

Need #4

Brain Development, Coherence Balancing and Inflammation Regulation

“The idea that the brain can change (heal) its own structure and function through thought and activity is, I believe, the most important discovery of the brain since we sketched out its basic anatomy and the workings of its basic components, the neuron.”

Norman Doidge
The Brain That Changes Itself

*“In his book *The Mindful Brain*, Siegel has both a meticulous understanding of the roles of different parts of the brain and an intimate relationship with mindfulness”.*

Scientific American Mind

Introduction

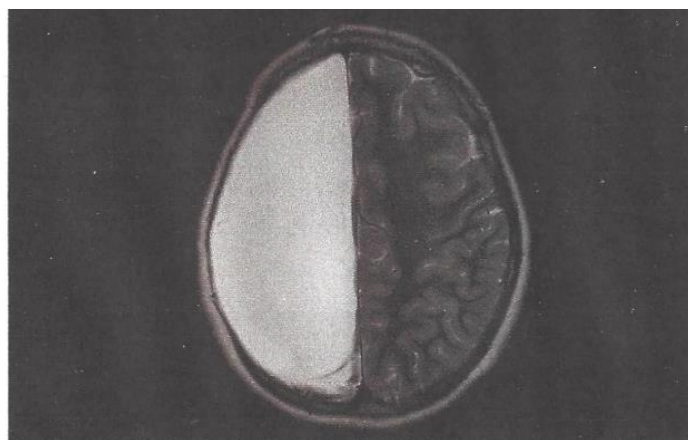
Need #4 offers numerous ways to enhance brain functioning including empathy, cognition and emotional self-regulation. All strategies are proven to be effective by the best research science has to offer at present.

This said, many will start reading this section with a heavy amount of skepticism that the brain of PwDD can develop beyond behaviour compliance and conforming to directives.

We therefore decided to start this Need with the true story of Cameron Mott as published by David Eagleman, Neuroscientist, in his book *The Brain* (pages 162-163).

At the age of four, she began to have violent seizures. The seizures were aggressive: Cameron would suddenly drop to the floor, requiring her to wear a helmet all the time. She was quickly diagnosed with a rare and debilitating disease call Rasmussen’s Encephalitis. Her neurologist knew that this form of epilepsy would lead to paralysis and eventually to death – and so they proposed a drastic surgery. In 2007, in an operation that took almost twelve hours, a team of neurosurgeons removed an entire half of Cameron’s brain.

In this scan of Cameron’s brain, the blank space is where half of her brain has been removed.



What would be the long-term effects of removing half her brain? As it turns out, the consequences were surprisingly slight. Cameron is weak on one side of her body, but otherwise she's essentially indistinguishable from other children in her class. She has no problems, understanding language, music, math, stories. She's good in school and she participates in sports.

How could this be possible? It's not that one half of Cameron's brain was simply not needed; instead, the remaining half of Cameron's brain dynamically rewired to take over the missing functions, essentially cramming all the operations into half the brain space. Cameron's recovery and thousands of other examples identified in the references underscores a remarkable ability of the brain: it rewires itself to adjust to the inputs, outputs, and tasks at hand.

CCS invests significant time and energy to train supporters to learn how to become more mindful. The reason for this is two fold.

Neuroscience over 20 years ago confirmed beyond any doubt that each human has a part of their brain that is responsible for activation of mirror neurons. Mirror neurons are the most prevalent of all brain cells that are responsible for empathy. Empathy, in great part governs our emotional self-regulation.

Neuro studies (e.g. Siegel, 2007, Brefczynski–Lewis 2006, Lazor 2006, Short 2006) independently found that areas of the brain connected to mirror neuron activation could be fired and wired (i.e. developed) by Mindful Awareness.

These areas are mainly the insula, superior temporal and medial pre frontal cortex (MPFC). This system forms the interconnected “resonance circuitry”. Each time we become mindful, we fire-up these regions and what fires, wires (i.e. grows new neuron cells i.e. neurogenesis) (reference Seigel, D., *The Mindful Brain* pages 165-190).

For this reason, CCS invests heavily in mindfulness training to enhance the development of emotional self-regulation in supporters who in turn will then be competent and committed to teach mindful awareness to PwDD to enhance their emotional self-regulation.

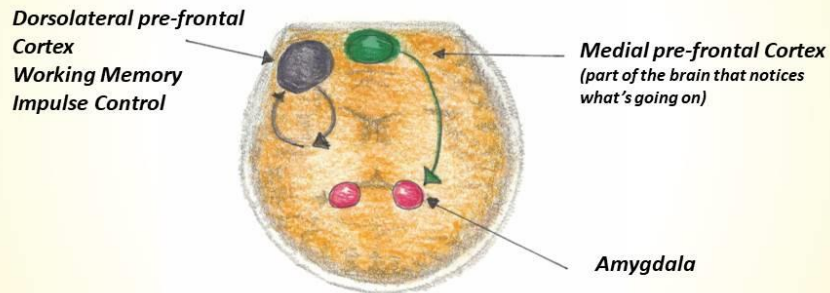
While studies show that the brain of PwDD can be operative in this region, (i.e. MPFC) it has been found that it is not as readily activated as neurotypical brains. Improving this region's functioning using various strategies is the purpose of this section on Brain Development, and Coherence. (reference News Medical Life Sciences Jan 2015, *Improving the prefrontal cortex activity could help autistic people regulate emotions*, UNC School of Medicine, published in the *Journal of Autism Developmental Disorders*, Gabriel Dichter, PhD, associate professor of psychiatry and psychology).

The following drawing shows the location of the MPFC and describes its nine basic functions.

B-FIT Mindfulness to be Emotionally Self-Regulated

Mindful Emotional Self-Regulation

The main way we can consciously access the emotional brain is through self-awareness*, i.e. becoming mindful. Mindfulness increases connections in the medial pre-frontal cortex. This reduces anxiety for the Supporter and the Individual Supported.



(*Research reference: J. LeDoux, "Emotion Circuits in the Brain", Journal of Neuroscience 33, no. 9 (2013) 3815-23)

According to Dr. Daniel Siegel in *The Mindful Brain* (2007, pages. 42-43) the following brain, body and being functions correlate with the activity of areas within the medial prefrontal cortex:

- **Body regulation:** the emotional brakes and accelerator functions;
- **Attuned communication** involves the coordination of the input from another person with the activity of one's own (as with mirror neurons);
- **Emotional balance:** to have enough activation so that life has meaning and vitality but not so much that life becomes chaotic;
- **Response flexibility:** the capacity to pause before action;
- **Empathy:** knowing what might be going on inside someone else;
- **Insight or self-knowing:** awareness to be able to link the past, present and future;
- **Fear modulation** that may be carried out by the release of the inhibitory neurotransmitter GABA;
- **Intuition:** a neural mechanism by which we process deep ways of knowing via our body, i.e. somatic intelligence;
- **Morality:** taking into consideration the larger picture, to image what is best for the whole not just one's self, even when alone.

The illustration above describes some of how mindfulness regulates one important part of the brain for all of us. The medial prefrontal cortex (MPFC)—in green—is not naturally activated sufficiently in most PwDD. This compromises the individual's ability to self-regulate. Mindfulness significantly helps them improve activation.

Much research has been done with respect to this under-active MPFC part of the brain. Detailed understanding of the complex wiring and firing of both the neurotypical brain and the autistic brain began approximately twenty years ago with the use of functional MRI. This technology is not perfected, but many findings to date have proved reliable and useful. The above drawing of key parts of the brain is based on MRI evidence and shows links between the MPFC and the amygdala, the two-times-per-second watchdog to the emotional brain regions.

If there is an under-active MPFC, anxiety often results. An under-active MPFC means in part that the calming of the amygdala that neurotypical people enjoy as a result of a more active MPFC is not experienced in the same way by PwDD. When increased activation of the MPFC is needed to achieve more effective functioning of the brain, researchers have demonstrated that mindfulness exercises can be beneficial. As discussed throughout Part TWO, mindfulness consists of paying non-judgmental attention to:

- what one is doing or saying at the time;
- awareness that one is “here now” and paying attention;
- how one’s body, thinking and feeling senses are reacting to life experiences.

Increasing activation of the MPFC is strongly influenced by exercises that develop these elements of self-awareness. One part of what mindfulness practices do is to decrease amygdala sensitivity and therefore limit the firing of brain regions linked to fight, flight and freeze responses. In other words they encourage calm. The heartening discovery is that the vast majority of PwDD can be taught to do mindful movement and other exercises which activate the MPFC, calm the individual and make self-regulation possible.

Consider a practical example of a mindfulness activity and its relation to emotional self-regulation. At Community Living Cambridge, a large organization in Ontario, Canada, eighty to ninety PwDD have been gathering for several years Monday to Friday mornings for thirty minutes of group mindful-movement exercises. They are lead by Jonathon Turnbull and other CCS graduate students. With mindfulness exercises, these participants are learning self-regulation skills through this non-cognitive and non-behavioural experience of emotional self-awareness. This training not only teaches calming skills that can be used at times of stress, but it also develops capacity to eliminate resistance and stress.

Mindfulness to Develop Social, Empathic & Emotional Self-Regulation Skills

If you were looking at someone right now and they put their arm back as if to throw something, several interesting things would be happening in their brain. But maybe even more interesting is what would be happening in your brain.

In their brain at this moment millions of very specific neurons fire (i.e. mirror neurons) that are associated with that movement and neurons that are anticipating their next move (i.e. to throw) also fire.

In your brain, the identical firings are also taking place. It seems that to help our ancestors to survive long ago it was very helpful to know what other folks were up to by observing their actions—whether they were friend or foe.

Mirror neurons actually enable us to perceive and understand other people’s emotions. For example, when you see someone start to cry, neurons are activated in you whereby you automatically start to empathize and have concern for the other person. “Because our survival depends on understanding the actions, intentions and emotions of others, we simulate those automatically without logic, thinking or analyzing,” say Sandra and Matthew Blakeslee in their well-researched publication *The Body Has a Mind of Its Own*. It seems, however, for most (not all) of our brothers and sisters with ASD/DD, their mirror neuron functions are compromised because they have not been sufficiently activated through appropriate exercises.

Autism Links to Mirror Neuron Dysfunction

The Blakeslees go on to say,

“According to numerous studies [see Recommended Reading list below] most individuals with Autism when studied with EEG brain tracking show that their mirror neurons respond mainly to what they do and not to what others do. Researchers go further to say that mirror neurons are not only involved in the execution and observation of movement, but also in higher cognitive processes like language or being able to imitate and learn from others’ actions and decode their intentions and empathize with their pain.”

These are keys to socialization and interpersonal communications which are typically compromised with most PwDD. As research is also showing however, mirror neuron activation and its related benefits can be learned by PwDD.

Mirror Neuron Development/Activation Skills Enhancement and Therapies (e.g. mindfulness, bio and neurofeedback)

Dr. Daniel J. Siegel is a professor of clinical psychiatry at the UCLA School of Medicine, the Executive Director of the Mindsight Institute, and the author of *The Mindful Brain*. Siegel (2006) states the following about mindfulness and neural firing:

“The basic steps linking consciousness with neural plasticity are as follows: **Where attention goes, neural firing occurs. And where neurons fire, new connections can be made.** In this manner, learning a new way to pay attention within the integration of consciousness enables an open receptive mind.”

And that, at its core, is what mindfulness-based self-awareness is all about: learning a new way of paying attention to everything going on within you and without you, while concurrently cultivating empathy and insight regarding self and others – which are skill functions of the mirror neuron system.