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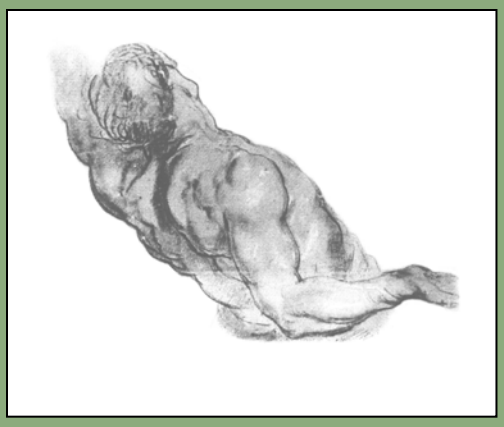

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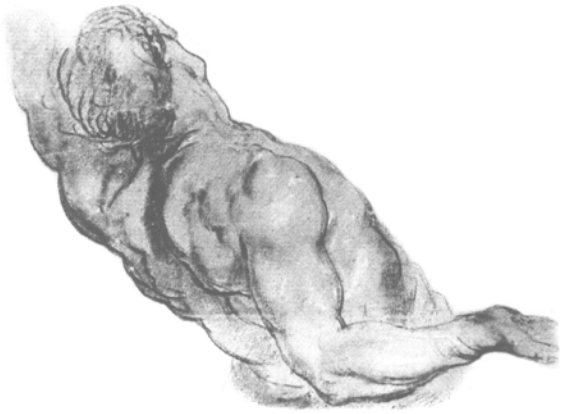

USABP Mission Statement

The USABP believes that integration of the body and mind is essential to effective psychotherapy, and to that end, its mission is to develop and advance the art, science, and practice of body psychotherapy in a professional, ethical, and caring manner in order to promote the health and welfare of humanity. (revised October 1999).

A Neuroscience Book Review
[with a Primer of Terms and Concepts]

Aline LaPierre, Psy.D.

Abstract

This is the first of a three part review. I have approached the now extensive neuroscience literature with an educational objective, and an eye to its relevance to our somatic psychotherapeutic work. It is my hope that these reviews can serve as an orientation to this broad field and as a point of reference to one of its core integrative questions: What is the self in neurobiological terms?

In this issue, **Part I: Understanding the Mind-Brain and Nervous System** orients us to current foundational books that map the essential principles of neuroscience. In the next issue, **Part II: Affective and Developmental Neuroscience** will look at authors such as Antonio Damasio, Joseph Le Doux, and Jaak Panksepp, at Allan Schore's regulation theory, and at Dan Siegel's interpersonal neurobiology. Finally, **Part III: Neuroscience in Somatic Clinical Application** will explore the integration of neuroscience in body-centered clinical work

Keywords

Neuroscience - Book Review - Body-centered - Somatic Pschotherapy

Part I
Understanding the Mind-Brain and Nervous System

> *If we look at a tapestry closely, view it with a magnifying glass, we see the threads, but from a distance, it is composed of patterns; the threads are the brain, the patterns are the mind.*
>
> *– Russell Brain*

What exactly *is* "the mind"? How indeed does immaterial consciousness emerge in the brain from cell assemblies which are not that fundamentally different from those of other bodily organs? And what are the neural mechanisms that generate the awareness of our selves interacting with the outside world?

There is agreement in the neurosciences that the full meaning of the emerging information is not yet known, and that we are still far from having a complete picture of the brain and nervous system. However, a partial view is better than none, and the certitude also exists that an area of knowledge has been opened that has the potential to change how we think about ourselves forever. The idea that we now have the possibility of studying, in measurable units, the inner life of the mind generates palpable excitement and demonstrates that it is feasible to find the neurological correlates of traditional psychodynamic concepts, thereby setting them on a firm, organic foundation. In the field of somatic psychotherapy, there is hope that neuroscientific research can provide validating bridges that highlight the connections between body-centered and psyche-centered therapies.

Neuroscience (the scientific study of the nervous system) is a broad field that embraces behavior from the molecular to the psychophysical, ranging from the smallest structures–genes, cells, molecules, neurons–to whole-body structures such as the central and peripheral nervous systems, and even larger frames of reference such as thoughts, feelings, and fantasies. Llinás, in his book *I of the Vortex* (2002), writes that because this field of research is so widespread, neuroscientists tend to work within certain *orders of magnitude*. For example, a magnifying glass allows the observation of large single-cell neurons. Two orders of magnitude down, the microscope brings in the range of synaptic transmission, and down two additional orders of magnitude, the electron micrograph allows entry into the realm of the molecular. Inversely, two orders of magnitude up from the single-cell neuron begins the observation of organized systems and up yet two more orders of magnitude brings in the world of motricity and cognition that is recognizable as human behavior. Orienting to the order of magnitude helps navigate the continuum between the subtle small-scale molecular and neuronal worlds and the large-scale cognitive and emotional systems familiar to our felt experience.

Basic Concepts

The Mind-Brain Relationship *by Regina Pally.* New York: Karnac Books, 2000.

The Brain and the Inner World *by Mark Solms and Oliver Turnbull*. New York: Other Press, 2002.

A User's Guide to the Brain *by John J. Ratey*. New York: Random House, 2001

As scientific knowledge grows about the role of the brain in mental disorders, clinicians can no longer remain ignorant about neurobiology. For those of us who need a guided tour of the recent insights into the natural laws that govern our brain, our nervous system, and our inner life, these authors have created accessible maps to

orient our exploration and help us conceptualize neuroscientific clinical applications. The authors of these three books make no assumptions about the reader's previous knowledge and remain, without patronizing, within the bounds of a simple aim: to familiarize us, the nonspecialists, with the basic facts of how the brain produces our subjective mental life. Before we can feel comfortable in this new field, we need to learn its language and develop an understanding of the brain, its geography, and its mental functions. These books shed light on the core topics of neuroscience: evolution, neuronal dynamics, sensation, perception and emotion, memory, motivation and intentional action, language and the social brain, bilaterality, and what has been referred to as the Holy Grail of modern neuroscience, consciousness. Following a review of each of these three books, I have drawn on their overlapping information to piece together a summary overview of some of the core principles they cover.

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Originally written as a series of six articles for the *International Journal of Psychoanalysis* (1997), ***The Mind-Brain Relationship*** is a small, well-researched monograph with a broad perspective summarizing for the non-initiated the main thrust of contemporary neuroscientific concepts relevant to and shaping current clinical theories. As such, it is a good introduction for those beginning the journey of integrating neuroscience into their practice. Regina Pally, a psychiatrist, psychoanalyst, and UCLA professor sums up for clinicians, at the systemic level, the often daunting neuroanatomy, physiology, and experimental data and their clinical implications:
(1) how the past influences the present; (2) why we need to feel our feelings; (3) why making the unconscious conscious is therapeutic; (4) why verbalizing feelings is therapeutic; (5) why we need other people; (6) how the mind and body are integrated with one another; (7) why we tenaciously hold on to belief systems, and how belief systems influence our perception, thoughts, and behaviors; (8) how anything we do repeatedly or experience repeatedly can be incorporated at an unconscious level and contribute to habits, character, and our relationship with others; (9) how nonverbal behavior affects both patient and therapist in the treatment situation.

Pally begins with a description of how the development of a child's neural circuitry directly reflects and is shaped by early environmental influences and reviews how the brain actively constructs perception. She devotes a chapter to the structure, function, varieties and dynamics of memory, another to the unconscious and evolutionary roots of emotions and how emotional processing is the most important link in the mind-body connection. Yet another addresses the fascinating topic of hemispheric asymmetry and specialization, using the new information to offer insights into clinical phenomena such as transference, projection, dreams, and hallucinations. She closes the book by providing a comprehensive overview of the topic of consciousness research, the "final frontier" of neuroscience.

This little book performs a valuable service in that it delivers the main thrust of contemporary brain research. It brings center stage those topics that are of interest to psychotherapy and psychoanalysis, giving us, as body-psychotherapists, a foundation from which to transition our interests to more focused personal explorations.

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Gathering and distilling vast amounts of information, connecting it to psychoanalytic theory, and presenting it in a way that can be understood by the neophyte without falling into a reductionist attitude is a veritable tour de force. In ***The Brain and the Inner World,*** Mark Solms, a neurophysiologist and psychoanalyst, and Oliver Turnbull, a Cambridge-trained neuropsychologist, cover much of the same territory as does Pally but from a different perspective. They approach the mysterious relation of body and mind with a focus on the neuroscience of *subjective* experience and span a greater order of magnitude, taking us full spectrum through the nested hierarchies of the small-scale neuronal world to the large-scale systems.

Entwined like yin and yang, knowledge of mind and brain, which has resided in the separate fields of psychology, psychiatry, and neuroscience, finds here a respectful blending. In his *Project for a Scientific Psychology* (1895), Freud had attempted to construct a systematic model of the functioning of the human mind in terms of its underlying *neurobiological mechanisms*. With the primitive knowledge of his time, he was not able to do so and eventually disavowed the project. Thus, for reasons of expediency, the subjective approach to mental science (psychoanalysis) split off from the objective approach (neuroscience), and since then, each discipline has developed along its own path. Today, we have come full circle; neuroscience has caught up with psychoanalysis and the movement is under way to bridge the historical divide and build interdisciplinary links. In order to understand how mental disorders arise and in order to develop increasingly efficient therapies, Solms and Turnbull make the case that clinicians can no longer afford to be ignorant of the complexities of the neuroscience of human subjectivity. The core of the book demonstrates that a substantial body of neurobiological knowledge now exists which is sufficiently advanced to be of interest to psychology, psychoanalysis, and I would add, somatic psychology.

The first chapter presents a summary description of the brain's anatomy and physiology. It is intended as a starting point and is frequently referenced by the authors as they flesh out the functional architecture of consciousness, emotion, and memory, and the laws that govern their workings. The book's value is in its clear presentation of fundamental principles. For example, that the brain is connected to two worlds, interposed between the internal milieu *within* and the external environment *without,* seems, on initial formulation, relatively obvious yet has far-reaching repercussions. Since everything we require to meet our inner needs is in the outer environment, and since this outer environment is largely indifferent to our inner needs (with the exception of good parents and loved ones), it is the brain's task to mediate between our vital internal requirements and the ever-

changing outer environment. Thus, the brain's job resides in its ability to guide our interactions with the outer world of reality and is thus critical to our survival.

Another important point is that the brain is the part of nature *that we ourselves occupy*. The authors reconcile the misleading mind-body dichotomy by pointing out that we humans have a unique dual observational perspective; while neuroscientists turn their scientific attention to *objectively* observing the physical organ of the brain and the workings of the mind viewed from the outside, psychologists study it *subjectively* from the point of view of what it feels like to *be* such a system. The authors view the correlation of these two points of view as the beginning of a new scientific discipline which they call *neuro-psychoanalysis*. The current success of neuro-psychoanalytic interdisciplinary groups have led Dr. Solms to initiate the creation, in 1999, of the journal *Neuro-Psychoanalysis* (www.neuro-psa.org/journal) published by Karnac, and to the establishment of an institute, a society, and an annual congress.

The authors survey the various research approaches used as neuroscience and psychology work to discover the common ground between the brain's tissues and its psychological processes. Although there are numerous techniques used in neurological research, neuro-psychoanalysis currently relies on studies of actual patients with brain damage as its principle method of investigation. In relating the effort to reliably link localized brain damage with corresponding impairment of mental functions, this book evidences the fact that we stand on the shore of an unmapped continent. As clinical and scientific reaches broaden, the authors leave us with the impression that we should be prepared for the emergence of undreamt-of directions. It is my hope that in the charting of new directions to set psychodynamic concepts on firm organic ground, body-centered psychotherapies will be able to formulate a meaningful contribution.

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From a body-centered perspective, there is a great deal of wisdom to gather from ***A User's Guide to the Brain***. John Ratey, Clinical Professor of Psychiatry at Harvard Medical School and bestselling co-author of *Driven to Distraction*, looks at the brain as a malleable organ whose development and capacity for improvement and change is a continuous, lifelong process. Using as an example the experience of Temple Grandin, who suffered from autism and became a world expert in animal handling, he shows how the adult brain is both plastic and resilient and can be strengthened as we exercise our ability to determine who we want to become. Ratey believes that, in order to approach psychotherapy more effectively, we need a new, multifaceted paradigm to define mental disorders. Each brain is the unique expression of a particular range of neurological dynamics. His view, that we are not prisoners of our genes or our environment, leads him to propose a model for analyzing human experience which addresses what he calls the "four theaters of the brain"; (1) perception, the gateway through which we receive information from our five senses; (2) attention, consciousness, and cognition, by which ill-formed cognitive networks lead to confused internal representations affecting how we represent the incoming world to ourselves; (3) brain function: movement, memory, emotion, language, and the social brain, which contribute to, and are molded by, conscious experience; and (4) identity and behavior: our decisions, behavior, and historical sense of self, which constitute the brain's output.

In an approach that is familiar to body-psychotherapists, Ratey proposes that in order to take neurophysiology into account, treatment should begin with tracking experience. A clinician, in his opinion, should begin by looking at how a patient experiences the world, focusing the primary diagnostic inquiry not on "How do you *feel*?" but rather on "How do you *perceive* and comprehend the world?" Since emotions are created by the physical firing of neurons in the brain, a clinician should delve below the emotional surface of feelings, first considering their biological cause and effect. For Ratey, the root of *e-motion* is "to move," and in a wonderful chapter on movement, he shows how our "higher" brain functions have evolved from movement and still depend on it and that purely cognitive processes are carried out by the same regions of the brain responsible for actual movement. Thus, he makes the argument for the need to understand movement in order to understand thoughts, words, and actions.

Following an easy narrative through the developmental, perceptual, and emotional aspects of the brain, Ratey takes an excursion into language and the social brain. We learn that social behavior is, in large part, a brain function like memory or language. Even though we typically think of capacities such as making friends, getting along with coworkers, and forming intimate relationships as learned, there is evidence that these social skills have a strong biological basis. Neurologists and neuroscientists have shown that damage to the cortex can affect one's ability to be empathic, that problems in the cerebellum can cause autism and its social ineptness, and that deficits in the right hemisphere can make it difficult to understand life's overall picture. Following discussions on the development of the social brain—why we are social, the role of cerebellum coordination, free will and the anterior cingulate gyrus, nonverbal cues and the right hemisphere, and the biochemistry of love and intimacy—it becomes clear that biochemicals in the brain influence the ability to engage in sex, love, bonding, and child-rearing, all fundamental social behaviors. For as much as individuals may need to fight or flee, they also need sociability. Understanding how our social brain functions brings answers to philosophical questions that touch the very core of our lives such as why we care for others or how we recognize friendship and intimacy. From the perspective of evolutionary adaptability, there is no doubt that we are designed for group living, and as we understand how the brain affects social functioning, we can improve our success as social creatures and learn to minimize the enormous pain that issues from socioaffective disorganization, deficits, and ignorance.

I found **A User's Guide to the Brain** to read as easily as a novel. It is filled with vivid imagery that enlivens otherwise dry concepts. Writing about synapses for example, Ratey describes how "like the outstretched fingers of God and Adam on the ceiling of the Sistine chapel, they remain separated by a small gap." Ratey concludes the book with a short chapter on the care and feeding of our brain. When all is said and done, we come away with the realization that the most important lesson we can learn about our brains is how to care for them, love them, and learn to use them to their maximum potential.

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A Primer of Terms and Concepts

Contained somehow in the cortical web is an enormous array of experiential memories and new, imaginative associations that lift our behavior out of the closed circles of reflex and instinct—lift us so high at times that it is entirely possible for liberated abstract thought to forget its own biological basis.

— Deane Juhan

Drawing on the viewpoints of Pally, Solms and Turnbull, and Ratey, and moving freely among their three books, I have attempted to condense and highlight some of the major terms, principles, and dynamics that are the groundwork of current neurological thinking. This brief, bare-boned primer, painted in broad strokes, intends to stimulate the curiosity and creativity of readers who need an initial orientation to the neuroscientific language and way of thinking, and who may be reticent to delve into a subject that, at first sight, might appear awe-inspiring and bewilderingly complex.

Genetic and Environmental Influences on Mental Development

Pally begins the neurological journey at the threshold of the nature/nurture debate. The reigning doctrine of modern neuroscience is that brain development is largely ***experience-dependent***. Pally suggests that although during gestation, and for a few months after birth, brain growth and development are mainly directed by the genetic code, the brain is born prematurely that is, it is unfinished at birth—and the genetic code is not sufficient to supply all the needed information. Therefore, it is *the interactions with the environment that stimulate the more precise wiring of neural connections.*

Solms and Turnbull bring an important element to this argument by describing how environmental influences impact the genetic mechanisms at the cellular level. Genes, they tell us, have two major functions: a ***template*** and a ***transcription/translation*** function. In their *template* function, which is mostly restricted to the genes of the sperm and ovum, they replicate the design of a new baby or ***genotype***, whereas in their *transcription/translation* function, they work in complex interactions with the environment to transform the genotype's coded DNA into an actual "you" or ***phenotype***. The environmental context opens the genotype to a wide range of manipulations, which in turn shape the phenotype. This transformation of the genotype's template potential into an actual individual, which is referred to as ***gene expression***, though it varies depending on the type of cell or organ involved, is linked to the unique environment in which each brain's development unfolds. Gene expression demonstrates how it is the fundamental nature of life to transform biology.

Therapeutically, these findings support the object relations psychological hypothesis that our early developmental experiences shape our subsequent psychological functioning. Experience-dependent evidence affirms the view that relationship complements the inborn instincts and gives a neurological explanation for the theory that a child transforms its caregiver's external regulations into internal mental representations within which are encoded the strategies for managing internal body states. Neuroscience affirms that the function of internal representation is not only mental, but because of its self-regulatory influence, psychobiological.

The Evolutionary Architecture of the Brain

Pally continues the mind-brain journey by traveling through the evolutionary architecture of the brain. It is important to remember that the brain is a physical organ that evolved *from the bottom up*, with the higher centers developing as elaborations of lower, more ancient parts, thus retaining features of its evolutionary ancestors—reptiles, lower mammals, and primates. Through the process of chance mutation and survival of the fittest, newer brain structures that perform more adaptive functions were built upon older structures, keeping those areas of our predecessors that had proved useful and slowly *adding complexity* and sophistication. First came the ***brainstem,*** which surrounds the top of the spinal cord and is preprogrammed to regulate bodily processes and vital functions of physiological survival such as the sleep-wake cycle, heart, respiration, body temperature. Next, our reptilian ancestors developed the ***basal ganglia***, responsible for behavioral-motor routines learned from repeated behaviors which then become automatic-such as riding a bicycle or playing the piano. Third, with the emergence

of mammals, came a ring-like section surrounding the brainstem called the ***limbic*** (Latin for *ring*) ***system***. Also referred to as the emotional brain, it is from the limbic system that emotion and the uniquely mammalian behaviors of nursing, parental care, and play evolved. The limbic system added powerful tools to upgrade our adaptation to the changing demands of the environment–learning, memory, and the beginning of socialization. Fourth, the ***cortex***, considered the most highly evolved part of the brain, fine-tunes our lower functions and brings in rational thought and the ability to strategize and plan long term. Its executive ***prefrontal cortex*** evidences the greatest degree of development with its capacity for planning the future, directing attention to a task, regulating affect, and controlling voluntary movement. It is fascinating that, in spite of this layered evolutionary architecture, in which the processing of experience is distributed simultaneously across neuronal groups in many different areas, the brain operates as a dynamic, integrated whole; for example, a simple perception such as seeing a cat traverses all regions of the brain.

Neural Assemblies

Within our 3-pound brain, which looks more like something one might find washed up on a beach than like one of the wonders of the world, each of the 100 billion neurons is capable of synaptic connection with 60,000-100,000 other neurons, a tremendous organization of neuronal configurations with almost infinite potential. The cortex alone, which contains about 30 billion neurons, is estimated to contain something of the order of 1 *million billion* connections. This teeming neuronal forest is governed by key laws that direct their organization into larger systems. All new information entering the nervous system, whether of internal or external origin, activates in the neurons to form unique patterns of interconnection, called ***neural assemblies***. The laws that direct neural assemblies provide the basis for important somatic principles:

- ***Hebb's law*** posits that "cells that fire together, wire together." If two neurons are electrically active at the same time, they will automatically form a connection. If they were already weakly connected, the synapse between them will be strengthened. This has important implications for our understanding of memory. Working memory for example, appears to involve reverberating circuits of interconnected cells that fire together in closed, self-reactivating loops. It is the maintenance of the firing pattern that *is* the holding in mind of information. This activity-dependent wiring of working memory produces an increased density of neural tissue and transforms short-term memory into long-term memory.
- When a new experience evokes a pattern similar to one already established, ***pattern-matching*** gives us the sense of recognition. *Perception happens through a comparison of past and present.* For perception to occur, the brain searches for a match between the incoming pattern of neuronal activity and patterns already stored in memory.
- Individuals experience ***qualia***, that is, a high-order discrimination of environmental features, i.e., green, hot, or round, and this, it is believed is a large part of what constitutes consciousness. The term ***quale*** refers to the experience of a particular property, and each property is processed *in its own separate region and neural networks*. It is not possible to experience a quale, say "green," in isolation of other attributes. The experience of qualia is highly personal and is based on the wiring and activity of an individual's nervous system.
- By an operation called ***reentry,*** the brain coordinates the stimuli or qualia entering in the separate regions of the brain, so that the individual groups of specialized neurons can interact rapidly and reciprocally with the other regions of the brain. For example, information being processed in the visual cortex automatically influences processing in the auditory cortex, and vice versa–what we see influences what we hear, and what we hear influences what we see. Given the absence of a computer-like central processor in the brain, it is believed that reentry could be the *unique*, *single most important feature* of higher brain organization, the vital component of integrated, complex cognitive tasks. If reentrant interactions are blocked, entire sections of consciousness disappear and in cases of trauma, unprocessed sensory information that remains in dissociated fragments may cause consciousness itself to shrink or split.
- We are born with an overabundance of synapses representing the *potential* connections between neurons that might be needed to create internal maps and models of the world in which we find ourselves. In the neonatal period, a ***pruning*** or ***parcellation*** process begins: Because of the experience-dependent development of neural circuits, neural paths that are activated remain, whereas those that are not used atrophy and die–a "use it or lose it" rule.
- For the development of normal perception, the cortex must receive specific kinds of stimulation within particular time-frames. For example, during the first year, there is a ***window of sensitivity*** for the development of attachment that mediates the capacity for self-regulation.
- Although there are specific windows of sensitivity, *brain growth is not exclusively limited to sensitive periods* or to early development. Over the lifespan, every part of the nerve cell alters its dimensions in response to a stimulus-rich environment. Studies have shown that throughout our lives, long-term repeated exposure to stimulation triggers gene transcription and translation of new proteins and stimulates the growth of new synapses.

- It appears that the brain's design strikes a balance between ***circuit permanence*** and ***circuit plasticity***. For functions such as math or new vocabulary, the brain exhibits a lot of plasticity, thus facilitating new learning. However, in the emotional limbic circuits, the brain exhibits more circuit permanence and less plasticity, which stabilizes psychological development. It is because of circuit permanence that children develop longlasting attachments and that we, as adults, continue to seek out and strongly respond to familiar sources of comfort and safety. The brain's plasticity is an essential feature of our capacity for learning and change.
- ***Bottom-up*** mechanisms of the central nervous system are involuntary, always unconscious, and related to the physical effects of environmental stimuli upon the body. In contrast, ***top-down*** mechanisms can be voluntary, conscious, and pertain to how memory, motivational relevance, emotion, attention, and imagery shape perception. It can be argued that babies mostly rely on bottom-up perceptual mechanisms.

Perception

How does the brain construct perception? Contrary to popular belief, the brain does not operate like a camera that takes in a whole scene. It is more like a *feature detector* that detects individual stimuli, such as edges, contours, line orientation, color, form, pitch, volume, and movement, and processes them in separate regions of the brain. Each and every perception is actively constructed from the building blocks of individual sensory cues *under the guidance and influence of emotion, motivation, and prior experience*.

The brain accesses the outer world in two major ways: (1) through the sense organs of vision, hearing, and somatic sensations, whose specialized receptors transform external conditions into nerve impulses; and (2) through the musculoskeletal motor system which uses our inner responses to act upon the outer world. Interestingly, the term *somatic sensation* defines a group of sensory modalities that include touch, pain, the ability to sense vibration and temperature, and muscle-and-joint position. Thus the five classical senses are condensed into three categories based on the three lobes located in the back half of the brain where their information is projected: vision to the occipital lobe, hearing to the temporal lobe, and somatic sensation to the parietal lobe. The sensory knowledge gathered from the external world follows a specific path. It is (1) integrated with previous experience, (2) transmitted from the back half of the brain to the frontal association cortex, and (3) balanced with information from the internal body.

Because perception evolved to facilitate adaptive and survival behaviors, economy and speed of processing is critical. The faster a brain detects food, foes, and mates, the better the survival chances. This need for efficiency prompted the development of a ***split perceptual system*** within the brain's architecture. For *quick survival-based responses,* one system, based on pattern matching from minimal environmental cues, uses the shortest possible route to pass sensory stimuli from the thalamus directly to the amygdala, which is poised, like an alarm, ready to activate the body's fight-or-flight hormones. This quick-response, emergency route bypasses the executive cortex, sacrificing accuracy and discrimination for speed, so that in a prey-predator world, it can make the difference between life and death. The second perceptual path seeks out detailed features for pattern-matching and is consequently much *slower*. Moving from the thalamus through the more complex executive cortex and on to the hyppocampus, this pathway provides the sensory discrimination that allows us to assess, regulate, and inhibit behaviors that, in the amygdala, are automatic responses based on summary information. This mechanism implies that conscious awareness helps diminish fear responses.

The split perceptual system follows a pattern-matching protocol: (1) To minimize effort, the brain makes a quick assessment with just enough detail for a "good-enough" match. If danger is assessed, the amygdala responds to this minimal information. (2) If no match is found, the brain proceeds to seek more information, until a match is found. (3) If no match is found, a new category of experience is generated, whose pattern is stored in memory for later matching.

Pattern-matching suggests an explanation for people's tendencies to confuse events in the present with events from the past or repeat past painful experiences. Because the brain initially looks for a good enough match between past and present events, we tend to jump to conclusions prematurely and "see" what we have seen before. Neurologically, it is not so much that we repeat the same experience but that we interpret current situations with a bias toward what has occurred in the past. For example, a child, seeing an animal never previously encountered, such as a raccoon, might say "cat" because it fits the general pattern of "furry animal" already stored in memory. However, with conscious focus on detail, a new category of animal will be generated. Greater perceptual accuracy develops by encouraging conscious attention to details in order to create new categories of experience. It follows that psychotherapy could be conceptualized as a method of treatment that pays conscious attention to increasingly specific details in order to develop greater perceptual accuracy and, when necessary, generate new categories of experience.

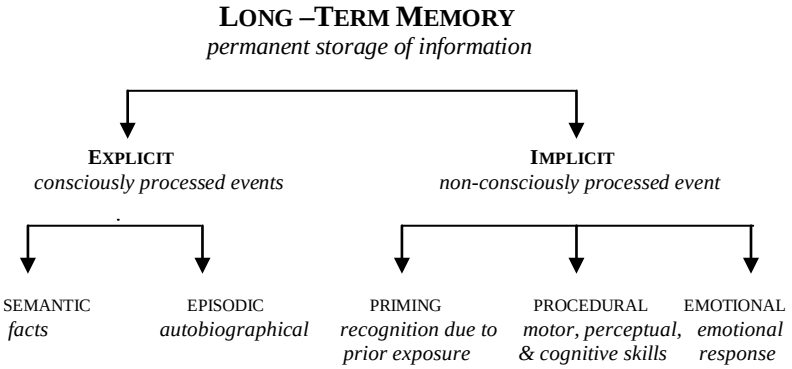
Memory

We take for granted our capacity to look from the present to the past and, at the same time, witness the passing of the present into the future, a mechanism called ***memory***. For neuroscientists, including Pally, Solms and Turnbull, and Ratey, the word *memory* is an umbrella term: For example, the memories of what we did last night, of how to tie a shoelace, of our telephone number, of how we felt when someone dear to us died are each mediated in a different brain system.

Although the content of the memory system is unique to each individual, its organization, like the perceptual system, follows a protocol structured according to a standard pattern: (1) acquisition of new information, or ***encoding***, (2) retaining of information, or ***storage***, (3) recalling information, or ***retrieval***, and (4) continuous ***consolidation*** of experience to deeper and deeper levels of storage. The steps to encoding, storage, retrieval, and consolidation are as follows: First, when a sensory organ is activated long enough, the incoming information becomes a perception and flashes, for less than 1 second, through ***iconic memory***. The perception then moves to the prefrontal cortex into ***working memory***, which can hold several relevant pieces of information simultaneously for a few minutes. Working memory is synonymous with the ability to consciously "hold things" in mind, and it appears that we can hold about seven units of information at any one time (hence 7-digit phone numbers). A kind of erasable work space, working memory not only takes in new information but also searches for and retrieves information stored permanently in ***long-term memory***. In response to these search-and-retrieve commands, information stored in long-term memory flows *backward* into working memory. Problems with the backflow of information from long-term memory can result in memory deficits—repression, for example, is thought to be a problem of information retrieval from long-term to working memory. Many higher cognitive functions, such as the comprehension of complex information, reasoning, decision making, and planning for the future depend on the ability to hold a number of pieces of information simultaneously in working memory. In fact, *intelligence* itself may, in part, be the result of the ability to juggle many possibilities at once via a competent working memory and its access to long-term memory.

Our long-term memory, which is the permanent storage of information within which information is consolidated, divides into two branches: ***explicit*** or *consciously* processed memory, and ***implicit*** or *nonconsciously* processed memory. It should not be surprising that long-term memories, because of the vast assemblies of neuronal connections involved, generally encode in more than one way and thus are very difficult to obliterate. It is important to remember that one does not have to retrieve a memory explicitly in order for it to actively influence cognition and behavior. The distinctions between explicit conscious and implicit unconscious memory are well established in contemporary neuroscience.

Usually, when we think of memory, we are thinking of the explicit branch that holds all the sights, sounds, smells, conversations, as well as thoughts and images *of which we are conscious*. The explicit branch subdivides into a ***semantic factual memory*** for personal and general facts that underlie our basic knowledge of the world—date of birth, who is president—and ***episodic autobiographical memory*** for specific personal events that uniquely define our lives—yesterday's visit to a friend, last year's birthday celebration. When we say "*I remember…*" we are speaking of an episodic memory that involves the literal "reexperiencing" of past events.



The implicit branch, on the other hand, stores information *without our awareness*, and consequently, even though it constantly influences our current functioning, it does not feel like memory to us. Implicit memory subdivides into ***priming memory***, or the memory of shape and form; ***procedural memory***, a kind of bodily memory for perceptuomotor and ideomotor skills, habits, and routines; and, ***emotional memory***, or the memory of our emotional responses. Because implicit memory is nonconceptual and nonlinguistic, it is difficult to investigate its content with verbal methods. Techniques that use empathic resonance are better suited to explore experiences encoded in implicit memory.

Transforming what we see, hear, feel, and think into memory is directly related to the *degree of conscious attention* we give to the information we receive. Emotionally arousing and personally relevant information is more

likely to be encoded. Likewise, memory retrieval is impacted by the way a person pays conscious attention to, and reflects upon, the information received, and the richness of associations made between what is to be remembered and what is already encoded. Much of what we believe to be perception and take for granted as "the way the world is" is, in fact, the world as we *remember* it. Memory retrieval is a *re*constructive process: *Every time a memory is recalled, it is treated as new information and an opportunity is created for its alteration.* A retrieved memory is not an exact replica of the past; therefore, through repeated retelling, a painful childhood memory can be altered to reduce its associated pain. The closer the experiential similarity between an encoded and a retrieval cue, the more the memory retrieval is enhanced. We are, for example, more likely to recall an event that was encoded in a sad mood if we are feeling sad. This close relationship between encoding and retrieval cues, called a ***state-dependent condition***, has a number of important applications in the narrative elaborations of verbal therapies as well as in the use of body postures and movement in body-centered approaches.

Although emotional arousal normally enhances memory retrieval, it is important to remember that excessively high levels of emotional arousal can *impair* memory. Traumatized individuals either do not have a high enough cortisol response to stress, or they experience autonomic hyperarousal and do not know how to regulate their overaroused autonomic nervous systems. In the case of severe trauma and posttraumatic stress disorder, high levels of circulating cortisol can cause cell damage, or even complete shut down, in the hippocampal system, precipitating impairments in explicit memory that cause it to become disconnected from implicit memory in such a way that events held in implicit (unconscious) memory are explicitly (consciously) forgotten. In these cases, memories are expressed in ways that are disconnected from the traumatic event, such as in dissociative behaviors, startle responses, nightmares, and visual and somatic flashbacks. It has become apparent from the current neurological research that merely uncovering memories psychologically is not enough—memories need to be carefully reconstructed neurologically. Because most individuals with psychological and developmental trauma have difficulties processing anxiety-activating information, treatment that focuses prematurely on the past can exacerbate, rather than relieve, traumatic intrusions, leaving some traumatized people incapable of finding flexible and adaptive neurological solutions.

Emotions, Motivation, and the Internal World

To grasp the potent hold of emotions on the thinking mind, we must remember that, because the rational cortex is rooted in the earlier emotional limbic system, cortical and limbic brains are inseparably intertwined. In effect, we have two minds—one that thinks and one that feels—the classic duality of the rational head and emotional heart. Pally impresses upon us the vast-ranging importance of emotions, in that they (1) coordinate mind and body by organizing perception, thought, memory, physiology, behavior, and social interactions; (2) connect mind and body both within internal experience and in attunement between individuals; and (3) guide mind and body to find adaptive, problem-solving solutions to the basic events of life, such as finding food, defending against danger, reproducing, caring for babies, and organizing social relations. Because using reflective cortical processes to regulate emotional arousal is now recognized as critical to healthy functioning, the axiom *I feel therefore I am* has become the current version of updated Cartesian thought.

Emotions are driven by primitive, instinctual mechanisms that come into balance through frontal-lobe voluntary regulation, an organization that somewhat parallels the psychodynamic equilibrium of primary and secondary processes under the aegis *id* and *ego*. On the primary instinctual id side, the ***basic-emotion command systems*** are the outcome of proven survival and reproductive values. Deeply conserved within the mammalian genotype, these "e-motions" or "evolutionary motions" are a heritage which evolved over eons of time and have been in existence long before *Homo sapiens* came on the scene; accordingly we share them with all other animals. Solms and Turnbull use Panksepp's (1998) nomenclature to describe the four basic-emotion command systems: (1) The ***seeking system***—which includes curiosity, interest, appetitive states, need-detection mechanisms, and lust/pleasure—whose job it is to switch on consummatory behaviors. It is through the seeking system that early experiences of satisfaction form the templates of our understanding of how life works. (2) The ***rage system***—activated by states of frustration triggered when goal-directed actions are thwarted—is a type of hot aggression associated with fight or affective attack responses, whose job it is to assure survival in competitive and predatory environments. (3) The ***fear system***, which generates, on the perceptual side, feelings of fear-anxiety, and on the motor side, flight and freeze responses. (4) The ***panic system***, associated primarily with panic, is also called the separation-distress system because it is now linked with loss and sorrow. This connection between panic attacks, separation anxiety, and depressive affect is presently substantiated, and the intimate association between this system and social bonding and parenting is becoming increasingly clear.

In an infinitely unpredictable world, these four inherited, emotionally driven behavioral stereotypes are not sufficient to fully modulate our responses to the unknown. Consequently, the basic-emotion command systems are not "hard-wired"; on the contrary, they are open to the influence of learning mechanisms and are designed with "blanks" to be filled in by life experience. For example, the seeking system is driven by an "objectless" drive so that we know *that* we need but not *what* we need. We are left to learn from experience which objects satisfy our needs and which do not.

Is it good or is it bad? Is it familiar, or is it unfamiliar? Such vital questions lead to a complex constellation of stimuli, ***appraisal of stimuli***, and ensuing behavioral responses. The ***autonomic nervous system,*** which divides into two branches operating in tandem, plays a most important role in brain-body appraisal of stimuli and resultant emotional interactions: (1) a ***sympathetic*** activating branch copes with external stimuli and mobilizes the fight or flight response, and (2) a ***parasympathetic*** rest and digestion branch tends to the internal environment responsible for repair, nutrition, growth, and homeostasis. The most important appraisal centers seem to be the ***amygdala***, which appraises external stimuli; the ***orbitofrontal cortex***, which weighs all incoming information against accumulated personal experience; and the ***anterior insular cortex***, which appraises thoughts and body sensations. Stimuli are either rewarding and give us positive emotions (i.e., happiness) or aversive and give us negative emotions (i.e., fear). *It is through our emotions that the body plays an active role in mental life*. In the simplest of terms, the emotional limbic system organizes our responses toward pleasurable and unpleasurable stimuli and guides us to find adaptive, problem-solving solutions to the basic events of life, such as finding food, defending against danger, reproducing, caring for babies, organizing social relations.

Is it safe or is it dangerous? Appraisal centers evaluate stimuli for their survival significance, and emotions originate in root impulses that prepare the body to take survival-oriented action. For example, fear enhances the likelihood that a stimulus will be interpreted as dangerous, anger brings the blood to flow into the hands to grasp a weapon, while adrenaline generates a pulse for vigorous action. All animals, including humans, *react with fear to aversive stimuli*. No matter what the aversive stimuli, the behaviors of anxiety and fear are the same in all, human or animal: racing heart, increased respiration, dry mouth, diarrhea, upset stomach, vigilance, jumpiness, easy startle, apprehension.

Emotional arousal causes a variety of brain alterations; high levels of emotions, as well as lack of emotion, lead to physical changes that can contribute to autonomic dysregulation and psychosomatic disorders. In response to external danger, emotional processing shifts *away* from the frontal cortex which is responsible for focused attention, motivation, and monitoring of goals, to the posterior cortex, responsible for vigilance. Reduced frontal activity seems to contribute to the apathy and lack of concentration associated with major depression. Intense emotion and stress-related illness are often accompanied by cognitive complaints such as impaired memory, diminished concentration, and difficulty thinking coherently. In chronic states of high autonomic arousal, constant elevated levels of cortisol can impair the immune system, contribute to ulcer formations, lead to diminished activity or even atrophy of hippocampal cells, and cause damage to body tissues in the viscera and cardiovascular system. High emotional arousal can also trigger the physical symptoms of anxiety and panic such as muscle tension, heart palpitation, increased blood pressure, and difficulty breathing; in turn, the autonomic dysregulation of the lungs and intestinal function may play a role in such conditions as asthma and irritable bowel syndrome. The list of dysfunctions caused by emotional deregulation continues to grow: Obsessions and compulsions seem to be caused by a fixed neural switch in a brain area that monitors the environment for danger; addictions, eating disorders, and alcoholism stem from dysfunction in the brain's reward system, whereas disorders on the anxiety spectrum (anxiety, panic, phobias), disorders of affect regulation (bipolar, dysthymic), borderline personality disorder, and many others are increasingly seen as rooted in the neurobiologically induced affective chaos that may have its origins in early failures of attachment or breakdowns of the environment.

In turn, these ***internal body*** imbalances call an individual's attention to his or her internal world and override, sometimes dangerously, his or her ability to tend to the external world. The internal body, more particularly the operation of the viscera—respiration, digestion, blood pressure, temperature control, sexual reproduction, etc., which are all responsible for the maintenance of life—is of critical importance for understanding the world of subjective emotional experience. There is very little cortical conscious control in the autonomic innervation of the viscera, yet visceral experience is at the core of the sense of self and the ability to change.

The key to mastering emotions lies in the ability to give ongoing attention to interoceptive states as they occur, even in the midst of turbulent sensations. Although the brain's anatomy does not allow us to control the primitive emergence of our emotions, we can more readily learn to control how long and how appropriate our emotional expression will be. Since it is now known that consciously attending to verbalizing an experience enhances cortical activation, it can be argued that psychotherapeutic approaches modulate deeply ingrained emotional responses by teaching the neocortex new, containing responses for those signals. Even though the limbic circuitry still sends its signals, the neocortex can learn to inhibit autonomic reactions. This clarifies why dynamic techniques help patients increase insights by exploring the link between their present conscious experience and unconsciously held, in-the-gut, neurologically encoded affective memories.

Bilaterality

In a healthy brain, right and left cortical hemispheres are lateralized for specialized functions but operate collaboratively. The right hemisphere "knows" through grasping the emotion, intent, and background context of what is expressed and accomplishes this *outside* of consciousness. The left hemisphere contributes linguistic and causal understandings, which occur *in* consciousness. Because feelings and words mutually interact to enhance each other, psychological treatment needs to include attention to the nonverbal emotional cues as well as to the

verbal content. Putting sensations and feelings into words increases the ability to regulate affect, and because access to emotion enhances the ability to arrive at the linguistic meaning of experience, both are of equal importance. Particularly useful in this respect are metaphors that contain sensory, imagistic, emotional, and verbal elements that activate both sides of the brain simultaneously. This being the case, Solms and Turnbull take great care to dismantle any belief that the right brain is the seat of the unconscious or the left of consciousness. For the most part, it appears that the primary process of the unconscious id has more to do with the primitive "state-dependent" subcortical structures than with the "channel-dependent" information-processing functions of the cortex, whereas the ego's secondary process inhibitory function is more appropriately linked with *both* frontal lobes.

Deficits in interhemispheric transfers give rise to problems. According to Pally, a functional disconnection from *right to left* leads to ***repression***, in which emotion-laden experiences cannot be adequately verbalized. As a result, very early affective experiences may remain inchoate and impossible to verbalize, and distressful affects will be insufficiently processed. A functional disconnection from *left to right* leads to ***disavowal***, in which patients can speak about emotional events but deny their emotional significance and potency. Patients may know that they are having certain feelings, such as sadness over a loss, but cannot access any "felt" experience of their emotion.

The Special Problem of Consciousness

Science has always tried to eliminate the subjective, yet in the case of consciousness, subjectivity itself has become the subject of investigation. All three books discuss the mystery of consciousness at length. Pally gives an excellent account of the historical journey taken in the quest for its understanding. Solms and Turnbull make the argument that evaluating and knowing what we feel *is* the function of consciousness, for without consciousness, how can we know our feelings. Ratey highlights the importance of the inexorably intertwined link between consciousness and *attention*, a complex function that filters out and balances perceptions and attaches them to emotional significance based on how they relate to our internal categories of experience. For events to be conscious, they need to be held in attention and to be significant to the self. Becoming *more* conscious seems related to the ability to pay attention.

How much of mental life is conscious? Freud lived in an age when consciousness and mental life were thought to be identical; he was one of the first to claim that conscious mental life is only a part of the mind and that most mental operations are unconscious. Today, there is controversy among several competing models of consciousness and exploring them is somewhat like the blind men's exploration of the proverbial elephant: Based on the part of the elephant they touch–trunk, ear, leg–the blind men imagine diverse animals.

The issue of consciousness is often framed as a body-mind problem: How does matter become mind? It is good to know that, amidst the contention, and even if for different reasons, neuroscientists seemingly agree on one point: They all reject the idea of a mental-physical dualism. Some scientists center the debate around the question of whether we are dealing with a computational device operating on binary (yes-no) signals, with the brain as the "hardware" and the mind as the "software." Others argue that the "soul" cannot be reduced to biology, or that we do not yet have sufficient knowledge to put forth a theory of consciousness, while yet others believe that consciousness is a function of the brain in the same way that digestion is a function of the stomach. One theory contends that lower-level neuronal processes lead to ***emergent properties***, that is, properties that are causally explained by the behavior of the elements in the system, but are not the property of any of the elements in the system–for example, the liquidity of water comes from the H_2O molecule in which neither hydrogen nor oxygen is liquid. Another theory argues that just as electricity is not caused by the movement of electrons but *is* the movement itself, so causation and identity of conscious states are one and the same so that the physical and the mental cannot be separated. Yet another theory views the brain as a complicated nonlinear system capable of self-organization: The brain does not respond directly to incoming stimuli like a reflex action, but is continuously constructing its own neural activity patterns in response to real time interactions. Thus, the brain adapts to and synchronizes with the external stimuli it encounters, a feedback system called ***circular causality.*** This inventory is but a small sample of the numerous theories and illustrates how, for all of the current knowledge, a theory of consciousness remains elusive. Tribulations attendant to its elucidation continue to occupy researchers.

Is there a *where* to consciousness? We are trying to connect "something out there"–the brain– with "something in here"–our own individual experience happening within us, the conscious observer. Seeking to solve the mystery of consciousness has raised the issue of ***localization***, the attempt to correlate behavior with specific brain regions. The issue of localization which might, on the surface, seem to have an obvious solution, is not a simple matter. For example, there is extensive evidence that certain structures in the brainstem are critical for generating a global state of consciousness: A tiny group of tightly connected nuclei, roughly the size of match heads, called the ***extended reticular and thalamic activating system*** or the ***ERTAS***, run up the brainstem, which is itself approximately the size of a human thumb. It is remarkable that when damaged, this tiny region of the brain leads to the obliteration of consciousness and to deep coma yet, it is also clear that the ERTAS is not the seat of consciousness. The search for where sensory input comes together to create a meaningful story faces a key

dilemma in the ***binding problem*** which attempts to solve the fact that although composed of modular specialized areas, the brain integrates these separate signals into a whole unified experience.

As a result of such challenging complexities, there is a growing consensus that consciousness is not a unitary thing, nor is it an "all or nothing" phenomenon. Unconsciousness gradates into consciousness and unconscious mental contents have an effect on consciousness.

Presumably, primitive organisms do not have consciousness; they respond with "hard-wired" inborn reflexive behavior, which brings us to consider the *why* of consciousness. When no salient or meaningful change occurs in the environment or within oneself, we stop paying attention. Consciousness provides a means of noticing changes and flexibly choosing the most adaptive response to those changes. In self-reflective consciousness, one's self becomes the object of perception so that patterns of behavior and interpersonal interactions can be reflected upon. As a result of the adaptive flexibility afforded us by consciousness, we are open to learning, growth, and change.

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Biopsychology & Neurogeography

I hope that your brain enjoys learning about itself. –John Pinel

Biopsychology (Fifth edition with CD Rom)) *by John P. J. Pinel.* Boston: Allyn & Bacon, 2003.

Mapping the Mind *by Rita Carter*. Berkeley: University of California Press, 1999.

If you are ready for a more detailed structural and functional understanding of neuroanatomy and an exploration of its psychological aspects, then Pinel's ***Biopsychology***, which comes with an excellent CD ROM, is a solid choice. Professor Pinel, a biopsychologist and award-winning teacher currently at the University of British Columbia, considers ***Biopsychology*** to be his major career-related accomplishment. Unmistakably, this textbook, now in its fifth edition, reflects the author's desire to bring biological psychology to life, and as such, is an enthusiastic labor of love. The book's defining feature is its unique combination of biopsychological science and personal, reader-oriented discourse. Although it is primarily a textbook, it is "untextbooklike" in its interweaving of the fundamentals of the field with clinical case studies, social issues, personal implications, and humorous anecdotes. The abundant, polished, and detailed illustrations that accompany the text are largely attributable to the talent of Maggie Edwards, an artist and professional designer, who is also Pinel's wife.

Neuroscience is a team effort, and biopsychologists are important members of that team. Some refer to this field of inquiry as *psychobiology*, *behavioral biology*, or *behavioral neuroscience*. Pinel prefers *biopsychology* because psychology stands center stage in this inquiry into the relationship of psychological processes and the brain. More than facts which are too soon forgotten, Pinel's intent is to teach productive ways of thinking biopsychologically. Consequently, the book is organized around four major thematic objectives: (1) To assist readers in making a transition from being passive consumers of biopsychological claims to becoming *effective thinkers* who take nothing at face value. (2) To think creatively about *clinical implications*. Much of what is learned about the functioning of the normal brain comes from studying diseased or damaged brains, and conversely, much of what is discovered about healthy brains has relevance to the treatment of brain disorders. This interplay is highlighted throughout the book in the contexts of both pure and applied research with human and nonhuman subjects. (3) To anchor the reader in an *evolutionary perspective,* which has proven to be one of the cornerstones of modern biopsychological inquiry. It is by trying to understand biological phenomena through the activating environmental pressures and comparing the effects in different species that we humans have learned much about ourselves. (4) To familiarize us with the *new discoveries* of neuroscience that are currently fueled by the development of functional brain-imaging methods.

This is a book to refer to again and again as your comprehension matures. As an in-depth introductory textbook, Pinel goes into comprehensive explorations that overlap and extend the territory covered in the first three books reviewed: evolution, neuroanatomy, neural conduction and synaptic transmission, perceptual systems, the neuroplasticity of learning and memory, motivational systems and reward circuits, consciousness and attention, lateralization, language, cognition and emotion, research methodology, and psychopathology. In addition, the accompanying CD ROM contains animations, demonstrations, video clips, practice tests, and electronic flashcards—*and*, as an added bonus, each chapter offers a log-on referral section to websites that contain further information on the topics discussed.

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Functional brain-scanning machines are opening up the territory of the mind just as the first ocean-going ships once opened the globe, or as the first X-ray machines revealed our bones. These metaphors give perspective to the importance of the new imaging techniques that now make the internal world of the mind visible. Having a map is essential to any new journey, and ***Mapping the Mind*** brings news of the discoveries of the explorers who are charting brain function. Many explorers of the mind, such as Damasio, LeDoux, and Freeman,

have enhanced this book with their written contributions. Aided by an abundance of brain scans, diagrams, and illustrations, the author takes us on an unforgettable tour that meets the two criteria necessary for inclusion in this review: It assumes no prior knowledge, and it is comprehensible even to those who are new to the field.

Brain mapping fell out of grace along with phrenology and the use of psychosurgery (which included the shockingly primitive frontal lobotomy). It was replaced by a theory of "mass action," which held that complex behavior arose from the action of all the brain cells working together. Today, however, the technological ability to watch the living brain at work has given new life to the desire to identify which bit of brain does what; brain imagery has revived the belief in the biological basis of mental illness, along with the idea that we could relieve mental anguish by manipulating specific brain tissue. Brain mapping, according to this author, is providing the navigational tool required to control brain activity in a precise and radical way. No one, she writes, can reasonably observe the frenzied, localized activity in the brain of a person driven by an obsession or the dull glow of a depressed brain without questioning the physical etiology of illness and leaving behind a belief in the ineffability of soul sickness. Even though, in my mind, this point remains open to discussion, the detection of the physical signs of such complex qualities as kindness, humor, mother-love, and self-awareness is impressive.

If we were to draw a "you are here" sign on our map of the mind, it is to the frontal lobes that the arrow would point. In fact, arrow diagrams indicating various neural and chemical pathways are present throughout the book. The currents, chemical flows, and mysterious oscillations of brain activity are bound together in a dynamic system that does millions of diverse things in parallel. We are reminded that we are in the early days of mind exploration, and that we should view the current knowledge as having the same level of accuracy as a 16th-century map of the world. Surely a few dragons lurk along the edges, but, if we remember that we are entering largely virgin territory, our spirit of adventure should rise up– and those who prefer the well-worn paths should await the future.

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A Colorful Introduction to the Anatomy of the Human Brain *by John P. J. Pinel with Maggie Edwards.* Boston: Allyn & Bacon, 1998.

Human Brain Coloring Workbook *by Kapil Gupta.* New York: Random House, 1997.

Browsing the neurobiological literature, I came across two coloring books that each, in their own way, provides an enjoyable means of learning or reviewing the fundamentals of structural and functional neuroanatomy. The effectiveness of coloring as a method of active learning–in particular, to learn anatomy–is pedagogically well established. It is especially useful for those who require a more hands-on approach to memorize neuroanatomical details. Kapil Gupta claims that learning interactively through coloring takes less time than memorizing from textbooks.

Pinel's ***Anatomy of the Human Brain*** is composed of 72 learning units, with an average of four or five key neuroanatomical structures per unit. A proponent of the "less is more" philosophy, the author covers the brain structures using a two-perspective approach: Part 1 describes the location of the major brain structures; Part 2 explains their function and psychological purpose. As an introduction to the neuroanatomy of the human brain, this coloring book progresses in logical, easy-to-learn increments and offers several learning tools to promote self-study, such as a flap that folds over the illustration labels to promote self-testing, a list of key-term definitions to effectively summarize key points, and plenty of review exercises.

Gupta's ***Human Brain Coloring Workbook*** aims at a more sophisticated audience interested in clinical medicine, healthcare, research, and teaching. The book is targeted for the clinician, and even though I was initially predisposed to Pinel's coloring book because I thought of it as a companion book to *Biopsychology*, I appreciated the greater level of detail and broader organization of Gupta's book. Gupta supports the integration of anatomical knowledge into clinical application right from the beginning; he believes that it is not enough to know where structures are located, or even what their functions are, if you don't understand the clinical implications. So, for every structure, he includes an extremely interesting and useful section on clinical correlates. I also appreciated such additional material as a cross-sectional atlas of the brain and spinal cord with dimensional views from varying angles, and a detailed section on the cranial nerves. I found myself developing a better sense of orientation to the varying structures, perhaps because of the finer drawings and varied perspectives. Overall, however, you really can't go wrong with either of these coloring books; Gupta's book will work you harder, whereas Pinel's will not overwhelm you with too many details.

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Conclusion

Psychotherapists are clinical neuroscientists who create an individually tailored enriched environment to enhance brain development.
– Louis Cozolino

When I began reading neuroscientific literature, I fell in love with the vocabulary. Words such as *neural oscillation*, *parcellation*, and *sinusoidal waves*, like music, evoked in me a sensory resonance born of a mysteriously intangible recognition. Perplexed, I surmised that this terminology activated contact with a dimension of implicit experience where words bridge the passage of the body through the mind and the mind through the body. I became interested in exploring a rationale for these powerful, yet easily overlooked, responses.

It occurred to me that most of us tend to observe ourselves at the macro-level of organized cognitive and emotional systems and seldom, if ever, attempt to include in our range of daily attention the dynamic processes now observed and portrayed at the microscopic cellular or molecular levels. Do we, or can we, have a direct experience of ourselves in those smaller ranges, or are they simply too far out of the reach of perception and therefore fated to remain implicit and unconscious? To those who explore the body in its subtle dimensions via such approaches as Vipassana, Body-Mind Centering, Continuum, or Cranial Biodynamics, it has become apparent that focusing solely on macro systems of awareness curtails a rich web of direct biological experience that, when ignored, leaves us out of connection with the body's deep knowledge, ancestral wisdom, and healing potential.

We are still at the beginning of understanding the relationship between mental illness and its underlying neurobiological processes. By asking questions such as "What is feeling?" "What is consciousness?" and "What is the self?" neuroscience has moved research to an affective focus that seeks to penetrate the very heart of the body's subjective life. Through the lens of neuroscience, symptoms are increasingly seen as the dysregulation and disorganization of neural networks; as a result of this new research, there is a growing need to expand the conception of what constitutes viable and successful clinical interventions. The old idea of a predetermined and static brain, which from today's perspective appears to have been a kind of neural fatalism, is replaced by the knowledge of a neural plasticity that allows the brain to constantly reshape itself to meet new circumstances.

We are in need of clinical approaches that better utilize the neurobiological mechanisms of learning and change that are based on use and enriched experiences. As body-centered psychotherapists, our somatic perspective has trained us to consciously focus attention on subjective experiences that arise, bottom-up, from within the bodily self. We are in a unique position to contribute a distinctive point of view to clinical applications that (1) encourage an ever-growing interaction between consciousness and its biological roots, (2) challenge our assumed neurological limits, and (3) take us beyond the indelibility of developmental critical periods. It is hopefully more than a visionary dream to imagine that somatic psychotherapy can draw on its rich tradition to contribute valuable insights to the practical application of neuroscience with approaches that harness the plasticity of our nervous systems by stimulating neural connectivity, expand the inner reaches of the brain, regulate and control unnecessary destructive impulses, and enhance the interactive cooperation between sensations, emotions, and thoughts—and thus maximize the potential for gene expression and brain growth.

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Suggested Further Reading

The neuroscience literature is abundantly rich. Here are a few other vital books dedicated to furthering our knowledge of the foundations of this important field:

The Mind-Brain Continuum: Sensory Processes, *edited by Rodolfo Llinás and Patricia S. Churchland.* Cambridge: MIT Press (1996).

How Brains Make Up Their Minds, *by Walter J. Freeman.* New York: Columbia University Press, (2000).

Brain-Wise: Studies in Neurophilosophy, *by Patricia S. Churchland*. Cambridge: MIT Press (2002).

The Quest for Consciousness: A Neurobiological Approach, *by Christof Koch*. Englewood: Roberts and Company (2004).

A Universe of Consciousness: How Matter Becomes Imagination *by Gerald M. Edelman and Giulio Totoni.* New York: Basis Books (2000).

Wider Than the Sky: The Phenomenal Gift of Consciousness, *by Gerald Edelman*. New Haven, CT: Yale University Press (2004).

The Psychobiology of Gene Expression, *by Ernest L. Rossi.* New York: W. W. Norton (2002).

Biography

Aline LaPierre, Psy.D., is a somatically trained licensed psychotherapist in private practice in Los Angeles. She is a graduate of Pacifica Graduate Institute, Santa Barbara, and Ryokan College, Los Angeles. She is a core faculty member in the somatic psychology doctoral program at Santa Barbara Graduate Institute, a clinical associate at the Los Angeles and Southern California Psychoanalytic Institutes, and a member of the Allan Schore study group on regulation theory and developmental affective neuroscience. She can be reached at aline@cellularbalance.com.

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CRITERIA FOR ACCEPTANCE
How does material in this manuscript inform the field and add to the body of knowledge? If it is a description of what we already know, is there some unique nugget or gem the reader can store away or hold onto? If it is a case study, is there a balance among the elements, i.e, back ground information, description of prescribed interventions and how they work, outcomes that add to our body of knowledge? If this is a reflective piece, does it tie together elements in the field to create a new perspective? Given that the field does not easily lend itself to controlled studies and statistics, if the manuscript submitted presents such, is the analysis forced or is it something other than it purports to be?

PURPOSE
This peer-reviewed journal seeks to support, promote and stimulate the exchange of ideas, scholarship and research within the field of body psychotherapy as well as an inter-disciplinary exchange with related fields of clinical practice and inquiry.

To ensure the confidentiality of any individuals who may be mentioned in case material, names and identifying information have been changed. It must be understood, however, that although articles must meet academic publishing guidelines, the accuracy or premises of articles printed does not necessarily represent the official beliefs of the USABP or its Board of Directors.

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First consideration will be given to articles of original theory, qualitative and quantitative research, experiential data, case studies, as well as comparative analyses and literature reviews. Submission of an article to the *USA Body Psychotherapy Journal* represents certification on the part of the author that it has not been published or submitted for publication elsewhere.

Initial submission should be e-mailed to jacarletonphd@gmail.com as an attachment in Microsoft Word.

Manuscript should be double-spaced in 10pt. type, with at least a one inch margin on all four sides-please include page numbers, otherwise manuscript should be free of other formatting.

Title, full authorship, **abstract of about 100 words and 3-5 key words precde the text.** Please include an endnote with author's degrees, training, mailing address, e-mail fax, acknowledgement of research support, etc.

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References: References within the text should include author's surname, publication date and page number.

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The editors are eager to receive letters, particularly communications commenting on and debating works already published in the journal, but also suggestions and requests for additional features or departments. They may be sent to the email address below. A selection of those received will be published in the next volume of the journal.

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