

## *Quotes that link the mind and the body*

*“The sum total of your numerous flexible, morphable body maps gives rise to the solid feeling subjective sense of me-ness and to your ability to comprehend and navigate the world around you. You can think of the maps as a mandala whose overall pattern creates your embodied feeling self. All your other mental faculties- vision, hearing, language and memory are supported in the matrix of this body mandala like organs on a skeleton. Developmentally speaking, it would be impossible to become a thinking self-aware person without them.”*  
*Sandra And Matthew Blakeslee*

*“The developmental achievement of a sense of self that is simultaneously fluid and robust depends on... a stable foundation for relational affect regulation that is internalized as nonverbal and unconscious”* Philip Bromberg, *Awakening the Dreamer*

*“The sixth sense represents a functional awareness, with both conscious and unconscious dimensions, of what is happening inside the body.”* Stephen Porges

*“The ego is first and foremost a bodily ego... (it) is ultimately derived from bodily sensations chiefly those springing from the surface of the body.”* Freud

*“Before we can find words, we must perceive experiences that give substance to our words”*  
*Arthur Robbins*

*“We find either that individuals live creatively and feel that life is worth living or else that they cannot live creatively and are doubtful about the value of living”* Winnecott

*“What we do in psychotherapy is to constantly work at deep levels with the body, with emotions, and with many different elements of memory, to help people make sense of their inner worlds and their interpersonal lives. Such a making sense process may depend of various levels of neural integration”* Daniel Siegel

*“Thus we might refer to the whole system as a psychosomatic information network, linking psyche, which comprises all that is of ostensibly nonmaterial nature such as mind emotion, and soul, to soma, which is the material world of molecules, cells, and organs. Mind and body, psyche and soma...”*

*Your brain is extremely well integrated with the rest of your body at a molecular level, so much so that the term mobile brain is an apt description of the psychosomatic network through which intelligent information travels from one system to another. Every one of the zones, or systems of the network- the neural, the hormonal, the gastrointestinal, and the immune is set up to communicate with one another, via peptides and messenger specific peptide receptors. Every second, a massive information exchange is occurring in your body. Imagine each of these messenger systems possessing a specific tone, humming a signature tune, rising and falling, waxing and waning, binding and unbinding, and if we could hear this body music with our ears, then the sum of these sound would be the music that we call the emotions.”* Candace Pert

*“In the beginning, the word, the body, affect, relational connection- these are all indistinguishable components of a unified experience”* Stephen Mitchell

## **Embodied Neurobiology Notes**

The brain is a part of the body; a deeply complex organ that orchestrates our interactions with the world around us. It is responsible for taking in massive amounts of simultaneous sensory information, sorting out and interpreting what we are experiencing based on past associations, and then coordinating our response. This dynamic interchange is communicated and experienced through the body.

Brain cells include:

1) Glial cells, Astrocytes and Oligodendrocytes, which are vital to the normal functioning of the nervous system.

Astrocytes support and guide neurons during development, facilitate chemical interactions involved in neural activity, and remove neuroactive and neurotoxic substances from the extracellular environment,  
Oligodendrocytes myelinate the axons of neurons in the CNS.

2) Neurons are polarized cells with dendrites, specialized for receiving information, and axons, specialized for sending information – the junction between two neurons is called the synapse. The unique shaping of the axons of a neuron as a group is referred to as its arbor. Each of the 100 billion or so neurons in the brain can make thousands of synapses, and there are about 100 trillion synapses in the adult human brain!

### **Arousal and Rest**

1. Throughout life, the brain balances activation and rest, stimulation and integration through the biodynamics of the body. The sympathetic and parasympathetic branches of the autonomic nervous system help to organize this balance.

2. The foundation for this balance is located in the caudal base (hind part) of the brain, and includes the reticular activating system, the cranial nerves, the medulla, the pons and the cerebellum. These structures regulate motor, sensory, and emotional states, through coordination of arousal levels, balance of neurotransmitters, and focus of attention.

3. Their neural interconnections penetrate all parts of the brain, and they are linked to biochemical processes throughout the body such as hormone levels, peptides, and the immune system.

Picture an infant who is younger than four months and the contact that they get through the spine and the back of the skull as they are held. The rhythm and quality of this contact—whether it is attuned or disconnected to their needs, tender or rough, feels safe or unsafe, impacts the relative activation of the sympathetic/parasympathetic pathways (vagal functioning) and the functioning of the reticular activating system, the cerebellum, and the medulla.

## **Somatosensory Processing and Memory**

1. Many brain structures are involved in the processing of somatosensory information and its translation into our experience of emotion.

2. As sensory information from the outside world is received it travels first to the thalamus and then to the specific sensory association areas of the brain. In kinesthetic sensing, this area is called the parietal lobe or somatosensory cortex.

3. The somatosensory cortex receives neuronal input from each part of the body in proportion to the number of nerve endings in that area, making an internal body map in the brain.

4. This region works closely with the limbic system, including the hippocampus and the amygdala to imbue the sensory perceptions with affective or emotional value.

5. Finally, the limbic system then interfaces with cortical process areas and marks certain information as particularly relevant. Thus, emotional processing is first linked to the body's response to the environment and then continues as a complex system which influences cortical processing by imbuing experience with meaning.

## **Memory**

Memory is necessary for self-cohesion; it functions as a dynamic process of holding who we are and organizes what we can expect as we encounter new experiences. Memory keeps us oriented in the ongoing process of change that life always encompasses.

We have multiple ways of storing and retrieving memory, which are localized in different areas in the brain (Siegel 2003, Hart 2008). These can be grouped into two overlapping categories, implicit and explicit, and the boundary between them fluctuates.

Implicit memory emerges prenatally, predominates in infancy, and colors our perception of experience throughout life. The primary part of the brain involved in its storage is the amygdala.

The body, as the initial agent of experience, experiences an event through sensory processing; it is heard, seen, and/or felt.

Experiences with strong emotional charge are relayed to the directly from the thalamus, involved in sensory processing, to the amygdala in a process that is preconscious. The amygdala bypasses cortical processing and does not require verbalization for storage. The amygdala works with the right hippocampus to store our earliest preverbal experiences without our being conscious of them. The right hippocampus seems to be more linked into "right brained" ways of perceiving experience and processing information--body based, emotionally engaged, and symbolic (Schoore, 2003). It informs our perception of events in a way that is not literally language; yet it is felt and sensed and underlies all of our experience.

## Explicit Memory and Language

A second step is required in the consolidation of experience into explicit or autobiographical memory. Explicit memory is understood in neuroscience as the type of memory that we can consciously recall and narrate about ourselves.

Developmentally, autobiographical or procedural memory begins with the capacity for speech. Imagine a preschooler talking to a parent about the events of the day. As he describes what he has experienced and discusses it with a parent, it is encoded in the brain as “something that happened to me.” As experiences are discharged emotionally and then verbally processed, they are stored in the hippocampus. This happens in the context of relationship; we narrate our experience only in the presence of others who are paying attention. If we are interrupted or shamed, this encoding process is disrupted.

## Motion/Emotion The Biology of Affect

1. Affective neurobiologists refer to emotions as physiologically based and view feelings as the mind’s subjective interpretation of these somatic cues. Emotions involve the mind and body’s processing of its responses to the environment, to both people and situations.

2. Our perception of experience is colored by emotion, yet the impact of the body on our experience of emotion is not (often) consciously registered in the moment.

3. Movement engages physiological processes and makes them potentially more available to the conscious mind. At the same time, these physiological processes are themselves engaged and impacted through the movement itself.

4. As conscious interrelationship between the mind and the body is developed, the body naturally becomes a powerful, conscious resource for emotional self-regulation and integration.

5. Candace Pert, *Molecules of Emotions*, p.189.

Your brain is extremely well integrated with the rest of your body at a molecular level, so much so that the term mobile brain is an apt description of the psychosomatic network through which intelligent information travels from one system to another. Every one of the zones, or systems of the network- the neural, the hormonal, the gastrointestinal, and the immune is set up to communicate with one another via peptides and messenger specific peptide receptors. Every second a massive information exchange is occurring in your body. Imagine each of these messenger systems possessing a specific tone, humming a signature tune, rising and falling, waxing and waning, binding and unbinding, and if we could hear this body music with our ears, then the sum of these sounds would be the music that we call the emotions.

6. Biochemical regulation of emotions involves the synapse activation and potentiality for firing and uptake which is influenced chemically through:

a. Neurotransmitters, including Amino Acids, Glutamate (primary activation), Gaba (primary inhibition), Acetylcholine, Monoamines, Serotonin, Noradrenalin, Dopamine, Adrenalin

b. Peptides- Opioids (betaendorphins and enkephalines, CRF (acts as a hormone in connection with stress activation

c. Hormones- Oxytocin, Vasopressin, Oestrogen, Testosterone, ACTH CRF, Cortisol

7. It is the dance between activation and inhibition, and the rhythm of uptake and connectivity which impact our subjective experience of emotion, motivation, meaning, and arousal.

8. Emotions link with Memory, Perception, and Behavior together make up a “State of Mind”.

## **Mirror Neurons and Attachment**

1. Our mind’s capacity to sense and respond to each other within a context of congruent communication is an essential part of being human. We are constantly adjusting our responses to others based on our sense of what is happening in the minds of those with whom we are in relationship. This capacity for empathy and developing “a theory of mind” provides the foundation for attachment and interrelationship throughout life. Developmental and attachment psychologists have pioneered these dimensions of understanding human experience, and recent advances in neuroscience help us to understand more about their neurophysiological underpinnings.

2. The work of a group of Italian researchers including Giacomo Rizzolatti, Marco Iacobini, Vittorio Gallese, and others is essential in understanding the intersubjective nature of the mind. This capacity is rooted in the mirror neuron system of the brain, so called because mirror neurons are found in many areas of the brain which that work together. Mirror neurons are found in the posterior frontal and rostral inferior parietal areas, as well as in the amygdala, the insula, and the prefrontal cortex.

3. The workings of mirror neurons were first discovered when a monkey whose brain was wired for an experiment in the research lab was watching a person grasping an object to eat, and the monkey’s brain fired off the exact pattern of neurons as if he had been the initiator of the action. With further research, it was discovered that the brain activity was also engaged in tracking the intention of the action, as neuronal firing varied depending on the context (Iacobini, et al., 2005).

4. The mirror neuron system coordinates perception of nonverbal communication through tracking movement and expression in others, replicating the patterns of activation in the brain of the observer. Mirror neurons provide an inner simulation of the observed facial expression or action. They send signals throughout the insula to the limbic system, which integrates information about the feeling of the observed emotion. This allows one to observe the actions of another and to track and infer the intention of another’s communications.

5. Mirror neurons may provide the neurophysiological foundation for empathy, love, and human interaction. Mirror neurons are experience-dependent, and early relationships with caregivers shape and support this developing system.. The experience of being mirrored stimulates the neurological development of the baby’s own mirror neuron system. How we are seen shapes how we are able to see ourselves and others, and who we are able to become.

7. In dance/movement therapy, the mirror neuron system is engaged directly (Berrol, 2006). Mirror neurons are powerfully stimulated when a person's movement is reflected through another moving with them in empathetically attuned movement. The somatic attunement of the therapist, in face-to-face engaged interaction through embodied movement, activates the mirror neuron system, creating a powerful experience of being with another. This process activates very early relational attachment systems in the brain. Nonverbal mirroring of body language helps to impart a "sense of feeling felt" by another. Relational movement/mirroring methods also strongly facilitate self-awareness, through the experience of being seen and accepted by another with one's full range of emotions.

How we are seen shapes how we are able to see ourselves and others, and who we are able to become.

Recall an experience where you have felt seen, understood, or accepted? How does that experience live and breathe inside you? How has it impacted your capacity to be with others?

### **Brain Lateralization: Right Brain/Left Brain**

*The kind of attention we pay actually alters the world: we are, literally, partners in creation. (Iain McGilchrist).*

Language is so complex that the brain has two ways of processing it simultaneously. The left brain is responsible for denotation; the right for connotation, or context.

To understand a sentence, the left brain processes the meaning of the separate words; the right brain their relationship to each other.

The brain houses two independent, interconnected lobes that function simultaneously together in perceptual processing. The left brain is linear, focused on compartmentalization and discrimination of information. The right brain is global, perceives time only in the present, and is more focused on wholistic processing.

Structurally, the neurons in the left side of the brain are more densely linked to other neurons nearby. This supports discrimination of subtle detail and specific focus. In the right side, the neuronal connections encompass and interconnect across longer distances linking affect, somatic sensation, and memory (Hart, 2008).

The body itself is perceived simultaneously through both the left and the right sides of the brain. This is reflected in the mind's capacity to perceive the body as simultaneous subject and object, as both I and "it" at the same time.

The right side of the brain controls the movement and perception of the left side of the body and vice versa. Sensory processing and information travels through the corpus callosum, which connects the right and left sides of the brain and continues to descend through the body on the other side.

Right-brain states involving creative exploration through writing, drawing, or movement facilitate active body involvement, and engage emotional and conscious processing of experience. Experiential process engages and integrates multiple levels of brain functioning simultaneously.

