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The New Neuroscience School of Therapeutic Hypnosis, Psychotherapy, and Rehabilitation

by Ernest L. Rossi, Ph.D., Salvatore Iannotti, MD, and Kathryn L. Rossi, Ph.D.

ERNEST ROSSI, Ph.D. is the author of The Psychobiology of Gene Expression: Neuroscience and Neurogenesis in Hypnosis and the Healing Arts (W.W. Norton Professional Books, 2002). He received the Lifetime Achievement Award for Outstanding Contributions to the Field of Psychotherapy from the Erickson Foundation in 1980 and The American Association of Psychotherapy in 2003. He teaches workshops in Ericksonian Hypnosis at ZIST, Penzberg, Germany lutz.bessel@zist.de

ABSTRACT

Currently the healing arts are witnessing a tremendous infusion of fundamentally new discovery from neuroscience and functional genomics that has important implications for understanding the human condition at the deepest levels. This paper outlines four basic principles of our New Neuroscience School of Therapeutic Hypnosis, Psychotherapy, and Rehabilitation for training a new generation of students and professionals to integrate these discoveries with the traditional clinical arts. We propose that many phenomena associated with therapeutic suggestion, psychotherapy, and rehabilitation are the phenotypic or observable cognitive-behavioral manifestations of *activity-dependent gene expression, brain plasticity, and mind-body healing* in the construction and reconstruction of consciousness, memory, learning, and behavior. A general model of the creative process of gene expression and brain plasticity is used to illustrate the new neuroscience of therapeutic suggestion in activity-dependent hypnosis, psychotherapy and rehabilitation.

We introduce four principles of our New Neuroscience School of Therapeutic Hypnosis, Psychotherapy, and Rehabilitation in the healing arts. We begin with a review of how gene expression and brain plasticity have emerged as the core of the construction and reconstruction of memory, learning, and behavior during our natural daily rhythms of waking, working, sleeping, dreaming, and healing. New concepts of the relationships between gene expression, brain plasticity, and consciousness offer a new vision of human nature that is leading to a renais sance in our deepest philosophical and spiritual understan ding of life, meaning, and healing. We are continually engaged in the reconstruction and re-synthesis of mind, consciousness, meaning, and healing during our natural daily cycle of growth, exploration, and healing as illustrated in Figure one.

The mind-body healing cycle of Figure one illustrates the circular bioinformatics communication loop between the psychosocial experiences of (1) observing consciousness, (2) mirror neurons, (3) the gene expression/

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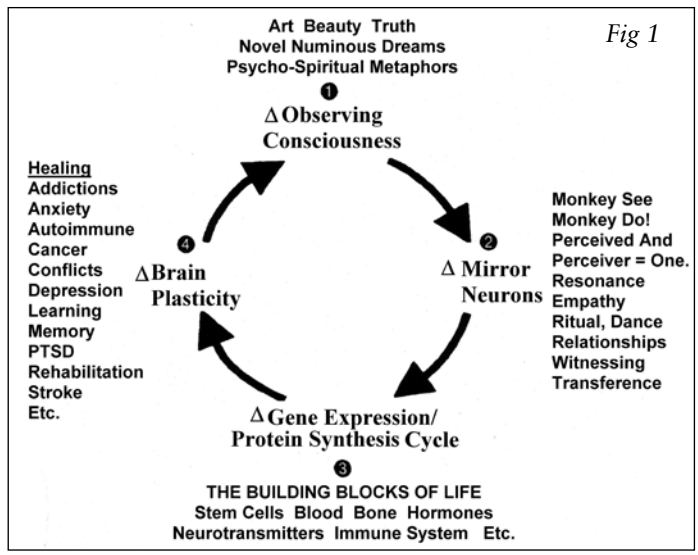
protein synthesis cycle, and (4) brain plasticity, which leads to further iterations of new consciousness and healing *ad infinitum*. This mind-body healing cycle comes as a surprise to most people when they realize how the frontiers of current neuroscience suggest a new vision of the meaning of art, beauty, and truth for understanding the human condition and healing. Charles Darwin (1871) pointed out the importance of beauty in sexual selection in human evolution, for example, in his book, *The Descent of Man*. This interpretation of the role of beauty and related experiences in art and truth is to be vastly preferred to the common misconception of evolution as implying only "survival of the fittest" and "nature red in tooth and claw" for a philosophy of life. More recently Roughgarden et al. (2006) have documented how a mathematical game theory of cooperative social interaction leads to a more comprehensive understanding of human reproductive behavior than a narrow interpretation of Darwin's sexual selection theory that emphasizes the concept of selfish genes and memes (memory and cognitions analogous to genes) in competition for survival (Dawkins, 1976).

Figure 1. The Mind-Body Healing Cycle from Consciousness to Brain Plasticity. *Heightened experiences of art, beauty, and truth can attract (1) Observing Consciousness, which activates (2) Mirror Neurons and associated experiences of empathy, transference, and rapport to turn on their (3) Gene Expression/Protein Synthesis Cycle to make the Building Blocks of Life, which generate (4) Brain Plasticity and the possibility of Healing many body dysfunctions on the molecular-genomic level, which leads to another round of observing consciousness. This normal mind-body loop of communication, self-creation, and healing, which cycles every ~90 – 120 minutes throughout the ~ 24 hour circadian day, is the natural life process we attempt to access and facilitate with our innovative activity-dependent neuroscience approaches to therapeutic hypnosis, psychotherapy, and rehabilitation.*



It is now well known that our genes create the proteins that are the building blocks of life, which make up the psychophysiology of the body, brain, behavior, consciousness, and personality. From this perspective we could define and consciousness as a phenotype (outer manifestation) of gene ontology (biological history at the molecular-cellular level). It is usually not recognized, however, how the reverse is also true: the feedback loops of consciousness heightened with numinous experiences of art, beauty, and truth of Figure one can heighten the activity level of our mirror neurons so that they turn on their gene expression/protein synthesis cycle to construct the building blocks of life. We could express the essence of this new vision of mind-body communication and healing with a single sentence. *Our novel and numinous experiences of fascination with the mysteries of the world and ourselves excite the mirror neurons of our brain to turn on the gene expression/protein synthesis cycle and brain plasticity for the continual construction and re-construction of our consciousness and health in our daily life and dreams.* The profound significance of this new neuroscience approach to therapeutic hypnosis, psychotherapy, and rehabilitation can be appreciated with even a brief introduction to four innovative ideas from current neuroscience (Rossi, 1986/1993, 2002, 2004, 2005).

1. Elevated Gene Expression Levels Generate Elevated Levels of Neuronal Activity that Distinguish Human Brains from Non-Human Primates

How can we account for the differences between human consciousness and culture in comparison with other primates when they all have about the same number of genes (~24,000), which are more than 99% alike? Current neuroscience presents experimental data on how human brain activity is distinguished from that of non-human primates at the level of gene expression and brain plasticity. A DNA microarray revolution is currently exploring the special qualities of human brain evolution (Preuss et al., 2004). Cáceres et al. (2003) summarize their research in this area as follows.

Little is known about how the human brain differs from that of our closest relatives. To investigate the genetic basis of human specializations in brain organization and cognition, we compared gene expression profiles for the cerebral cortex of humans, chimpanzees, and rhesus macaques by using several independent techniques. We identified 169 genes that exhibited expression differences between human and chimpanzee cortex, and 91 were ascribed to the human lineage by using macaques as an outgroup. Surprisingly, most differences between the brains of humans and non-human primates involved up-regulation, with ~90% of the genes being more highly expressed in humans. By contrast, in the comparison of human and chimpanzee heart and liver, the numbers of up- and down-regulated genes were nearly identical. Our results indicate that the human brain displays a distinctive pattern of gene expression relative to non-human primates, with higher expression levels for many genes belonging to a wide variety of functional classes. The increased expression of these genes could provide the basis for extensive modifications of cerebral physiology and function in humans and suggests that the human brain is characterized by elevated levels of neuronal activity." (pp. 13030, italics added)

These elevated levels of gene expression and neuronal activity in the human brain remind us of the heightened psychological experiences of focused consciousness (*monoideism*) and *fascination,* which were key concepts in early descriptions of the psychophysiology of therapeutic hypnosis by James Braid (1855/1970) outlined in his book, *The Physiology of Fascination,* as follows.

With the view of simplifying the study of reciprocal actions and reactions of mind and matter upon each other... the [hypnotic] condition arose from influences existing within the patient's own body, viz., the influence of concentrated attention, or dominant ideas, in modifying physical action, and these dynamic changes re-acting on the mind of the subject. I adopted the term 'hypnotism' or nervous sleep for this process . . . And finally as a generic term, comprising the whole of these phenomena which result from the reciprocal actions of mind and matter upon each other, I think no term more appropriate than 'psychophysiology'."(In Tinterow, 1970, Pp. 369-372, italics added).

Cáceres et al. (2003) do not discuss therapeutic hypnosis and the healing arts in their paper on elevated gene expression and heightened neuronal activity in the human brain but their research has important implications for a new theory of therapeutic hypnosis, psychotherapy, and rehabilitation at the molecular-genomic level. They discuss the genes they found related to higher levels of neuronal activity that may contribute to heightened behavioral, emotional and cognitive states of consciousness as follows.

The identification of the genes that exhibit regulatory changes in adult human cortex provides clues to the biochemical pathways and cell-biological processes that were modified during evolution. *The apparent up-regulation of so many different genes suggests, among other things, that the general level of neuronal activity and the metabolic processes that support it may be unusually high in human cortex.* Consistent with this is the up-regulation of genes involved in synaptic transmission, including the control of glutamatergic excitability (*SYN47*, also known as Homer 1b), plasticity at glutamatergic synapses (*CAMK2A*), phosphatidylinositol signaling (*IMPA1, CDS2*), synaptic vesicle release (*RAB3GAP, ATP2B1*), axonal transport along microtubules (*KIF3A, DCTN1*), microtubule assembly (*MAP1B*), and targeting of proteins

to postsynaptic densities (*USP14*). *We have also found expression changes related to energy metabolism*. For example, *CA2*, which is expressed in glia, has been related to the generation and transport of lactate by astrocytes for use by neurons as an energy source. To our knowledge, the possibility that the human brain has an unusually high metabolism has not been previously considered. Typically, larger brains have lower metabolic rates (per unit of tissue) than smaller brains. Nevertheless, recent studies with imaging techniques to measure cerebral glucose metabolism in the conscious state suggest that metabolic rates are as high or even higher in humans than in macaques. *Higher levels of neuronal activity are likely to have important consequences in cognitive and behavioral capacities,* and of the genes up-regulated in humans, *CAMK2A* is involved in learning and memory, and mutations of *GTF2I* (Williams syndrome), *CA2* (marble brain disease), and *SC5DL* (lathosterolosis) have been linked to mental retardation." (pp. 13034)

At the present time it is not known to what degree the daily expression of these genes and their associated states of neuronal activity are related to human experiences of consciousness, therapeutic hypnosis, psychotherapy, and rehabilitation. The DNA microarray approach could be applied in many interesting ways to current theories of consciousness and its activities at the molecular-genomic level, however (Rossi, 2005/2006). Crick and Koch (2005), for example, have proposed that the claustrum is a little known part of the brain that may be a key to understanding the dynamics of consciousness. The claustrum is a thin layer of gray matter that functions as a two-way street between the higher cortex of the brain and the lower sub-cortex involved in processing sensations, emotions and other activities involved in consciousness. Crick and Koch interpret the probable function of claustrum to the role of an orchestra conductor who integrates the activities of the individual musicians into the holistic experience of consciousness (Bittman et al., 2005). It will be a challenge to design research with brain imaging in combination with DNA microarrays to determine to what degree the claustrum preferentially expresses the 196 genes, which Cáceres et al. (2003) found associated with the heightened activation of neural activity in the human brain. It will be an even greater challenge to assess our molecular-genomic theories of therapeutic hypnosis, psychotherapy, and rehabilitation with such research.

2. The Neuroscience of Mirror Neurons: Empathy, Rapport, & Transference

What is the basic talent of all students and professionals in the healing arts? We believe that the discovery of mirror neurons by Giacomo Rizzolatti and his research team at the University of Parma in Italy may provide an important clue for a new answer. Rizzolatti and Arbib (1998) describe their work as follows.

In monkeys, the rostral part of ventral premotor cortex (area F5) contains neurons that discharge, *both when the monkey grasps or manipulates objects and when it observes the experimenter making similar actions. These neurons (mirror neurons) appear to represent a system that matches observed events to similar, internally generated actions, and in this way forms a link between the observer and the actor.* Transcranial magnetic stimulation and positron emission tomography (PET) experiments suggest that a mirror system for gesture recognition also exists in humans and includes Broca's area. *We propose here that such an observation/execution matching system provides a necessary bridge from 'doing' to 'communicating', as the link between actor and observer becomes a link between the sender and the receiver of each message* (p. 188, italics added).

This *"observation/execution matching system,"* which *"provides a necessary bridge from 'doing' to 'communicating', as the link between actor and observer"* appears to provide a neural mirroring system *for a new neuroscience theory of therapeutic hypnosis, psychotherapy, and rehabilitation.*

A more recent study by Fogassi, Ferrari, Gesierich, Rozzi, Chersi, & Rizzolatti (2005) generalizes the function of mirror neurons in observation, behavior, cognition, and "mind reading" in a manner that may have important implications for new approaches to the healing arts.

Inferior parietal lobule (IPL) neurons were

studied when monkeys performed motor acts embedded in different actions and when they observed similar acts done by an experimenter. Most motor IPL neurons coding a specific act (e.g., grasping) showed markedly different activations when this act was part of different actions (e.g., for eating or for placing). Many motor IPL neurons also discharged during the observation of acts done by others. Most responded differentially when the same observed act was embedded in a specific action. *These neurons fired during the observation of an act, before the beginning of the subsequent acts specifying the action. Thus, these neurons not only code the observed motor act but also allow the observer to understand the agent's intentions* (p. 622)... *Understanding "other minds" constitutes a special domain of cognition.* Brain imaging studies suggest that several areas might be involved in this function. *Given the complexity of the problem, it would be naïve to claim that the mechanism described in the present study is the sole mechanism underlying mind reading, yet the present data show a neural mechanism through which a basic aspect of understanding intention may be solved. Furthermore, they represent an examp-le of how action and cognition are linked with one another and how the refinement of the motor organization may determine the emergence of complex cognitive functions.* (p. 666, italics added).

We can observe the profound implications of the role of mirror neurons in explaining, "*how action and cognition are linked with one another"* by examining the classical Penfield & Rasmussen (1950) image of the sensory-motor homunculus of the human brain. Figure two illustrates how human evolution has selected for much larger areas of the human brain cortex to map important details of the face (emphasizing its importance for communication and *cognition*) and the hands for *actions* and manipulation.

Human speech and hands are of primary importance in both verbal and non-verbal communication in recent innovative activity-de-

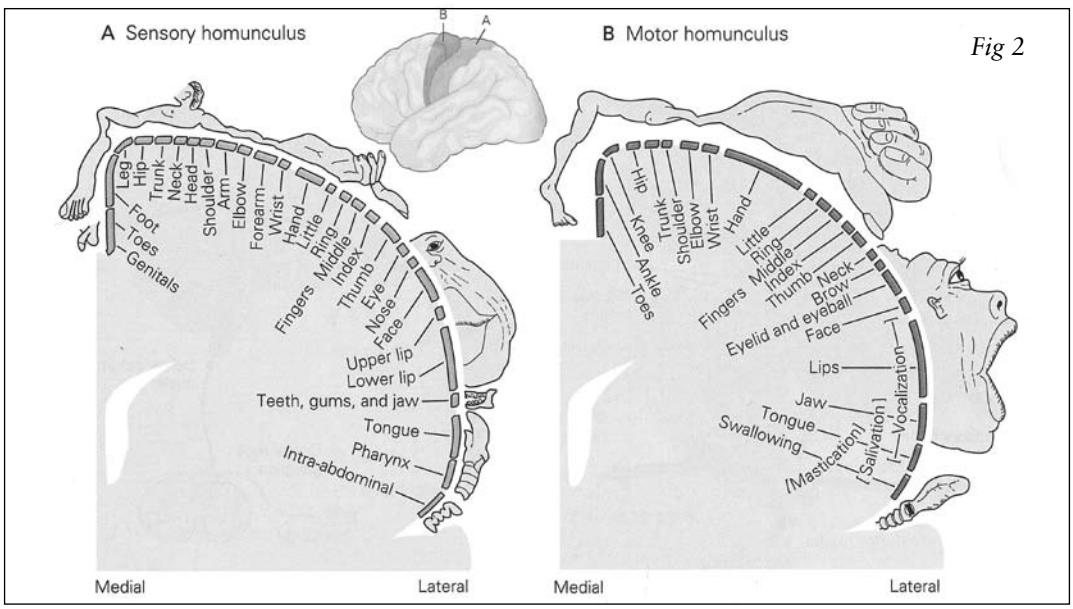


Figure 2. Penfield and Rasmussen's Sensory-Motor Homunculus of the Cortex of the Human Brain. *The apparent distortions of the human body image actually are valid approximations of the amount of the cortex that evolution has selected to encode the sensory and motor activities of various areas of the body. Notice how the oversize of the hands and lip-tongue-face anatomy reflects the large areas of the brain that evolution has selected to map these two important areas of grasping and communication for survival. These areas of hand and finger signaling as well as facial cues and speech are utilized in our innovative activity-dependent neuroscience approaches to therapeutic hypnosis, psychotherapy, and rehabilitation (Rossi, 2002, 2004, 2005a-f).*

pendent approaches to therapeutic hypnosis, psychotherapy, and rehabilitation (Rossi, 1986/1993, 2002, 2004, 2005a-f).

From a historical perspective the experience of understanding *"other minds"* via mirror neurons would appear to be the essence of what has been called *"rapport"* in the traditional literature of therapeutic hypnosis, *"empathy"* in psycho-therapy, and *"transference"* in psycho-analysis. We propose that mirror neurons bridge the so-called *"Cartesian mind-body gap"* for a new empirical theory of the creation and transformations of memory, learning, behavior, and consciousness throughout the life cycle in trauma, stress, sickness, and health as implied in Figure three.

Figure three is an up date of Kandel's summary of his Nobel Prize winning work illustrating how sensory neurons receive and transmit stimuli to motor neurons that demonstrates how activation of mirror neurons may turn on the gene expression/protein synthesis cycle and brain plasticity (Kandel, 2000; Rossi, 2002, 2004). Ordinary experiences of short-term memory and learning (~20 minutes) transmit stimuli from modulatory sensory neurons to motor neurons in the short gap across synapses via neurotransmitters in brief pulses lasting only milliseconds. Novels, surprising, or stressful experiences, however, require a much longer route to the nucleus of the mirror neuron where the gene expression/protein synthesis cycle is activated (labeled "Returning Arrow to the Genes" in Figure three). This longer route of the activity-dependent gene expression/protein synthesis cycle generates the growth of new synaptic connections, which are the essence of brain plasticity that encodes novel, surprising, and complex experiences into new memory, learning, and consciousness.

We propose that this circular loop of information between observing consciousness, mirror neurons, the gene expression/protein synthesis cycle, and brain plasticity that encodes the transformations of consciousness and our sense of self and free will bridges the so-

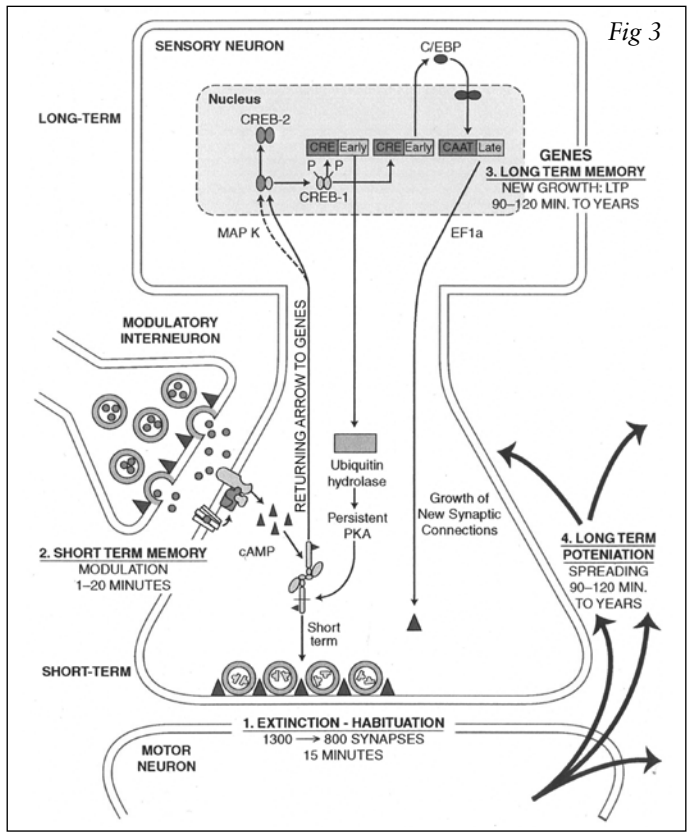


Figure 3. How Mirror Neurons Access the Gene Expression/Protein Synthesis Cycle to Bridge the Cartesian Gap between Mind and Body. *1. The usual learning processes of Extinction and Habituation and (2) Short Term Memory (~ 20 minutes) of the ordinary activities of consciousness in daily life require only communication between synapses of neurons via neurotransmitters. When we experience much the much stronger stimulation of novel, numinous, fascinating, and motivating situations of important life transitions, however, another molecular-genomic pathway to the nucleus of the neuron is activated (RETURNING ARROW TO GENES) to turn on the gene/expression protein synthesis cycle of (3) LONG TERM MEMORY and the Growth of New Synaptic Connections. (4) Two way communication between one neuron and the next activates LONG TERM POTENTIATION to encode new memory, learning and states of consciousness, which can require ~90-120 to years in the natural life cycle.*

called mind-body gap. This much longer process of long term memory, learning, consciousness and personality requires ~90-120 minutes, which accounts for the typical Basic Rest-Activity Cycles of everyday life as well as our dream (REM) cycles (Rossi, 2002, 2004, 2005a-f).

3. Novel and Motivated Activity Creates New Neurons and Consciousness

Previous generations regarded the brain as a hard-wired organ that did not replace its cells throughout life. During the 1990, however, it was learned that the experiences of novelty, social enrichment, and exercise (mental as well as physical) could activate stem cells in the brain to mature into new neurons that could encode new memory, learning, and consciousness (Rossi, 2002, 2004, 2005a-f; Van Praag et al., 2002). The hippo-campus was documented as a key memory center, and proved to be a central locus for neurogenesis in mice and men. More recently neuroscientists have reported that synapses formed by newborn neurons in the adult hippocampus are more malleable than those of more mature neurons. These new neurons are more easily activated by new experiences than old neurons and therefore strengthen or weaken their synaptic connections with other neurons in the dynamics of brain plasticity. Miller (2006) reports current views expressed at a recent symposium of neuroscientists.

Bischofberger and others presented additional details on *the physiology of new neurons that suggest activity is a key to survival.* Adult-born neurons that don't pick up on the buzz of electrical activity among their neighbors and add something useful to the conversation are less likely to integrate into the existing neural circuitry. And failure to fit in can be lethal to those new neurons, just as it can be in the developing brain, where neural activity helps weed out bad connections. "During early development, there's a critical period where neurons are capable of a greater degree of plasticity," says Linda Overstreet Wadiche, a neuroscientist at Oregon Health & Science University in Portland. *Much of the new work is converging on the idea that adult-born neurons recapture this youthful flexibility,* Wadiche says: "It's not just that adult neurogenesis is adding new cells; it's adding a new type of neuron." Kempermann theorizes that new neurons optimize the hippocampus to process novel and complex stimuli. Based on his data, Macklis suspects a similar role for new neurons in the olfactory bulb. *Both brain regions are ancient structures that help animals deal with novel and complex features of their surroundings... New neurons may give these parts of the brain additional plasticity that couldn't be accomplished by tweaking existing synapses, as happens throughout the brain. "It makes sense evolutionarily that one would want to … allow whole new circuits to form by the integration of a steady stream of new neurons."...* A better understanding of the physiology of new neurons in healthy brains should help researchers evaluate the role of adult neurogenesis in the diseased brain as well. An uptick in neurogenesis, perhaps as a compensatory response, has been proposed to accompany several types of brain injury, including stroke and neurodegenerative disorders such as Alzheimer's and Parkinson's disease. There's also evidence that depression reduces neurogenesis and that antidepressant drugs work by promoting it, at least in rodents... Yet little is known about whether newborn neurons in diseased brains successfully integrate into existing circuitry, let alone whether they could be exploited to restore the function of damaged circuits. (p 393-394, italics added here).

Schmidt-Hieber, Jonas, and Bischofberger, J. (2004) describe how the activity of these new neurons differ from older neurons in the brain as follows:

Neural stem cells in various regions of the vertebrate brain continuously generate neurons throughout life. In the mammalian hippocampus, a region important for spatial and episodic memory, thousands of new granule cells are produced per day, with the exact number depending on environmental conditions and physical exercise. The survival of these neurons is improved by learning and conversely learning may be promoted by neurogenesis. Although it has been suggested that newly generated neurons may have specific properties to facilitate learning, the cellular and synaptic mechanisms of plasticity

in these neurons are largely unknown. *Here we show that young granule cells in the adult hippocampus differ substantially from mature granule cells in both active and passive membrane properties. In young neurons*, T-type Ca^{2+} channels can generate isolated Ca^{2+} spikes and boost fast Na^{+} action potentials, contributing to the induction of synaptic plasticity. Associative long-term potentiation can be induced more easily in young neurons than in mature neurons under identical conditions. *Thus, newly generated neurons express unique mechanisms to facilitate synaptic plasticity, which may be important for the formation of new memories.* (p. 184, italics added)

Lisman & Morris (2001) describe how the creative replaying of neuronal activity generates brain plasticity between different areas of the brain as follows:

These findings were brought to bear on the 'consolidation' theory of memory. According to one mechanistic explanation of this idea, newly acquired sensory information is funneled through the cortex to the hippocampus. Surprisingly, only the hippocampus actually learns at this time – it is said to be online. Later, when the hippocampus is offline (probably during sleep), *it replays stored information*, transmitting it to the cortex. The cortex is considered to be a slow learner, capable of lasting memory storage only as a result of this *repeated replaying of information by the hippocampus.* In some views, the hippocampus is only a temporary memory store – once memory traces become stabilized in the cortex, memories can be accessed even if the hippocampus is removed. *There is now direct evidence that some form of hippocampal replay occurs...* These results support the idea that the hippocampus is the fast online learner that "teaches" the slower cortex offline. (p. 248-249, italics added)

It is precisely this updating and therapeutic replay between the hippocampus, cortex and other parts of the brain and body that we believe is the essence of all creative mind-body processes of alternative or complementary medicine that make up the curriculum of The New Neuroscience School of Therapeutic Hypnosis, Psychotherapy, and Rehabilitation.

4. Therapeutic Reconstruction of Consciousness During Life Transitions

Many neuroscientists are currently investigating the time parameters of activity-dependent gene expression and brain plasticity in the dynamics of development in early as well as adult memory, learning, stress, trauma, and behavior change during important life transitions. Cohen-Cory (2002) summarized these time dynamics at the synaptic level that are evident in mind-body symptoms and healing as well.

During development, more synapses are established than ultimately will be retained. Therefore, the elimination of excess synaptic inputs is a critical step in synaptic circuit maturation. Synapse elimination is a competitive process that involves interactions between pre- and postsynaptic partners. The dynamics of synap-se formation and of synapse elimination may be much more rapid in the CNS than at the NMJ [Neuro Muscular Junction], where synapse elimination has been well characterized. At the vertebrate NMJ, a single muscle cell is initially innervated by multiple motor axons. *The transition from multiple innervations to innervation by a single motor axon occurs gradually as some terminal branches retract from each muscle fiber before others, a process requiring about 24 hours for withdrawal of the presynaptic terminal...* In the CNS, as with the NMJ, a developmental, activity-dependent remodeling of synaptic circuits takes place by a process that may involve the selective stabi-lization of co-active inputs and the elimination of inputs with uncorrelated activity. *The anatomical refinement of synaptic circuits occurs at the level of individual axons and dendrites by a dynamic process that involves rapid elimination of synapses. As axons branch and remodel, synapses form and dismantle with synapse elimination occurring rapidly, in less than two hours... hippocampal neurons in which glutamate receptor function was alte red demonstrated that synapse disassembly in the CNS occurs rapidly, within 1.5 hours after synapses are no longer functional* (p. 771)... *Studies investigating the effects of long-term synaptic plasticity have generally used experimental paradigms in which repetitive, high-fre quency stimulation gives rise to synaptic poten tiation [called long-term potentiation, LTP, which is a*

scientific name for the molecular dynamics of "long term memory"] that is accom panied by structural and molecular changes at the level of single synapses. (p. 773, italics added).

Notice how the 1.5 to 2 hours required for synaptogenesis and brain plasticity, as reviewed above by Cohen-Cory (2002), appears to be identical to Kleitman's 1.5 to 2 hour Basic Rest-Activity Cycle (BRAC), which is the fundamental time parameter of the REM dream cycle where it was originally discovered (Aserinsky & Kleitman, 1954; Kleitman & Rossi, 1992). The basic chronobiological life processes of homeostasis, adaptation (Lloyd and Rossi, 1992, 1993; Rossi, 1982, 1986, 1986/1993, 1996, 2002; Rossi & Nimmons, 1991), stress and trauma (Kaufer et al., 1998; Rossi, 2000a, b), memory, learning, and neurogenesis (Kandel, 2000) as well as the dynamics of neuroendocrinology, psychoimmunology, and therapeutic hypnosis all are associated with the chronobiology of Kleitman's BRAC. Synaptogenesis, neurogenesis, and brain plasticity are the most recent additions to the list of *complex adaptive systems of the BRAC* that are evident on all levels from the molecular-genomic to the cognitive-behavioral (Rossi, 2002, 2004, 2005a-f).

Ribeiro et al. (2004) documented how the BRAC operates during novelty-induced neuronal reverberation during sleep and dreaming as well.

The present findings and the current literature suggest instead that slow wave (SW) and REM (dream) sleep play separate roles on memory consolidation, with memory recall occurring during SW sleep and memory storage taking place during REM sleep. According to this view, the deleterious effects of sleep deprivation on memory consolidation would be a consequence of the disruption of the underlying neuronal reverberation and gene expression during SW and REM sleep, respectively... *In conclusion, sustained neuronal reverberation during SW sleep, immediately followed by plasticity-related gene expression during REM sleep, may be sufficient to explain the beneficial role of sleep on the consolidation of new memories*. (p. 135, Italics added).

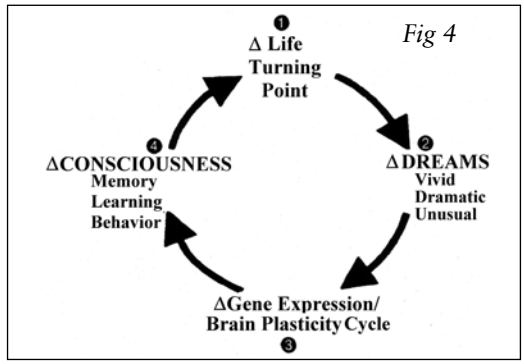


Figure 4. How Important Life Turning Points Engage the Gene Expression/Brain Plasticity Cycle During Vivid Dreams to Encode New Consciousness, Memory, Learning, and Behavior.

Previous research by Ribeiro et al. (1999, 2003) documented how novel and enrichening experiences during the waking hours of the day lead to the zif-268 gene being expressed during dream (REM) sleep. If there is no novelty during the waking hours the zif-268 gene, which expresses a neurotropic factor facilitating brain plasticity, is not turned on during sleep. We propose that these are the dynamics associated with the unusually vivid and dramatic "big dreams" that are experienced during the novel and often stressful turning points in the life cycle illustrated in figure four.

A theoretical profile illustrating how the well-researched 4-stage creative process (Smith, 1995; Wallas, 1926) of psychotherapy (Rossi, 1967, 1968) could be mapped onto the chronobiological dynamics of the BRAC is illustrated in figure five.

We propose that Milton H. Erickson's (2006) typical 1.5 to 2 hour sessions of therapeutic hypnosis, psychotherapy, and rehabilitation facilitated mind-body healing precisely when they engaged the molecular dynamics of the gene expression/protein synthesis cycle of the 1.5 to 2 hour Basic Rest-Activity Cycle (BRAC). Experimental support for this 4-stage profile of the creative process in therapeutic hypnosis, psychotherapy, and rehabilitation in figure five is implied by Levsky et al. (2002) who document similar chronobiological profiles at the level of single-cell gene expression that takes place during the typical 90-120 minute time parameter of Kleitman's BRAC.

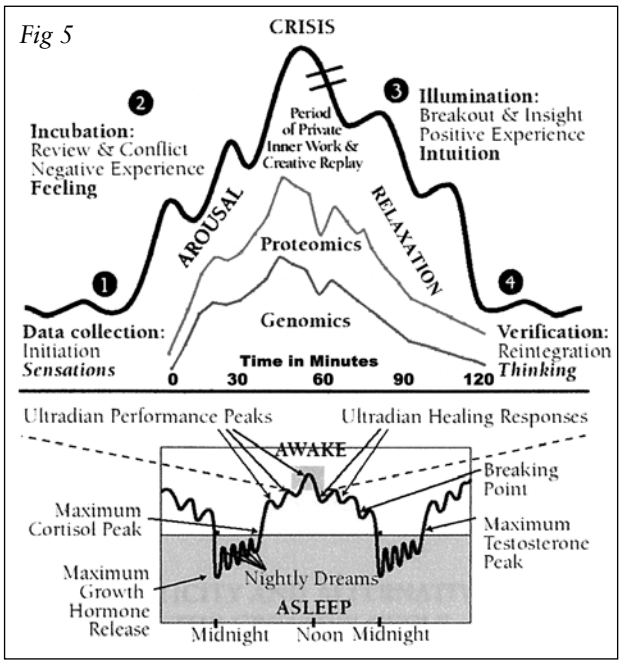


Figure 5. The Four-Stage Creative Process in Our New Neuroscience School of Therapeutic Hypnosis, Psychotherapy, and Rehabilitation. *The lower diagram illustrates Kleitman's 90–120 minute Basic Rest-Activity Cycle of waking, sleeping and adaptive psychophysiology for an entire day in a simplified manner. The ascending peaks of rapid eye movement (REM) sleep characteristic of nightly dreams every 90–120 mi-nutes or so are illustrated along with the more variable ultradian rhythms of activity, adaptation, and rest in the daytime Strickgold, R. (2005). This lower figure also illustrates how many hormonal messenger molecules of the endocrine system such, as growth hormone, the activating and stress hormone cortisol, and the sexual hormone testosterone, have typical circadian peaks at different times of the 24-hour cycle.*

The upper diagram outlines the basic neuroscience unit of psychotherapy as the creative utilization of one of the natural 90–120 minute ultradian rhythms of arousal and relaxation illustrated in the lower diagram. The classical four stages of the creative process: 1) Data collection; 2) Incu-bation; 3) Illumination; 4) Verification as documented by Wallas (1926) and discussed by Netz, (2002). Jung (1923) originally described how the four basic psychological functions of sensa-tions, feeling, intuition, and thinking were related to the dynamics of self-creation (individuation).

SUMMARY

Recent advances in neuroscience are generating profound insights into the traditional healing arts of therapeutic hypnosis, psychotherapy, and rehabilitation as well as art, beauty, and truth in philosophy, the humanities, and the sciences. This conceptual review outlines four basic principles of The New Neuroscience School of Therapeutic Hypnosis, Psychotherapy, and Rehabilitation.

1. Elevated gene expression levels generate elevated levels of neuronal activity that distinguish human brains and consciousness from other primates.
2. The new neuroscience of mirror neurons, empathy, rapport, and transference provides fresh insights into the basic psychosocial talent of all therapists.
3. Novel and motivated mental activity generate new neurons, meaning, and consciousness, which bridge the so-called "Cartesian gap between mind, body, and gene.
4. The normal process of the construction of consciousness, memory, and learning during important life transitions during waking, sleeping, and dreaming provide a natural model for our innovative neuroscience approaches to therapeutic hypnosis, psychotherapy, and rehabilitation.

We propose that the classical phenomena of therapeutic hypnosis describe the phenotypic or observable cognitive-behavioral manifestations of activity-dependent gene expression, brain plasticity, and mind-body healing in psychotherapy and rehabilitation. Research now is needed to evaluate the clinical efficacy of the 4-stage creative process in the reconstruction of consciousness, memory, and behavior in our innovative activity-dependent neuroscience approaches to therapeutic hypnosis, psychotherapy, and rehabilitation.

Correspondence Address:
Ernest Rossi
125 Howard Avenue
Los Osos CA 93402 USA
Phone: 805-528-0200
Fax: 805-528-0700
Email: Ernest@ErnestRossi.com

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