

*Reshaping
the brain,
re-opening
to the world*

THE Neurobiology OF “We”

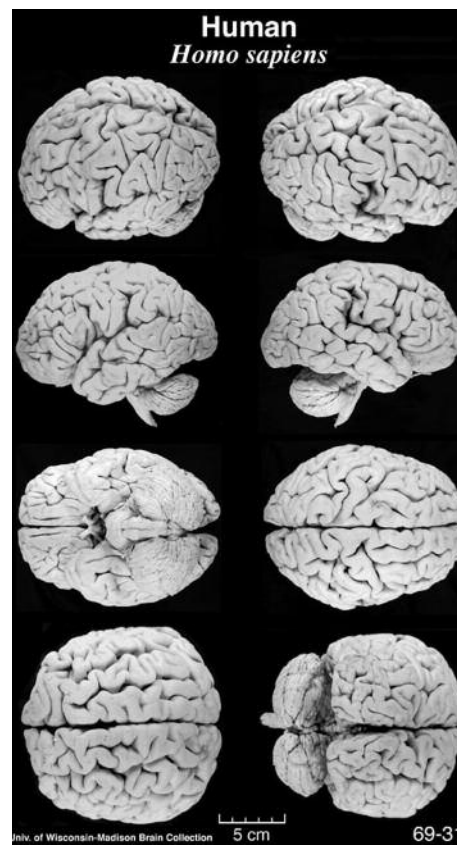
Patty de Llosa

Ramon y Cajal. Drawing
of a neuron, 1899

*The mind is its own place, and in itself
Can make a heaven of hell,
A hell of heaven.*

—John Milton, *PARADISE LOST*

DID YOU EVER WONDER, somewhat apprehensively, whether your true inner Command Center rests in the complex bio-mechanics of your brain or the vast reaches of your mind? It always seemed to me as inscrutable as asking which came first, the chicken or the egg. But the study of neuroplasticity is changing the way scientists think about the mind/brain connection. While they’ve known for years that the brain is the physical substrate for the mind, the central mystery of neuroscience is how the mind influences the physical structure of the brain. In the last few decades, thanks to PET and MRI imaging techniques, scientists can observe what’s actually going on in the brain while people sleep, work, make decisions, or attempt to function under limitations caused by illness, accident, or war.



The breakthrough in imaging techniques led Dr. Jeffrey Schwartz, now a research psychiatrist at the School of Medicine at the University of California at Los Angeles and author of *THE MIND & THE BRAIN*, to wonder two decades ago, “What kind of internal experience is generated by the neuronal activity captured on a brain scan? Even more important, how can we use scientific discoveries linking inner experience with brain function to effect constructive changes in everyday life?”¹ A student of Buddhist meditation, he developed a form of therapy to change the faulty chemistry of a well-identified brain circuit: that of the patient with Obsessive Compulsive Disorder. (OCD is a prime example of pathological brain processes in which

negative thoughts can be traced on an MRI). He told his patients: “The feeling of doubt ... is a false message, due to a jammed transmission in the brain.”² They learned to change the way they thought about their thoughts through regular refocusing, which engaged them in intentional rather than automatic behavior, activating a different brain circuitry. Not only did he introduce a new treatment for mental illness, he also provided hard evidence that the mind can control the brain’s chemistry as he demonstrated how refocusing literally reprograms the brain, and mindfulness gives people more control over their lives.

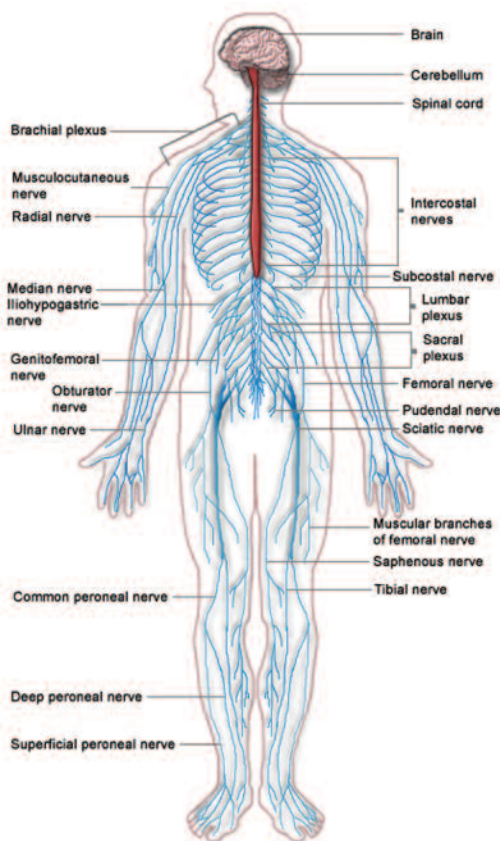
On another front, the millennial inner science of meditation became the focus of experiments by Dr. Richard Davidson, a pioneer in contemplative neuroscience at the University of Wisconsin at Madison. With the cooperation of the Dalai Lama, he made MRIs of Tibetan monks in such meditative states as visualization, one-pointed concentration, and the generation of compassion. According to Davidson, “the brain can be transformed through engagement with purely mental practices derived from the world’s great religious traditions.... The brain, more than any other organ in our body, is the organ built to change in response to experience.”³

When the Dalai Lama was asked what greater benefit he hoped for from this line of research, His Holiness replied: “Through training the mind, people can become more calm—especially those who suffer from too many ups and downs. That’s the conclusion from these studies of Buddhist mind training. And that’s my main end: I’m not thinking how to further Buddhism, but how the Buddhist tradition can make some con-

tribution to the benefit of society. Of course, as Buddhists, we always pray for all sentient beings. But we're only human beings; the main thing you can do is train your own mind."⁴

RELATIONSHIPS CHANGE THE BRAIN

I ASKED DR. DANIEL SIEGEL, founder of the emerging field of interpersonal neurobiology: How does the brain change as we influence each other? He has spent more than twenty years investigating the profound influence on us of those around us, or what he calls "the neurobiology of 'we.'"⁵ Siegel is Clinical Professor of Psychiatry at the UCLA School of Medicine, co-director of the Mindful Awareness Research Center, and



The human nervous system

director of the Mindsight Institute. He's convinced that the "we" connection is a little-understood, but powerful means for individual and societal transformation that should be taught in schools and churches, and even enter into politics.

"Interpersonal neurobiology isn't a form of therapy," he told me, "but a form of integrating a range of scientific research into a picture of the nature of human reality. It's a phrase I invented to account for the human effort to understand truth. We can define the mind. We can define mental health. We can base everything on science, but I want to base it on *all* the sciences. We're looking for what we call 'consilience.' If you think of the neuroscientist as a blind man looking at only one part of an elephant, we are trying to discover the 'whole-elephant' view of reality."⁶

In a tele-class on Clinical Applications of Interpersonal Neurobiology, he explained that "For a person to change, the mind must change." He added that "we now know 'mind' is coming both from interpersonal processes and from brain structure or neurobiology. The brain is the social organ of the body, where one hundred billion neurons reach out to other neurons. The release of neurotransmitters will excite or inhibit, fire or not fire. It's the firing patterns that lead, in part, to the experience of mind."⁷

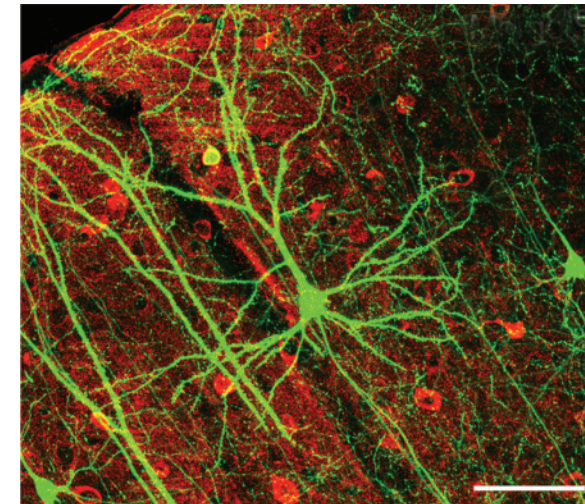
Here's an example he gave of how neural firing leads to mental experience and how mental experience creates neural firing. When someone says the words, "Eiffel Tower," you have an immediate visual experience because when you hear the word, an electrical current running through the acoustic nerve fires, sending a message to the left brain, where it is decoded. A visual image is then created

in other parts of the brain.⁸ As Siegel further explained at a recent conference, "the neural representation of the Eiffel Tower, or what's called its *neural net profile*, is created by experience as the mind links past, present, and anticipation of the future. No one on the planet knows how a neural firing turns into a mental image but we know where it happens and that it somehow leads to a subjective mental process. The mind emerges at the interface of neurobiology and the interpersonal transactions of experience between minds."⁹

The good news is that while our earliest interpersonal experiences may have created detrimental repetitive patterns, new patterns are formed all through our life span. We can liberate ourselves from those old patterns through new neural connections. And Siegel believes interpersonal relationships are key to new forms of mental flow that shape the focus of our attention and what we envision. "Since the mental processes of attention and imagination change the firing in the brain, the brain can be changed by the mind."¹⁰

Siegel is convinced that the development of attention through meditative exercises is a crucial aspect of inner balance. He recommends it to his patients, telling them mindfulness helps people regulate their internal states, including their immune system, their emotions, their attention, and even their interpersonal interactions. "Now, for me," he adds, "that's not a surprise. Because mindfulness promotes the growth of integrative fibers in the brain, which are what's needed for regulation across all these domains. Integration is the fundamental mechanism of self-regulation."¹¹

I asked him how meditation could help a soldier returning from Iraq deal with traumatic experiences. Wouldn't a



Neuron, 2005

deeply troubled or traumatized person who tries to sit in meditation feel more pain, even with an effort at "I am here"? He said, "With mindfulness you're not trying to get beyond the pain. It's just the opposite. You're trying to deeply accept the pain. So the resistance when you try to get 'beyond' the pain is actually creating more suffering. If pain is there, your job is to accept it, and the relief from the desire and drive and urgency to get rid of it actually powerfully reduces the suffering, even though the pain remains."¹²

"WE IS WHAT ME IS!"

OUR NERVOUS SYSTEM has two basic modes: it fires up or quiets down. When we're in a reactive state, our brainstem signals the need for fight or flight. This means we're unable to open ourselves to another person, and even neutral comments may be taken as fighting words. On the other hand, an attitude of receptivity activates a different branch of the brainstem as it sends messages to relax the muscles of the face and vocal chords,

and normalizes blood pressure and heart rate. “A receptive state turns on the social engagement system that connects us to others,” Siegel explains in his recent book, *MINDSIGHT*. “Receptivity is our experience of being safe and seen; reactivity is our fight-flight-freeze survival reflex.”¹³

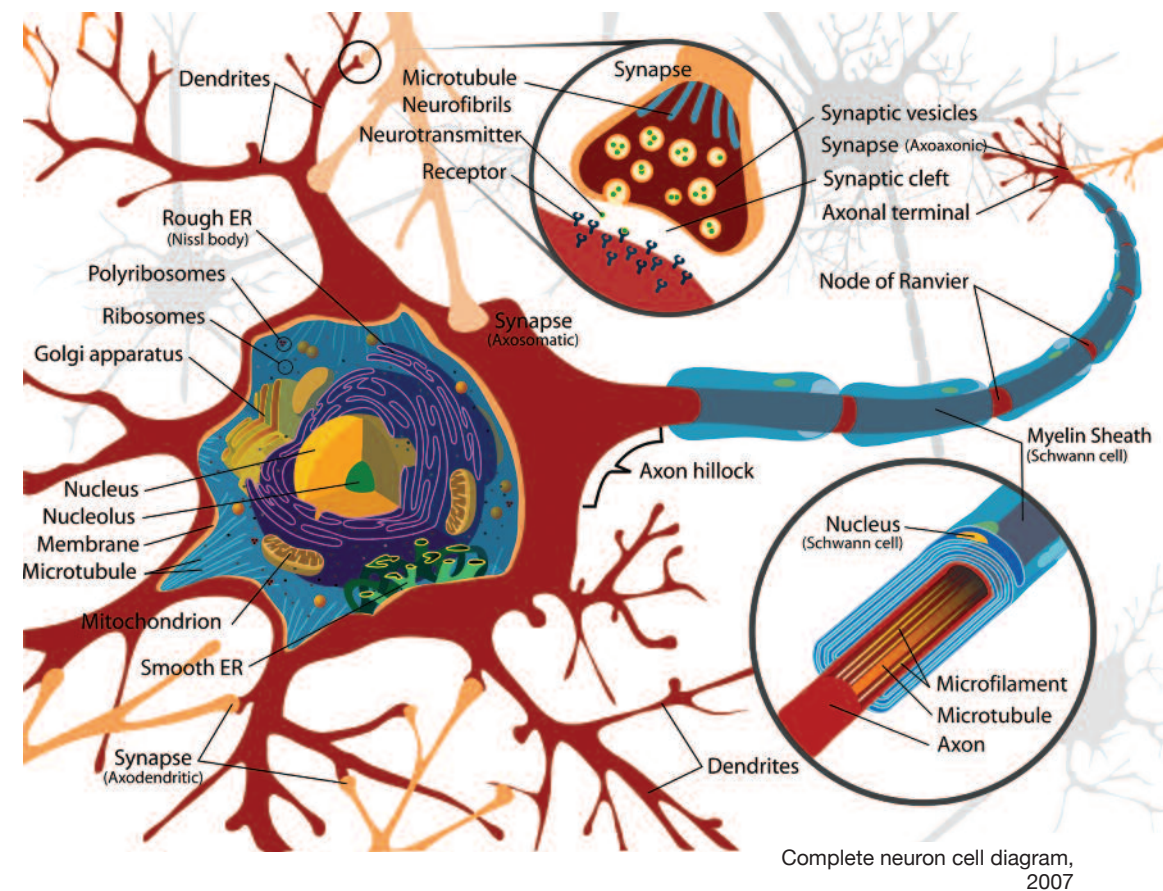
He describes the brain as part of “an embodied nervous system, a physical mechanism through which both energy and information flow to influence relationship and the mind.” He defines relationship as “the flow of energy and information between people.” Mind is “an embodied and relational process that regulates the flow of energy and information, consciousness included. Mind is shared between people. It isn’t something you own; we are profoundly interconnected. We need to make maps of *we* because *we* is what *me* is!”¹⁴

Although some neuroscientists insist the mind is just the output of the brain, Siegel points out that in the world of mental health, neither mind nor health have been adequately defined: “‘Mental health’ for many only means you don’t have any of the symptoms listed in the DSM IV [*THE DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS*], so you must be healthy!” he says. “We now know that integration leads to health and harmony. We can re-envision the DSM symptoms as examples of syndromes filled with chaos and rigidity, conditions created when integration is impaired. So we can define mental health as the ability to monitor ourselves and modify our states so that we integrate our lives. Then things that appeared unchangeable can actually be changed.”¹⁵

Integration, the vital connection with all our parts that leads to balance, is composed of both differentiation and linkage,

he says, and the absence of either impairs it: “Relationships, mind and brain aren’t different domains of reality—they are each about energy and information flow. The mechanism is the brain; subjective impressions and consciousness are mind. The regulation of energy and information flow is a function of mind as an emergent process emanating from both relationships and brain. Relationships are the way we share this flow. In this view, the emergent process we are calling “mind” is located in the body (nervous system) and in our relationships. Interpersonal relationships that are attuned promote the growth of integrative fibers in the brain. It is these regulatory fibers that enable the embodied brain to function well and for the mind to have a deep sense of coherence and well-being. Such a state also creates the possibility of a sense of being connected to a larger world. The natural outcome of integration is compassion, kindness, and resilience.”¹⁶

If mind is what flows through the mechanism of the brain, does that make neuroplasticity a process or a fact? “It’s a fact of a process,” he told me. “Process is a verb not a noun. It’s not a hypothesis, it’s a fact of science, a real entity, but a process—something moving, happening, and dynamic. Take running. It’s a noun but it’s about a moving process.”¹⁷ He touched on the same subject at the conference: “Everything we experience, memory or emotion or thought, is part of a *process*, not a place in the brain! Energy is the capacity to do stuff. There’s nothing that’s not energy, even ‘mass.’ Remember $E=MC$ squared? Information is literally a swirl of energy in a certain pattern that has a symbolic meaning; it stands for something other than itself. Information should be a verb; mind, too—as in *mind*ing or *inform*ationing.



Complete neuron cell diagram, 2007

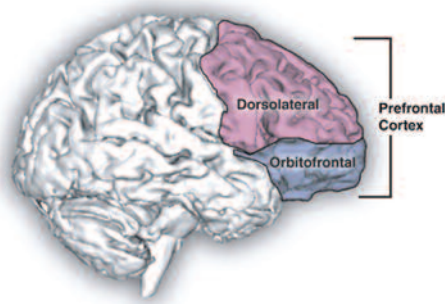
And the mind is an embodied and relational emergent process that regulates the flow of energy and information.”¹⁸

“WE CAN BE BOTH AN ‘I’ AND PART OF AN ‘US’ ”

ONE OF THE MOST EXCITING new discoveries in neuroscience is the system of mirror neurons, which help us connect with each other. Siegel, who has a talent for explaining the complex workings of the brain and nervous system, tells about them in simple terms for the uninitiated: “Certain neurons can fire when someone communicates with you. They dissolve the border between you and others. These mirror neurons are a hardwired system designed for us to see the mind-state of another person. That means we can learn easily to dance, but also to empathize with another. They automati-

cally and spontaneously pick up information about the intentions and feelings of those around us, creating emotional resonance and behavioral imitation as they connect our internal state with those around us, even without the participation of our conscious mind.”¹⁹ And in *MINDSIGHT*: “Mirror neurons are the antennae that pick up information about the intentions and feelings of others.... Right hemisphere signals (are those) the mirror neuron system uses to simulate the other within ourselves and to construct a neural map of our interdependent sense of a ‘self.’ It’s how we can be both an ‘I’ and part of an ‘us.’”²⁰

So how can we re-shape our brain to become more open and receptive to others? We already know the brain receives input from the senses and gives it meaning, he points out. That’s how blind people find ways to take in information and



map out their world. According to Siegel, they do this on secondary pathways rather than the main highways of the brain. That's a major key to how we can bring about change: "You can take an adult brain in whatever state it's in and change a person's life by creating new pathways," he affirms. "Since the cortex is extremely adaptable and many parts of the brain are plastic, we can unmask dormant pathways we don't much use and develop them. A neural stem cell is a blob, an undifferentiated cell in the brain that divides into two every twenty-four hours. In eight-ten weeks, it will become established as a specialized neural cell and exist as a part of an interconnected network. How we learn has everything to do with linking wide areas of the brain with each other."²¹

He calls the *prefrontal cortex* "the portal through which interpersonal relations are established." He demonstrates, by closing his hand over his thumb, how this little tiny piece of us (the last joint of the two middle fingers) is especially important because it touches all three major parts of our brain: the cortex, limbic area, and brainstem as well as the body-proper. "It's the middle prefrontal fibers which map out the internal states of others," he adds. "And they do this not only within one brain, mine, but also between two brains, mine and yours, and

even among many brains. The brain is exquisitely social, and emotions are its fundamental language. Through them we become integrated and develop an emergent resonance with the internal state of the other."²²

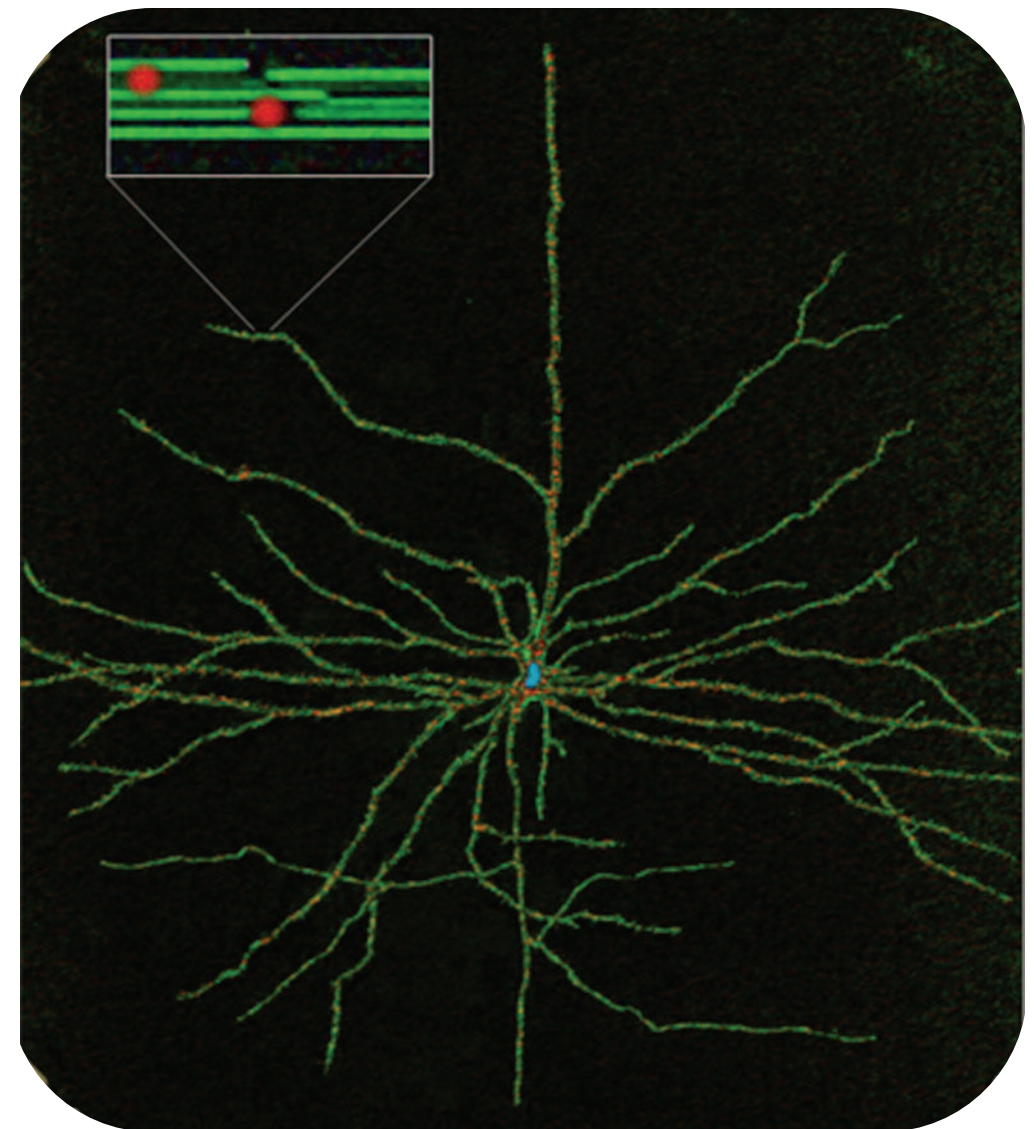
In Siegel's recent books, *MINDSIGHT* and *THE MINDFUL THERAPIST*, he emphasizes the regulatory role of the mind, which can both monitor and modify what's happening. Step by step he explains how the lens of the mind can be trained to see the mind in oneself and others. "Relationship is key," he emphasizes. "When we work with relationship, we work with brain structure. Relationship stimulates us and is essential in our development. People rarely mention relationship in brain studies, but it provides vital input to the brain. Every form of psychotherapy that works, works because it creates healthier brain function and structure.... In approaching our lives, we can ask where do we experience the chaos or rigidity that reveal where integration is impaired. We can then use the focus of our attention to integrate both our brain and our relationships. Ultimately we can learn to be open in an authentic way to others, and to ourselves. The outcome of such an integrative presence is not only a sense of deep well-being and compassion for ourselves and others, but also an opening of the doors of awareness to a sense of the interdependence of everything. 'We' are indeed a part of an interconnected whole."²³ ||

¹ Jeffrey M. Schwartz (with Sharon Begley), *THE MIND AND THE BRAIN* (New York: HarperCollins, 2002), p. 9.

² *Ibid.*, 80.

³ Davidson, Richard. 2009. "Transform Your Mind, Change Your Brain." *Google Personal Growth Series*. <http://www.youtube.com/watch?v=7tRdDqXgsJ0&NR=1>.

⁴ Goleman, Daniel. 2003. "The Lama in the Lab." *SHAMBHALA SUN* (March).



Neuron. Green: microtubules; blue: DNA; red: motors and microtubule associated proteins. Image captured a century after creation of neuron drawing on page 68

⁵ Daniel Siegel, *MINDSIGHT* (New York: Bantam, 2010), p. 210.

⁶ Daniel Siegel, interview by P. de Llosa, September 2010.

⁷ Daniel Siegel, "Clinical Applications of Interpersonal Neurobiology." Six-hour CD course, November 2003.

⁸ *Ibid.*

⁹ Daniel Siegel, "The Mind that Changes the Brain," Two-day conference, New York, July 2010.

¹⁰ *Ibid.*

¹¹ *MINDSIGHT*, p. 215.

¹² *MINDSIGHT*, p. 224.

¹³ Daniel Siegel, *THE MINDFUL THERAPIST* (New York: W.W. Norton, 2010). For more information, see www.drdsiegel.com.

¹⁴ Siegel, "Mind that Changes."

¹⁵ *Ibid.*

¹⁶ *Ibid.*

¹⁷ Siegel, de Llosa interview.

¹⁸ "Mind that Changes."

¹⁹ Siegel, "Clinical Applications."

²⁰ *MINDSIGHT*, p. 224.

²¹ "Mind that Changes."

²² *Ibid.*

²³ "Mind that Changes."