

Buddha's Brain:

The New Neuroscience and the Path of Awakening

Inquiring Mind

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In a way, the methodologies of Buddhist thought and science are essentially similar.
The Dalai Lama

We all want to be truly happy. The question is, *how*?

In Buddhist practice, the “how” includes gradually transforming the mind – the seat of clinging in all its forms – to increase the causes of happiness and reduce the causes of suffering – ultimately, to complete Awakening.

But what does it mean *actually*, to transform the mind? (We mean “mind” in the ordinary sense, as the realm of awareness, thoughts, feelings, sensations, images, desires, personality patterns, etc.)

Mind and Brain

In terms of Western science, changing your mind means changing your *brain*.

Many people, including ourselves, believe that there are transcendental factors at work in the mind outside of the realm of matter and energy. But apart from those potential influences, mind must be what the nervous system does. What else could it be possibly be?

While acknowledging the possibility of the transcendental, for the rest of this article, we'll stay within the framework of what's known scientifically about the mind and brain, and explore how you can use that information to support your own path of practice.

For example, psychology, neurology, and "contemplative neuroscience" have recently made discoveries about attention, cultivating positive emotions, and controlling craving that support the development of virtue, concentration, and wisdom. Further, the growing synergies between science and contemplative practice are a vital resource for a world poised on the edge of the sword, since the way it tips will depend a lot on whether enough people become more skillful at managing the reactive patterns of their minds – and thus, their brains.

Mind Changes Brain . . . Which Changes Mind

Scientists have shown that your mind and brain routinely change each other. This fact opens many gates to deepening practice.

For example, the mental activity of meditation changes your brain in numerous ways, including:

- It adds billions of synaptic connections – and thus, a measurable thickening of brain tissues – in the regions handling control of attention and sensory awareness (most obvious in the comparison between aging meditators and older non-meditators: good news for those of us with gray hair)
- It increases serotonin, the neurotransmitter that helps regulate mood and sleep
- It changes your brainwaves depending on whether you are doing a concentration or a mindfulness meditation

As the psychologist, Donald Hebb, put it: "Neurons that fire together, wire together." Fleeting thoughts, feelings, etc. leave behind lasting marks on your brain – much like a spring shower leaves little tracks on a hillside – which form the tendencies and views that make us suffer, or lead us to happiness. This means that your experience really, really matters. Which is a profound and scientifically substantiated rationale for being kind to yourself and creating the causes of more wholesome experiences and fewer unwholesome ones.

And as your brain changes over time, so does your mind. For example:

- If the left side of your frontal lobes becomes increasingly active compared to the right side, you become more prone to positive emotions.
- If serotonin increases through medication or through supplementing the amino acid it's built from, tryptophan, that can lift depression and free attention for psychological growth and spiritual practice.
- If the circuits of the soothing parasympathetic nervous system become more sensitized with practice, they help dampen stress reactions and support equanimity.

In sum, with a little skillfulness, you can use your mind to change your brain to benefit your whole being – and everyone else you affect.

Taking in the Good

So let's consider how this could actually work, in an extended example.

Imagine some of our earliest mammal ancestors, little rodent-like creatures scurrying about in the shadows of the last dinosaurs. The ones that became absorbed in the pleasant sensations of a good meal, warm rocks, and sweet-smelling flowers CRUNCH got eaten because they missed the sound of a slither nearby. The ones that

lived to pass on their genes were nervous and jumpy, quick to notice potential threats and to remember painful experiences.

That same circuitry is active in your brain today in the amygdala, hippocampus, and related structures. It's hard-wired to scan for the bad, and when it inevitably finds negative things, they're both stored immediately plus made available for rapid recall. In contrast, positive experiences (short of million dollar moments) are usually registered through standard memory systems, and thus need to be held in conscious awareness 10 to 20 seconds for them to really sink in.

In sum, your brain is like velcro for negative experiences and teflon for positive ones.

In the moment, this built-in bias puts a negative spin on the world and intensifies our stress and reactivity. Over time, these experiences build up in what's called "implicit memory," casting a glum shadow over mood and outlook, and darkening one's interior landscape. Yes, these hard-wired inclinations have been evolutionarily successful, but Mother Nature cares about grandchildren, not about *dukkha*.

In terms of Buddhist practice, the brain's negativity bias feeds all the hindrances, and it saps motivation for right effort. It also undermines *bhavana* – the cultivation of wholesome qualities – by downplaying good lessons and experiences, by undermining their storage, and by making it harder to recollect positive states of mind so we can find our way back to them.

You can overcome this innate tilt toward the negative by deliberately enhancing the way your brain forms implicit memories:

(1) Help positive events become positive experiences:

- Pay extra attention to the good things in the world and in yourself. For example, notice things that go well, or people who treat you kindly, or when you succeed at something. As we know, it is ignorance, fundamentally, that leads to suffering – and not seeing the good that is actually present is a kind of ignorance.
 - As a mindfulness practice, focus on the sensations and the feelings in your positive experiences since they are the pathway to emotional memory.
 - Deliberately create positive experiences for yourself. Examples include acts of generosity, evoking compassion, or recalling a time when you were happy.
- (2) Savor the experience as a kind of concentration practice; keep your attention on it for many seconds while letting it fill your body and mind.
- (3) Sense that the experience is soaking into you, registering deeply in emotional memory. You could imagine that it's sinking into your chest and back and brainstem, or imagine a treasure chest in your heart.

These three steps usually take half a minute or less, and with practice, you'll get even faster. Every day, there are many opportunities for noticing and absorbing good experiences. Any single instance won't make a big difference, but as the days and weeks add up, the mounting pile of positive implicit memories will provide more resources for coping – and practice – and brighten your inner landscape.

Because “neurons that fire together, wire together,” momentary *states* become enduring *traits*. These traits then become the causes of more wholesome states, which nourish your traits further in a positive cycle. To paraphrase Mathieu Ricard: If you

take care of the minutes, the hours – and the days and years – will take care of themselves.

How Brain Science Can Support Practice

To be sure, Western science is not *necessary* to fulfill the path of awakening set forth by the Buddha. But the emerging map of the mind and the brain can *support* practice in numerous ways.

First, knowing more about the brain/mind deepens conviction (faith) – one of the factors of enlightenment – since scientific developments keep re-confirming the dharma. For example, researchers have found that the activities of “self” are scattered throughout the brain, constructed from multiple sub-systems, and activated by many prior causes: there is no coherent, stable, independent self looking out through your eyes; in a neurological sense, self is truly empty. For many Westerners, science is the benchmark authority for what is true, and its harmony with Buddhism reduces the hindrance of doubt.

Second, neuropsychology can explain *why* traditional practices work, and help you emphasize their key elements. For instance, the rapture and joy that are traditional factors of meditative absorption, involve high levels of the neurotransmitter, dopamine. Your brain also uses pulses of dopamine to open the neuronal gate that allows new material into the field of attention. But when you're full of rapture and joy, any new surges of dopamine make little difference since their levels are *already* near their maximum. As a result, the gate of attention stays closed, and you remain focused on the breath. Happiness is truly skillful means!

Third, brain science can highlight which of the hundreds of traditional methods are likely to be most effective for individual needs. This helps intensify practice,

especially for householders who don't have the benefits of the all-surrounding environment and close guidance of monastic life.

Further, the great variety of brains and thus minds is a diversity issue itself, which underscores the value of the appropriate individualization of practice. For example, there is a wide range of temperaments, and for a person who's naturally spirited, understanding and normalizing the hungry-for-stimulation systems in his or her brain can lead to emphasizing certain forms of meditation in the development of steadiness of mind (e.g., tracking the breath as a whole rather than at just one spot), and to feeling more self-accepting.

Fourth, the developing brain/mind map can suggest new and effective methods to build upon established practices. For instance, some teachers are drawing on the research literature in attachment theory, empathic attunement, and mirror neurons to refine the methods of interpersonal mindfulness. (For more examples, please see our website, www.WiseBrain.org.)

Of course, any scientific enhancements of traditionally skillful means must be balanced by virtue and wisdom. Further, the ultimate fruit of practice, Nibbana, transcends all methods. Nonetheless, the Buddha taught that attaining Nibbana required a dedicated training of mind and heart – which means a transformation of brain and body. Even if the apple falls by grace, its ripening comes from water, sunlight, and fertile ground.

Cautions

The meeting between Buddhism and science brings many opportunities, but also some potential pitfalls, and understanding these could help you sift out the information that is personally useful:

- Getting neurologically reductionistic – While simplifications are sometimes clarifying, they need to be held in perspective. If you find yourself reading about the amygdala and fear, mirror neurons and empathy, oxytocin and lovingkindness, high-frequency brainwaves and meditative concentration, etc. . . . it's always more complicated than that.
- Glamorizing science – As the Buddha said, “See for yourself.” The ultimate test of practice is whether it *works* – and it has for millions of people for thousand of years. Buddhism does not need the endorsement of science to prove its validity.
- Over-generalizing from group data to individuals – In the press and even the scientific literature, you'll often find statements like these: “Men have enhanced visual-spatial abilities compared to women,” or: “Meditators react better to stress.” Yes, the average man could be slightly better at visual tasks than the average woman. But it's not correct to equate everybody in a group with its average, and then make categorical statements about all its members. Many women are more visually adept than many men . . . just like many meditators can get pretty stressed out!
- Over-valuing the physical – For example, genetic factors usually account for less than a third to a half of our personality, intelligence, happiness, satisfaction with relationships, lifetime earnings, or spiritual growth. The rest is due to the influences of our own self-direction and the ways we interact with our environments – which is very, very hopeful. And since the normal brain can hold both horrible and wonderful

thoughts, desires, etc., it's the *contents* of mind that usually count most, not the physical organ that enables them.

Further, appreciating the integration of mind and brain does not mean reducing mind *to* brain. To be unavoidably technical: mind is patterns of information represented by patterns of matter. Since much mental information can be represented by any suitable neural circuit – much like a picture can be represented by any available RAM on your computer – it is functionally independent of its physical substrate. Second, this independence enables thoughts (and other aspects of mind) to be the fundamental cause of other thoughts; the brain carries thoughts but it does not necessarily *cause* them. And third, mind can cause changes in matter through its representations in matter; for example, immaterial thoughts of gratitude are embodied in cascading physical processes which can trigger physical circuits that dampen the release of stress hormones.

- Under-estimating what the brain can do – The wonders of the mind do not necessarily require an extraordinary – call it mystical – basis in addition to the brain itself. For sure, it's reasonable to think that an extraordinary phenomenon requires an extraordinary explanation. For example, seeing the extraordinary differences between humans and other animals, many people concluded that we must have been created by an extraordinary God. But today, it's understood that humans evolved by ordinary causes – notably, DNA molecules and survival of the fittest – unfolding via zillions of organisms over several billion years. A *lot* of ordinary causes can produce an extraordinary result.

Similarly, when you take an ordinary synapse – basically, a simple on-off switch – but then multiply it by 500 trillion or so, usually firing many times a second, with tremendous inter-connectivity . . . well, you can get extraordinary results, like

understanding these sentences, or cultivating lovingkindness, or becoming aware of awareness itself. As the capabilities of the brain become even better understood over the next hundred years, we predict that most (if not all) of our experiences – the rich soil of the path of practice – will be revealed as entirely enabled by the physical brain, and not due in any way to extraordinary mystical factors.

For us, this view is not mechanistic or stifling. It makes us profoundly grateful for evolution's gift of the brain, sensitive to our own responsibilities to shape it over time, and inspired by its potential for extraordinary goodness, love, and realization.

Conclusion

The intertwining of mind and brain, information and matter, means that we need psychology to understand the brain . . . and neurology to understand the mind. And both are illuminated by centuries of practical experience in the world's contemplative traditions.

The intersection and integration of these three – psychology, neurology, and contemplation – is the heartwood of personal well-being and spiritual growth. The movement of Buddhism into the West has created an historically unprecedented opportunity for the dharma to inform science and *vice versa*, for the benefit of all beings.

BOX

Key Features and Functions of Your Brain

- It's shaped by evolution; the main genetic differences between humans and chimpanzees focus on the brain, particularly its social, emotional, linguistic, and conceptual abilities

- 3 pounds, 1.1 trillion cells, including 100 billion “gray matter” neurons
- Always “on” – 2% of the body’s weight uses about 25% of its oxygen
- Average neuron has about 1000 connections (synapses), 100 trillion in all
- Synapses firing 1 to 100 times a second
- Regions linked by brainwaves synchronized within a few milliseconds
- Extremely interconnected network full of circular loops
- Number of possible brain states: 1 followed by a million zeros
- An organ that learns from experiences through lifelong changes in its structure
- The most complex object known in the universe