes, lumps, and chambers that sits on top of the brainstem. This is known as the ‘mammalian brain’ because it is thought to have first emerged from mammals. This is an important center for the generation of emotions and many of the urges and behaviors that help us survive, such as hunger and the desire to reproduce.

The human brain evolved further with the pronounced development of the cerebral cortex, the deeply-wrinkled grey matter that gives the brain its characteristic appearance. The cortex, in particular the frontal lobes directly behind the forehead, gives humans their unique capacity to plan, reason, and imagine. Whilst many animals undoubtedly have sensory perception that is equal to or superior to that of humans – such as the capacity of a dog to detect odors, the keen eyesight of an eagle, or the sensitivity of a deer to sound – a powerfully-developed conceptual mind is the unique quality of humans. In Buddhism, it is said that the conceptual mind is what gives humans the capacity to recognize suffering, analyse its causes, and follow the path that will lead to liberation from suffering.

The brain is very much the focus of neuroscience. From an investigation of its physical properties, neuroscientists are able

to identify the functionality of different parts of the brain and determine the location of specific brain activity such as emotion, feeling, cognition, and so forth. Most neuroscientists maintain that consciousness is merely an emergent property of the brain that arises from neural activity following a structure which is formed from the interplay of genetic makeup and the environment.⁴

On the other hand, Buddhism is equally pre-occupied with the mind, a non-physical phenomenon that changes from moment to moment and which is simply described as “that which is clear and knowing.” Whilst Buddhists accept that coarse mental processes in humans, such as sense perception and conceptual thoughts, require a physical basis in the body, they maintain that subtler modes of consciousness do not require any underlying neural mechanisms. This provides Buddhism with a basis for positing past and future lives, which are difficult to explain if one accepts a materialist view that the mind is an emergent property of the physical body.

This illustrates that there are still major differences between neuroscience and Buddhism regarding the nature of the mind. Nevertheless, Western understanding of the physical properties of the brain and its relationship with consciousness is beginning to yield useful information that helps us understand the Buddhist view of consciousness within a scientific context. Of particular interest are recent advances in the understanding of how the brain learns and adapts. Whilst previously it was thought that from the time of the full development of the brain in early adulthood there was but a slow physical degeneration of the brain until its

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³ Rita Carter, *Mapping the Mind*, Orion Books, London, 2004, p42.

⁴ Carter, p331.

That the mind can be changed or 'trained' is clearly an important insight into how humans learn and develop. It also reflects the fundamental Buddhist notion that the mind can through familiarization be trained to adopt new ways of thinking, such as the development of the positive qualities of love, compassion, and patience, and to reduce negative qualities such as hatred, jealousy, and impatience.

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The cells that actually create brain activity are called neurons. These cells, of which there are approximately 100 billion in the average brain representing about ten percent of the brain mass, carry an electrical signal from one to the other. Each neuron connects with up to ten thousand neighbors. There is actually a small gap between each, called a synapse, which the current crosses with the aid of chemicals, called neurotransmitters, that are released when the cell fires up. These chemicals trigger a chain reaction among millions of neighboring cells, creating a pathway between neurons and different parts of the brain. The configuration of neural pathways reflects each individual's unique experiences and patterns of thinking. They are created and strengthened by use and degenerate when not used. Adults can increase their neural connections throughout their life by learning new things but, if the brain is not used, they will become depleted.

The process by which these neural pathways are created and strengthened is now the subject of much study within neuroscience. Fundamentally, our thoughts, perceptions, and memories consist of an association between groups of neurons such that when one fires, they all fire, creating a specific pattern. Memories form when a pattern of firing is repeated sufficiently for the neurons to bind together. In short, "neurons that fire together wire together."⁵

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⁵ Professor Lea Williams, Director, The Brain Dynamics Centre, Westmead Hospital, speaking at the 2nd International Conference on Mind & Its Potential, Sydney, 2006.

⁶ Shantideva, *A Guide to the Bodhisattva's Way of Life*, Library of Tibetan Works and Archives, 1979, p62.

⁷ This process is known as the seven modes of cognition (*blo rig bdum*).

Whilst the neurological explanation of how the brain learns and changes is necessarily physiological, Buddhism provides a psychological explanation of the process by which a practitioner can gain correct understanding and certainty in relation to an aspect of the teachings. It is a three-step process of listening, contemplation, and meditation. First, the practitioner listens to an explanation from her teacher. Then she reflects on the explanation, using logical reasoning to support the conclusions reached. To integrate and assimilate the information learned, the third and final step is to then hold that understanding single-pointedly in meditative equipoise.

In this way, the practitioner's understanding and certainty increases.⁷ She may have begun with a wrong understanding, but having listened to and reflected upon the explanation, a doubt arises that may initially tend away from the truth and then toward it. Further listening and reflection and then meditation on the explanation may then lead to a correct assumption arising, which is a correct understanding but which is not, as yet, held with certainty. It cannot be said that the practitioner has realized the object because superimpositions or conceptual overlays due to wrong beliefs and incorrect perceptions from the past remain which obscure her understanding. The force of one's conviction may be easily lost when challenged by another with an opposing view. However, through further listening, reflection, and meditation there arises an inferential cognition which is firmly or incontrovertibly held by the practitioner, which is at the level of a correct conceptual understanding based on valid reasoning. For example, our understanding of the causal relationship between fire and smoke is such that the sight of smoke is sufficient for us to infer the existence of fire.

Neuroscience and Buddhism both recognize the distinction between sense and mental perception. Neuroscientists have pinpointed specific locations within the brain that are responsible for visual, auditory, olfactory, gustatory, and tactile sensation. The frontal cortex has been identified as the area largely responsible for conceptual thoughts. According to Buddhism, the five sense perceptions are

instances of direct perception and together with the five sense powers⁸ are the means by which we perceive phenomena that are manifest in the world. However, Buddhism uniquely posits direct perception that is based on the mental sense power and which is crucial in the development of the capacity to understand hidden phenomena such as subtle impermanence and selflessness. Mental direct perception is experienced by those who have achieved extraordinary levels of meditative stabilization, giving them access to the power of clairvoyance such as the ability to know others' minds, to remember one's former lives, to perceive very subtle forms and sounds and so forth. Such perception is attained by the power of meditation and is not limited to Buddhist meditators. Advanced spiritual practitioners on the Buddhist path have the capacity to directly realize the nature of reality by unifying deep concentration and penetrative insight.⁹

What is common to both Buddhism and neuroscience is that habituating or 'hardwiring' the mind to a new way of thinking or behavior is a process that requires repetition and effort. Memory is possible due to the patterns that form by the firing of a common group of neurons in response to a stimulus, such that they become sensitive to one another and again fire together when that stimulus is encountered in the future. Repeated firing will cause the neurons to wire together to establish neural pathways that become the basis of new patterns of thinking and behavior.

How difficult is it to strengthen and wire together neurons to create neural pathways? Repeated familiarity is clearly important but it is a long process. Herbert A. Simon of Carnegie Mellon University coined a psychological law, the ten-year rule, which states that it takes approximately a decade of heavy labor to master any field.¹⁰ Even then, repetition is often not powerful enough in itself to deeply penetrate the neural structure of the brain. Otherwise, any one of us could become a grand chess master, a tennis champion, or concert pianist if only we would practice enough. Similarly, if repetition was sufficient to change our thinking, a long-term practice of reflection would inevitably yield its result. Unfortunately, many of us know this not to be true.

Scientists are now beginning to realize what Buddhist contemplatives have known for over two thousand years – to change thinking and behavior requires concerted effort, in the form of focused attention. In a paper published in 2005 in the *Philosophical Transactions of the Royal Society*¹¹, Henry Stapp and Jeffrey Schwartz reported that the mental act of focusing attention stabilizes the associated brain circuits.

Holding mental attention on a particular thought, emotion, or insight maintains the brain state arising in association with that experience. Over time, this has the capacity to strengthen neural pathways and produce significant and lasting physical changes in the brain's structure.

The activity of holding mental attention on a particular thought, described above, is the essence of meditation. By repeatedly bringing to mind the object of meditation the practitioner develops strong familiarity with that object and it can be held by the force of mental attention for increasingly long periods of time. Buddhist meditators have developed this power of focused attention to extraordinary levels. The teachings on calm abiding speak of a level of attainment at which the meditator has the capacity to place the mind on the object of meditation for as long as desired or at least for four hours without wavering. Once this level of focused attention is achieved, the mind becomes an extremely powerful instrument for attaining realization.

In recent years, neuroscience has begun to take an active interest in meditation and its effect on the brain. Pioneering work undertaken by Richard Davidson, Director of the Laboratory for Affective Neuroscience at the University of Wisconsin, demonstrated the unusual capacity of advanced meditators to hold their mental attention and develop qualities of mind to a degree that is unheard of for non-meditators.¹² Other studies have demonstrated that meditation has the capacity to produce measurable physical effects on the brain. A study by Sara Lazar¹³, a research scientist at Massachusetts General Hospital, found that the daily practice of meditation thickens parts of their brain's cerebral cortex, which is responsible for decision-making, attention, and memory.

The growing body of scientific study on the effects of meditation holds the tantalizing prospect of providing a new generation of Western Buddhists with validation of the effectiveness of the spiritual technology that has been handed down from teacher to disciple since the time of the Buddha. Whilst there are major philosophical differences that are yet to be resolved, this is an illustration of how the study of the brain by neuroscience is already enriching the Buddhist understanding of the mind. ❁

⁸ Eye, ear, nose, tongue, and body sense powers.

⁹ This is so-called 'yogic direct perception.'

¹⁰ *Secrets of the Expert Mind*, Scientific American, Aug 2006, Vol 295, No.2, p 46.

¹¹ *Quantum physics in neuroscience and psychology: a neurophysical model*, Philosophical Transactions of the Royal Society B, Vol 360, No 1458, June 29, 2005.

¹² Davidson's work is extensively discussed in *Destructive Emotions*, 2003.

¹³ Lazar et al., *Meditation experience is associated with increased cortical thickness*.