Gene Expression and Brain Plasticity in Stroke Rehabilitation:

A Personal Memoir of Mind-Body Healing Dreams

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ABSTRACT

In this persona memoir the author describes the process of his rehabilitation from stroke and the dream manifestations of his mind-body healing. He also shares his reminiscences about Erickson's physical difficulties as well as Erickson's naturalistic or activity-dependent approach to therapeutic hypnosis and rehabilitation. Rossi emphasizes what he considers the least understood and most under appreciated aspect of Erickson's hypnotherapy—the fact that his patients frequently experience intense emotional experiences as they access and replay their traumas in a therapeutic manner. He also speculates about the neural mechanisms of his rehabilitation from the standpoint of neuroscience theory and the novelty-numinosum-neurogenesis effect.

I was brutishly clubbed on the head in my sleep. I felt heavy and unable to move out of a cramped fetal position in the nightmarish darkness. I wanted to groan but could not. I did not know whether I was asleep or awake. But I must have opened one eye at least momentarily to glance at the dim luminous glow of a clock by my bed that registered about 2:30 a.m.

I awakened at about 4:30 a.m. with a strange sluggishness, stiffness and awkwardness of movement. I could hardly roll out of bed. I thought I was suffering from a sudden attack of arthritis or post-polio syndrome. I staggered to the medicine cabinet to try out some new anti-inflammatory medication my primary physician had give me a few days before. I wanted to record the exact time I took the medicine to see how long it took to give me relief. There was no paper handy so I tried to write "4:30" on the medicine package. But something was radically wrong with my writing; it was incredibly tiny and the numbers were written on top of each other! I thought it must be the unevenness of the writing surface on the medicine package. I finally found

a sheet of paper but my handwriting was no better – the numbers remained tiny and I was almost amused to realize I probably was experiencing micro-graphia for some unknown reason. But I was incredibly uncoordinated trying to take a shower and almost fell. It was a struggle to dress; my right leg could not find its way properly into my trousers. It wasn't till my wife awakened about two hours later that I realized I had badly slurred speech. A quick check of my face in the mirror revealed the truth: the right side of my face was pulled down completely out of its normal symmetry. I now knew I was experiencing a stroke. My wife, Kathryn, called the doctor and rushed me to the hospital in our van.

The CD player in our van automatically turned on playing my favorite contemporary composer, Kitaro. One passage of the music played a haunting drumbeat reminiscent of American Indian music. Suddenly I was seized with a paroxysm of hot tears as I glanced over the pristine countryside of the San Louis Obispo area through which we were driving on the way to the hospital. I was experiencing the truth of the deep tragedy of the American Indian Nation with what seemed to be a profound clarity - a cleansing of perception. Did not anyone else recognize the truth of this exquisite tragedy of the Indian Nation? Why wasn't something more being done to correct it! In reality I saw the mortified fear in my wife's face – she never saw me crying that way. She thought I was crying about myself and tried to reassure me. I had great difficulty with my slurred speech in trying to explain about the Indian Nation. I saw her growing alarm as she thought I was surely going daft. I now realized I was experiencing affect labiality, which is typical in stroke. I tried to calm down and smile to reassure her but all that came out was a strange, strangled laughing along with the tears that I still could not control.

The music of Kitaro continues to imbue me with a hypnotic focus of hyper-reality even today, a few months after that fateful ride, wherein the here-and-now was but froth on the time and space of eternity. It is the kernel of a personality change that is still taking place within me as I carefully cultivate a greater accessibility and expression of my emotions that my wife now greatly enjoys. Here is the record of a series of healing dreams I experienced during this period that seem to reflect Erickson's (1958/1980) naturalistic or activity-dependent approach to therapeutic hypnosis and rehabilitation.

The Body Out of Control (First week after the stroke)

I am driving on a freeway overpass but there is an accident and pile-up of cars ahead. Some people got out of their cars and went to the railing to get out of the way. But I fear I cannot stop my car because of some weakness in my leg and may run into them. I greatly fear that a tragic accident is about to take place.

This dream relates to the real weakness I feel throughout my body – especially on the right side. It really is a good idea not to drive at this time. I tell this dream to my physical therapist explaining how it probably related to my primary physician having to report my stroke to the DMV (Department of Motor Vehicles) by law and having my driver's license restricted. She looked at me softly and sympathetically but quietly questioned, "Have you considered the dream also could be reflecting your cerebral-vascular accident where the freeway was a blood vessel in your brain accidentally piling-up blood corpuscles?"

"Well, *yesh*," I slurred with a crooked little smile doing my best to make my face more symmetrical just to please her, "how come I did not think of that?"

Emergency Self-Observation of Lonely Radar: (Second week of recovery)

A small, lonely, emergency radar on an infinite, desolate, and dusty plain seemingly coughs, sputters erratically for a moment, and then shifts into scanning the sky rapidly in a circular pattern - frantically but futilely seeking a response. Gradually, in the far distance, I see a response beginning to develop on a computer screen. The image is a 3-D wire mesh outline of a human head circulating so one can get a complete 360-degree view of the interior of the head. With growing excitement I realize that it is a MRI image of my own head that may enable me to see the exact area of my brain that was damaged by the stroke. I start to go lucid in the dream: I realize that I am dreaming and if I can slow down the rotating image enough I will be able to see exactly where the damage is to better guide my rehabilitation program. The rotating image does indeed

slow down and I am just about to see the damaged area in my left cerebral hemisphere when I realize, “Oh, no, I am waking up!” I lose the image.

I am at first greatly disappointed when fully awakened because I could not exactly locate the damaged area. But gradually tears of gratitude come as I realize the most important significance of this dream. The lonely radar is a metaphor for a signaling system becoming activated in the self-reflective capacity of my mind-brain. My brain realizes that it is still in an emergency situation but enough recovery has taken place over the past two weeks so that at least a small radar is now operating seeking the information it needs to further direct its own self-repair.

It is well known that all cells of the brain and body are continually sending each other molecular messengers (neurotransmitters, hormones, growth factors etc.) to direct development, adaptation, and repair. The desolate plain is the damaged area of my brain where molecular signals from dead and still struggling neurons are thrashing about seeking contact and connection to reestablish lines of communication for my recovery. The dream inspires me to redouble my daily rehabilitation efforts in speech, memory, eye-hand coordination, balance and mildly strengthening physical exercises. I begin to go on little unsupervised walks around the block but I am not allowed to try to cross the street by myself yet.

My many rehabilitation therapists (occupational, speech, physical, neurologists, etc.) congratulate me on my positive attitude. They really don’t know half the story. My body is still very weak and uncoordinated. I have to hold the banister with two hands to get up and down stairs. My wife winces with worry as she watches me use both my arms to lift and haul my somewhat limp right leg into and out of our van. Paradoxically her worried wince evokes a grim satisfaction in me as I suddenly recall the analogous situation 30 years ago when the situation was reversed as I lifted the late Milton H. Erickson out of his wheel chair into his family’s old station wagon to take him for a drive through the deserts around Phoenix to visit rock shops. Then I was the one who winced with worry least I hurt Erickson as I hauled him about.

Erickson on the other hand, ever the healing mentor, tried to reassure me with his jaw firmly set in grim satisfaction as he told me yet another story about his efforts at self-rehabilitation from his lifetime of coping with polio. Life, he would explain, actually is a continuous process of rehabilitation. Every day and every moment when you *consciously choose* to work cheerfully and creatively with your handicap rather than complain - literally gives you a leg up. Getting in and out of an auto is *utilized as another opportunity* to gain yet another increment of muscle coordination and strength. He called this the essence of his *naturalistic or utilization approach* (Erickson, 1958/1980, 1959/1980). I now call it, "The Symptom Path to Enlightenment" (Rossi, 1996) whereby the *process of actively of coping with one's symptoms and problems* guides and facilitates real physical healing as well as further psychological development. This is the source of my positive attitude toward rehabilitation. It is Erickson's greatest legacy of healing although I could not appreciate its significance 30 years ago.

Erickson's Therapeutic Replaying in the Neuro-Psycho-Physiology of Hypnosis (Third week of recovery).

Real life circumstances of this dream: A neurologist filling out a routine medical form asks me if my illness has resulted in a loss of physical strength so that I can no longer do my job. I grimly grin at him with my best Ericksonian attitude and humorously respond, "Well, I'm not exactly an iron foundry worker you know." That night I have the following dream.

> A huge Paul Bunyan type man in the hellish glow of an iron foundry is using gigantic iron pliers and tongs to manipulate small metal objects. He is going to teach me how to do it skillfully. I am experiencing great awe that he notices me and I feel very grateful about the prospect his help.

I interpret this dream figure to be analogous to my occupational therapist who is, in reality, assessing and facilitating recovery of my damaged hand-eye coordination by giving me

many tasks involving puzzles, picking up small metal objects with tweezers etc. I tell him this dream and explain my interpretation: Paul Bunyan is a metaphor of an inner implicit healing process operating via activity-dependent gene expression and neurogenesis that hopefully are now being activated by all this occupational therapy to repair my brain. He has never heard of this new neuroscience of rehabilitation but I assure him that my new book is coming out soon so he can read about it (Rossi, 2002a). I'm just too exhausted to try to explain it all right now.

As I continue to emotionally replay this dream in active imagination the Paul Bunyan figure becomes evocative of the archetype of Vulcan. My Vulcan is somewhat like Mr. Spock of Star Trek fame. But he is Chinese blood red-orange with a thunderous body stretching from the center of the earth to the sky. He has huge massive muscles and an impassive mien. He does not speak and he hardly notices me but I am given to understand he actually is a genial gene genii ready, available, and fully capable of firing the sources of life should he be called.

Ok, so I'm calling, now! After a week or so of watching him do nothing but stand there silently poised with his huge iron tools, the Vulcan figure finally becomes activated in my imagination. One morning I awaken with grateful tears when I see Vulcan pounding a huge glowing gold ingot on a mighty anvil with flashing lightening leaping about with every stroke. I gain reassurance as I witness his continuing methodical pounding whenever I call him forth in my active imagination. On one level it is an awesome experience – a drama that I feel to be deeply healing. Simultaneously, on another level, I recognize with calm objectivity that this positive emotion is good for me so I try to replay it as long as I can. This inner drama wherein I am both healer and healed reminds me of Milton Erickson's emphasis on the value of such multi-level states in psychological development and healing.

This healing dream and emotionally heightened imagination implies that my rehabilitation will be facilitated by my being *actively and intensely engaged in the real and imaginative replay of exercises* like manipulating the tongs as illustrated with the Paul Bunyan figure representing the archetypal Vulcan.

This, ironically, is the substance of my new book (Rossi, 2002a) that was completed a few months before my stroke. Therein I discuss the possible molecular mechanism of

rehabilitation *via activity-dependent gene expression*. It is now intimated in the neuroscience that facilitating gene expression and *brain plasticity* (involving *synaptogenesis* as well as *neurogenesis* by stem cell differentiation and maturation in the brain) via *activity-dependent cognitive-emotional-behavioral experiences* is a basic mechanism of healing that makes rehabilitation possible (Cohen-Cory, 2002; Kandel, 1998; Nakatomi et al., 2003; Rossi, 2002b, 2003a, b & c). Patients with severe trauma resulting in loss or paralysis of sensory-motor functions due to physical injury, cardio-vascular accidents, stroke, etc., for example, can recover their abilities via occupational and physical therapy that works primarily by *activating their behavior* (Spedding et al. 2003). Until recently this molecular-genomic mechanism of rehabilitative healing by behavioral activation was not understood. *The new neuroscience hypothesis is that cognition and behavioral action initiates activity-dependent gene expression. This activity-dependent gene expression initiates healing by the generation of proteins that facilitate brain plasticity and stem cell differentiation into new tissues that can be initiated within minutes and continue for the hours, days, and weeks required for full rehabilitation* (Gage, 2000; Kempermann et al. 1997, 1999; Van Praag et al., 2002).

We do not yet know the full range and limitations of this new neuroscience approach to healing and rehabilitation (Johansson, B. (2000). It is now known, for example, that when experimental animals experience *novelty, environmental enrichment and physical exercise* the *zif-268 gene* is expressed during their REM sleep (Ribeiro et al., 1999). *Zif-268* is an *immediate-early gene* (IEG) and *behavioral-state related gene* that is associated with the generation of proteins and growth factors that facilitate synaptogenesis and neurogenesis, literally brain growth. Bentivoglio and Grassi-Zucconi (1999) ask questions about such genes that are of fundamental interest to therapeutic hypnosis.

> *IEG induction [within minutes] may reveal the activation of neural networks in different behavioral states.* Although stimulating, these findings leave unanswered a number of questions. *Do the areas in which IEGs oscillate during sleep and wake subserve specific roles in the regulation of these physiological states and in a general 'resetting' of behavioral states?* Is gene induction a clue to understanding the alternation of sleep and wake, and

REM and non-REM sleep? . . . Could behavioral state-related IEG induction underlie, at least in part, learning mechanisms? The oscillation of IEGs effects the expression of target genes, and thus brings about other questions: May the transcriptional cascade explain the biological need and the significance of sleep? *Does this explain the molecular and cellular correlates of arousal, alertness, and, more in general, of consciousness?* (p. 249, italics added).

Whitney et al. (2003) recently documented how individuality and variation in circadian gene expression patterns in human blood can be assessed with DNA microarray (gene chip) technology to investigate these questions.

Numerous studies have described efforts to map and characterize variations in human gene expression patterns associated with differences in cell and tissue type, physiological processes, and disease. . . *Profiles of gene patterns are also helping to define the complex biological processes associated with both health and disease in vivo.* . . The extent, nature, and sources of variation in gene expression among healthy individuals is a fundamental, yet largely unexplored, aspect of human biology. *Future investigations of human gene expression programs associated with disease, and their potential application to the detection and diagnosis, will depend upon an understanding of normal variation within and between individuals, over time, and with age, gender, and other aspects of the human condition.*

Peripheral blood is an accessible source of cells with which to investigate these questions. Moreover, circulating leukocytes can be viewed as scouts, continuously maintaining a vigilant and comprehensive surveillance of the body for signs of infection or other threats. *The gene expression responses of circulating leukocytes can potentially provide an early warning of the threats they may discover.* (p.1896, italics added)

This new technology of assessing rapidly changing profiles of gene expression (Rossi, 1999, 2000c, 2003a, b, c) during trauma, stress, and healing may provide the earliest and most sensitive measures of mind-body interactions modulated by therapeutic hypnosis. This means that DNA microarrays could used as a more sensitive, comprehensive, and reliable measure of neurogenesis and healing as an emerging neuroscience foundation for Erickson's naturalistic (1958/1980) and utilization approaches (1959/1980) to the "neuro-psycho-physiology" of therapeutic hypnosis and rehabilitation (Erickson, 1948/1980).

I recall and reread Erickson's naturalistic approach (1970/1980) in facilitating recovery in his psychotic patient "Edward C." by encouraging him to utilize his traumatic dreams by replaying them in a more innocuous and therapeutic fashion over and over in a series of sessions with hypnotherapeutic suggestions such as these.

> 'Dream the same dream with the same meaning, the same emotional significance, but with a different cast of characters. This time maybe it won't be so dark. Maybe you can see a bit more clearly. It won't be pleasant, but maybe it won't hurt so much. So go ahead as soon as you can and have your dream.' Within four minutes the dream developed; 20 minutes later, streaming with perspiration, Edward said, 'It was bad. It was awful bad. But it didn't hurt so much. . . Again he was asked to dream the same dream, but to dream it with less pain, less discomfort, and to dream more clearly – to see the characters more plainly. His fingers tightened on my hand, and the dream developed immediately. The observed behavior was essentially the same. The duration was again about 20 minutes. (pp. 62-63)

Such intense states of psychobiological arousal were characteristic of many of Erickson's case histories (Rossi, 1973) wherein '*therapy results from an inner resynthesis of the patient's behavior achieved by the patient himself*. . . this experience of re-associating and reorganizing his own experiential life that eventuates in a cure, not the manifestation of responsive behavior, which can, at best, satisfy only the observer. . .Not until sometime later did the therapist

[Erickson] learn by what train of thought he had initiated the *neuro-psycho-physiological process*. . . (pp. 38-39, italics added).

Similarly, Rudolph Otto (1923/1950) formulated the concept of the *numinosum*, as a state of heightened psychobiological arousal of *fascination, mystery, and tremendousness*, to describe the intense emotional arousal in spiritual experiences of naturalistic healing. I proposed the creative replay of the *novelty-numinosum-neurogenesis effect* as a neuroscience update of James Braid's (1855/1970) early concept of "The Physiology of Fascination" as the basic psychobiological mechanism of therapeutic hypnosis as well as healing via the cultural and spiritual arts (Rossi, 2002a).

> The *Creative Replay of the Novelty-Numinosum-Neurogenesis Effect in the Arts, Humanities, and Cultural Rituals:* Enriching positive life experiences that evoke the novelty-numinosum-neurogenesis effect during creative moments of art, music, dance, drama, humor, literature, spirituality, awe, joy, and cultural rituals can optimize the psychosocial genomics of consciousness, personal relationships, and healing.
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> The entire history of human approaches to healing that evoke the novelty-numinosum-neurogenesis effect — from ancient spiritual rituals of exorcism, shamanism, fire-walking, to the still "mysterious" methods of acupuncture, energy medicine, and neurofeedback is the data base for this hypothesis*. Psychobiological healing during ecstatic religious experiences of the numinosum involving a combined sense of fascination, the mysterious, and the tremendous has much in common with modern rituals of healing associated with the self-help groups, twelve-step programs, and the so-called "miracle cures" of therapeutic hypnosis*. I hypothesize that just as negative states of emotional arousal can evoke the psychogenomic network to initiate gene expression cascades leading to the overproduction of stress proteins and illness, so can positive psychological experiences initiate the novelty-numinosum-neurogenesis effect to facilitate gene expression, neurogenesis, problem solving, and healing. (p. 243)

A Dream of Numinous Beauty and Clarity: (Fourth week of recovery)

I enjoy the numinous beauty and wonderment of looking through a new clear crystal cover on our swim spa seeing the delightful light blue, clean water in the sparkling sunlight.

We actually don't have such a new crystal cover over our swim spa but one does not have to be a rocket scientist to realize this dream is a metaphor for some sunlight clarity coming into the waters of my brain. A battery of psychological tests administered to me at this time tells the story of my mental status in a stark manner that clearly outlines my assets and deficits. The good news is that my *abstract reasoning* is at the 99th percentile level and my capacity for *mental organization* is at the 97th percentile. The bad news is that I am way below normal in *perception and discrimination* at the 45th percentile level and, even worst, is my *short-term memory*, which is down to the 37th percentile.

I spend several afternoons sitting entranced in the sunlight gazing into the clear crystal water of our swim spa with a deep hunger to drink it all in somehow to assuage my still stunned brain. For the longest time it seems I find myself struggling to recall the words of the poem *Vacillation,* by Yeats (Finneran, 1997), which I once knew so well.

My fiftieth year has come and gone,
I sat, a solitary man,
In a crowded London shop,
An open book and empty cup
On the marble table-top.

While on the shop and street I gazed
My body of a sudden blazed;
And twenty minutes more or less
It seemed, so great my happiness,
That I was blessed and could bless.

After I repeatedly replay this dream in active imagination with wisps of poetry throughout the day for many days, it finally dawns on me that my hunger and preoccupation with the numinous experience of crystal clarity may be an example of the novelty-numinosum-neurogenesis effect. *The psychological experience of numinous beauty, wonderment, and crystal clarity may correspond to the activation of gene expression and brain plasticity to facilitate the healing* of my *perception and discrimination,* which is way below par at the 45th percentile level. I muse over the similarity of the three psychological qualities characteristic of the numinosum (*fascination, mysteriousness, & tremendousness*) in spiritual development and the three facets of *novelty, environmental enrichment and physical exercise* that neuroscience now finds characteristic of the development of consciousness (memory, learning etc.) via activity-dependent gene expression, synaptogenesis, and neurogenesis to build a better brain in daily life.

After replaying the numinous beauty of this dream for weeks I have a particularly vivid experience of it, an epiphany of sorts, while listening to a live performance of The Russian National Orchestra's rendition of Mussorgsky's (2002) "Pictures at an Exhibition." The program notes quote Mussorgsky's description of his creative fervor while composing this piece: "Ideas, melodies, come to me of their own accord . . . I gorge and overeat myself. I can hardly manage to put it all down on paper fast enough." Likewise, while listening to this performance, I have a similar experience by recognizing how music, art, poetry, philosophy, and science all come together as one in a new theory of aesthetics: *the numinous experience of beauty could generate gene expression, neurogenesis, and the actual reconstruction of the brain during creative moments described by John Keats as the equivalence of truth and beauty.* At this moment all these connections seem to be an astonishing reification of Jung's (1916/1960; 1966) concept of "The psychological 'transcendent function' [that] arises from a union of conscious and unconscious contents as well as the real and imaginary" (p. 69).

Is my repeated replaying of the numinous beauty and clarity of this dream a *novel, enrichening, exercise* that can facilitate neurogenesis so that my *perception and discrimination* will really improve? Can the numinous experiences of mind really facilitate physical healing on the molecular level in this way? The next dream certainly suggests continuing rehabilitation via

the very acute perceptions and fine discriminations that are now taking place between the various sides of my personality in creative confrontation with each other.

Caring for a Lost Inner Personality: (Eighth Week of Recovery)

> I am in the back seat of a car crowded with people. Suddenly the police force our car to stop and surround us with drawn guns to capture a dangerous person in the front seat. It is a tense and frightening moment but I remain calm, cool, and competent carefully sizing up the situation. I surreptitiously open the back door a bit and signal the police not to shoot because I was confident I could talk the dangerous fellow into giving up peacefully.
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> I then turn my full attention to the white frightened face of the dangerous fellow in the front seat - he is clutching a canvas bag with a hole burned through it by some acid he is hiding inside. He murmurs in a pathetic far away voice, "I want some more acid." I think to myself, 'Oh, my poor dear fellow, what would you want with more acid?' But instead of confronting him with such a question I simply smile gently to support him with the words, "Of course, let's figure out together how we can get you the *kind of acid* you want so you can get the *kind of help* you really need." I seem to be going lucid in this last part of the dream wherein I am consciously using a therapeutic approach called "presupposition," or "reframing" (or "over-lapping," or "hitchhiking one idea on another"). My plan is to carefully shift him away from the *kind of acid* he says he wants towards the *kind of psychological help* he really needs.

I am very comfortable with this dream, which I recognize as part of the continuing saga of a highly introverted part of me that seems to have had a hidden independent existence since my earliest childhood. It is probably no coincidence that this healing dream comes after 2 months of rehabilitation. It is well known in many stroke rehabilitation programs that the amount of recovery within the first few months pretty much tells the story of how much healing the patient will experience. This clinical experience is now confirmed by neuroscience research on neurogenesis (brain growth) and healing that is well summarized by Henrietta van Praag et al. (2002).

> Our findings demonstrate that newly generated cells mature into functional neurons in the adult mammalian brain. . . We have identified one-month-old neurons with functional properties similar to those of mature dentate granule cells in the adult hippocampus. We also show that newly generated neurons are initially smaller and reach a more mature morphology after 4 months. (p. 1030)

A Dream of Recovery (One year of recovery)

> I am a mental patient in a gray, barren, and dark institution. I walk along the main hall with a huge, disheveled man who is a mental patient and a friend of mine. I notice that my sensations are acute, my perceptions are vibrant, and my mind is clear. No one in the hospital seems aware that I have recovered. On a stairway up to the left is a dear, sad, little girl patient who reminds me of Anna Frank. I playfully toss her a pink rubber ball to try to cheer her up. On another stairway up on the right side is the office of the medical superintendent of the mental hospital. A nun standing outside his office confides to me that the medical superintendent has an interesting but little known personal history. It seems that he too is mentally ill but he is able to keep his illness under control with his sensible and well balanced manner. In fact, everyone has a deep love and respect for him because of his humble and helpful attitude. At that point I turn to my disheveled friend and tell him in a happy voice, "My mind is clear now! I am well! The doctors are going to let me go home now." My friend turns to me and sadly replies, "Well, of course they are going to let you go. You were able to explain yourself to them so that they could understand who you are." The implication of his words is that he and the other patients will have to remain in the hospital until they could explain themselves.

My basic feeling about this dream is gratitude: gratitude for my recovery, my good fortune in having such a wonderful wife, and for my returning mental faculties so I could write this paper. My wife tells me that in fact she has noticed over the past few weeks that I really am acting clear with full recovery from my stroke. She is almost completely right in this. A recent

retest documents that after 15 months of rehabilitation both of my major stroke induced cognitive deficits improved dramatically: my *perception and discrimination* improved to the 90th percentile from the 45th; my *short-term memory* improved to the 66th percentile from the 37th.

Summary

In an anecdotal report such as this it is difficult to determine the healing factors that contributed to mental and physical rehabilitation. Here is a short list of what was important from my personal perspective and what remains to be done from a scientific point of view.

- Accessing and re-experiencing the novelty-numinosum-neurogenesis effect in repeated creative replay is the essence of the psychological, cultural, and spiritual approaches to healing. Notice how often I report being preoccupied with certain numinous experiences in dreams and active imagination that continues over days, weeks, and months. Therapeutic hypnosis that generates mind-body healing requires repeated exercises of novel, enrichening, and positive, inner experience. Replaying numinous dramas of healing with deep emotions and many creative variations allows a natural Darwinian variation and self-selection of optimal healing strategies to take place on all levels from mind to gene throughout the days, weeks, and months of rehabilitation.
- Although we can cite many scholarly sources from the history of hypnosis, the humanities, psychoanalytic traditions, and current neuroscience to support these ideas about mind-body communication and the psychosocial genomics of healing, these conceptions remain speculative until they receive experimental confirmation. The bioinformatic technology to measure the initiation of gene expression, *** brain plasticity***, and stem cell differentiation in response to the creative replay of the novelty-numinosum-neurogenesis effect within the typical time frame of a single session of therapeutic hypnosis now exists.
- Experimental confirmation of the value of creative replay of the novelty-numinosum-neurogenesis effect in the arts, humanities, and cultural rituals would have profound implications for an understanding of role of consciousness in human nature. It would

mean that enriching life experiences that evoke the novelty-numinosum-effect during creative moments of art, music, dance, drama, humor, literature, poetry, spirituality, awe, joy, and cultural rituals could optimize the psychosocial genomics of consciousness, personal relationships, and healing. It would mean that there is something more involved than "Art for the sake of art." Rather it would mean "Art for the sake of building a better brain" in the daily construction and re-construction of our lives.

- This contains the seed of a new theory of aesthetics and science that reifies Keats' poetic and philosophical conundrum, "Beauty is truth, truth beauty, - that is all Ye know on earth, and all ye need to know." If beauty and truth are both numinous experiences that activate gene expression and brain plasticity, then beauty could actually reconstruct our brain to generate new experiences of truth and visa versa. This takes us quite beyond my personal story to a deepening exploration of consciousness, creativity, therapeutic hypnosis, science, and spirit in the future.

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