

**PSYCHOTHERAPY NETWORKER SYMPOSIUM
TELECONFERENCE
JUNE 5 - JULY 24, 2006**

THE NEUROPHYSIOLOGY OF HEALING

ROBERT SCAER, M.D.

Robert Scaer, M.D. is a board-certified Neurologist, in practice for 35 years, 20 of which were spent as the Medical Director of the Mapleton Center for Rehabilitation, a full-service rehabilitation center. In that capacity, he has directed the Center's Brain Injury and Chronic Pain rehabilitation programs, and has seen several thousand patients who have suffered traumatic injuries. In studying these patients, he has come to the conclusion that the emotional response to a traumatic event and the long-term physical symptoms and disabilities related to the injuries that the patient has suffered are intricately and specifically related to each other, forming a psychological/physical continuum that must be addressed for healing to take place. Specifically, in his study of victims of motor vehicle accidents, he has concluded that the varied symptoms of the Whiplash Syndrome have their roots in the storage of the somatic and autonomic sensory experiences of the accident in procedural memory, thereafter to be reproduced as symptoms in situations that reflect subtle cues of the traumatic experience.

Applying this theory to the spectrum of life experiences, he has developed a theory based on the neurophysiology of traumatic stress that relates the myriad experiences of life trauma common to all of us to the development of many chronic diseases currently of unknown cause. He has published articles on the Whiplash Syndrome as a metaphor for traumatic stress, and on the physiology of dissociation as the basis for chronic disease. He has published a book, *The Body Bears the Burden: Trauma, Dissociation and Disease*, that addresses these theories in detail, explores the spectrum of life trauma that may contribute to this process and makes a plea for the use of somatically-based psychotherapeutic techniques in the treatment of posttraumatic stress disorder. A second book, *The Trauma Spectrum: Hidden Wounds and Human Healing*, addressing the spectrum of insidious sources of trauma within society that are ignored or denied because they are culturally based and endorsed, is in publication, with release anticipated in early 2005. He continues to consult in the field of traumatic stress, to write and present workshops, nationally and internationally.

Robert C. Scaer, M.D.
515 Adams Avenue
Louisville, CO, 80027
303-664-5155
scaermdpc@msn.com
www.traumasoma.com

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I. How the Brain Operates in Traumatic Stress

The physiology of trauma has its roots in the fight/flight/freeze response. If a prey animal is unable to fight or flee from a predator, it will enter a state of immobility, called the freeze response that is governed by a deep state of parasympathetic autonomic dominance. If the animal survives this experience, it will undergo a stereotyped “discharge” involving the activation of seizure-like motor responses and sympathetic autonomic activation that “completes” the unconscious act of survival. If this freeze discharge does not occur, the animal, or person, will tend to retain all of the elements of the threatening experience in procedural, or unconscious, memory. Memory mechanisms in trauma are felt to be critical to the often-disabling symptoms that follow a traumatic event, described in psychiatric manuals as posttraumatic stress disorder (PTSD). The primary types of memory involved in trauma are conscious (explicit, declarative) memory, and unconscious (implicit, procedural) memory. If conscious and unconscious memories of the trauma are not dissipated through the freeze discharge, they will continue to recur under the influence of familiar environmental cues, and eventually lead to a process called kindling, or establishment of an internal self-perpetuating neural circuit that contributes to ongoing, often permanent symptoms. The process of classical conditioning is involved, and leads to fear conditioning, an animal model of trauma that is quite analogous to the behaviors observed in PTSD.

II. Trauma as a Universal Life Experience

The DSM-IV diagnosis of posttraumatic stress disorder (PTSD) defines several groups of symptoms that fall under core symptoms of *reexperiencing*, or memory phenomena, *arousal*, or symptoms linked to panic and anxiety, and *avoidance*, or symptoms of numbing, detachment and apathy. This classification represents the tip of the iceberg of posttraumatic experiences. A new and evolving approach to the definition of posttraumatic experiences addresses the concept of Complex Trauma, a recognition of the effects of cumulative trauma throughout the lifespan, which may manifest symptoms that fall out of the core symptoms of PTSD, and may include dissociation, impaired affect regulation, a wide variety of somatic symptoms and depression. This new approach to trauma addresses of resiliency and vulnerability, as well as the role of meaning of life events based on one’s past traumatic experiences. Issues of preverbal trauma, the role of maternal/infant bonding and the interaction of genes and experience in traumatic resiliency and the development of personality are raised by these considerations. In additions, the norms and standards for societal controls, and standards for societal behavior that are established by the leaders of institutions may in fact represent sources of significant insidious trauma, unrecognized and accepted because of the authority of its source.

III. Traumatic Reenactment

The victim of complex trauma often seems to be uncannily vulnerable to being exposed to new and repetitive traumatic experiences. Many times, these experiences seem to replicate the types of trauma that they have experienced in the past. One particularly unusual manifestation of this tendency is the experience of a new trauma within the anniversary time frame of a prior traumatic event, as if the victim contained an inner clock that determines a period of vulnerability. The well-known but inexplicable predominance of PTSD and trauma exposure in females may be related to these unusual features of traumatic stress. Many of theories of this gender distribution have been presented, including the genetically determined role of the female in a tribal society, and the intrinsic physical vulnerability of females. The role of endorphins in traumatic reenactment have been raised, and even presented as an “addiction to the trauma”. Clearly endorphins play a role in this process, and may contribute to such unusual behavioral manifestations as cutting, self-mutilation and exposure to high risk and ultimate endurance sporting events and pursuits.

III. Your Body Reflects Your Life Experience

Dissociation is a state of varied altered perception, often attributable to exposure to a threat to life in a state of helplessness. Examples include feelings of depersonalization, out-of-body experiences, altered perception of reality such as slowing of time, altered perception of self, including dissociative identity disorder, and conversion hysteria. Dissociation to a certain extent is culturally determined, but seems to be a universal response to extreme stress, and appears to share its physiological substrate with the freeze response. It involves release of high levels of brain endorphins, as well as significant alterations of normal autonomic homeostasis. The occurrence of dissociation at the time of a traumatic event is one of the primary predictors for the development of PTSD. Dissociation in fact may essentially represent the perceptual experience of the freeze response.

Conversion hysteria is of particular interest in the study of dissociation. Hysteria involves a wide variety of neurological symptoms that may involve any aspect of neurological function, but whose symptoms often relate to impairment of function of parts of the body that specifically experienced the sensory messages of the physical aspects of the threat. Thus the soldier who experienced a shell burst occurring to his right might thereafter experience hysterical blindness in the right eye, or paralysis of the right side of his body. Associated with this, the soldier might exhibit an exaggerated startle response to loud noise, or to any sudden visual or auditory stimulus in the region of the right side of his body. His perception of a safe space on his right side would be altered, a literal rupture of his sense of safe personal boundaries. The theoretical concept of boundaries in this context is important to our consideration of the spectrum of posttraumatic symptoms and diseases.

This concept of regional somatic dissociation has many implications for the development of specific vasomotor dysfunction and even disease in the dissociated regions of the body. I have now document dozens of cases of stigmata, altered skin

temperature and color, impairment of hair and nail growth and other signs of impairment of normal vasomotor function in dissociated body regions in victims of trauma. Some have developed objective evidence for complex regional pain syndrome or reflex sympathetic dystrophy, suggesting a neuropathologic basis for conversion hysteria. New evidence that has been recently found on imaging studies of the brain also suggest evidence for altered central sensory transmission in brain pathways in hysteria.

V. The Chronic Diseases of Life Trauma

We know that wild animals may actually die during an induced freeze response in a laboratory. Clearly sustained maintenance of the autonomic instability and vagal tone of the freeze is dangerous to mammals. This has broad implications for a host of “psychosomatic” diseases that manifest as states of impaired autonomic function and regulation. Such diseases include a well-known spectrum that includes fibromyalgia, chronic fatigue syndrome, irritable bowel syndrome, mitral valve prolapse, gastroesophageal reflux disease, multiple chemical sensitivities and interstitial cystitis.

Procedural memory for sensorimotor experiences in a traumatic event presents a compelling rationale for many poorly understood somatic symptoms and behaviors. Examples include to myriad symptoms of the Whiplash Syndrome, tics or habit spasms, myofascial pain, cumulative trauma disorder, phantom limb and other forms of unexplained chronic pain.

The concept of Somatic Dissociation also lends itself to the understanding of a variety of poorly understood diseases, the most obvious of which is reflex sympathetic dystrophy (RSD), or complex regional pain syndrome. All of these diseases involve unstable regulation of circulation of a part or region of the body that provided the sensory messages of a traumatic event to the sensory cortex of the brain. This process will be manifested by variable warmth and redness, or coolness and pallor in that part of the body. When severe, symptoms may include severe pain and eventually atrophy or degeneration of that body part due to impaired blood flow.

Late PTSD and dissociation is associated with well-documented alteration of endocrine and immune systems, as would be predicted by the alterations of the hypothalamic/pituitary/adrenal axis (HPA) in PTSD. Implication for a wide variety of endocrine and immune disorders is significant.

Dissociation alternating with abnormal arousal results in dramatic alteration of regional blood flow and energy utilization in selected brain centers. During arousal, the left frontal and mid regions of the brain received less circulation, perhaps explaining problems with problem solving, judgment and the use of words in trauma victims. These alterations in brain physiology may well contribute to the diagnoses of ADD/ADHD and dyslexia in children and adults. Concerns about an apparent epidemic of the supposedly genetic syndromes of ADHD and autism may reflect this process. The well known impairment of sleep regulation in trauma victims may well have a link with sleep disordered breathing, or sleep apnea and with some forms of narcolepsy.

VI. What This All Means for Trauma Therapy

Drug treatment of posttraumatic disorders has expanded dramatically in the past decade. The two major classes of drugs used include the mood modulators, most of which are actually anticonvulsants used for epilepsy. This treatment makes sense based on the rationale of kindling or neurosensitization as a basis for PTSD. The other major class is the antidepressant group of medications, especially the SRI (serotonin reuptake inhibitor) group. In clinical trials, only several members of the SRI group of drugs have been found to be helpful. Unfortunately, the posttraumatic disorders are by definition cyclical, or in fact bipolar in their varied manifestations. Treating one end of the autonomic spectrum by definition may worsen symptoms at the other end of the spectrum, leading inevitably to intolerable side effects. This phenomenon remains a persisting conundrum in the pharmaceutical management of PTSD.

Late symptoms of trauma are associated with recurrent memories and symptoms that are often unexplainable at a conscious level. This would be expected if the primary areas of the brain that retain traumatic memories do not serve conscious awareness, including the limbic system, basal ganglia, sensorimotor cortex and brainstem. Cognitive-behavioral therapy may assist the trauma victim in providing a logical cognitive substrate to their symptoms, and thereby may reduce their severity. By itself, however, cognitively-based psychotherapy is unlikely to extinguish unconscious sensorimotor traumatic associations that are conditioned and stored in procedural memory. The extinction of these paired conditioned associations requires the experiencing of the conditioned threatening stimulus and its response in a benign environment in order to extinguish the physical sensations, reflex motor behaviors and sympathetic autonomic arousal associated with that response. Since conditioning is an example of procedural memory, somatic reflexive therapy is essential.

There are many techniques for therapy for PTSD and its late symptoms that may be useful by this paradigm. Many types of therapeutic bodywork and movement therapy may be useful in facilitating the trauma victim in consciously reconnecting with her dissociated body. Increased body awareness, in fact, is an important first step in the dissociated patient being able to access other types of somatically-based therapies. The use of equestrian, dance and pool therapy may bring the messages of the body back into awareness. Gentle restorative strengthening exercise assists the trauma victim in recovering baseline levels of muscle tone that are intrinsically impaired in states of somatic dissociation. Biofeedback may provide a bridge between conscious awareness and lost unconscious and reflexive sensorimotor function in somatic dissociation. Heart rate variability (HRV) biofeedback has shown some promise in improving homeostatic states of autonomic function. Acupuncture may promote autonomic stability during the therapeutic process.

The somatically-based psychotherapies, including Eye Movement Desensitization and Reprocessing (EMDR), and Somatic Experiencing (SE) probably represent the primary approaches to specific extinction of fear conditioning, although the therapeutic

basis for these techniques is admittedly purely theoretical. Other therapies that involve the use of energy-based techniques have achieved widespread application despite their relatively controversial nature. The theoretical bases for somatically-based therapies probably lies in the process of extinction of conditioned associations. By replicating the sensorimotor experiences and cues of the traumatic experience in a benign and supportive setting that provides a sense of control, the act of defense or escape may be “completed”, and the traumatic cues extinguished. Through this process, a cognitive “meaning” for the previously threatening body sensations may be established that allows resiliency in the face of subsequent exposure to these cues. The ultimate goal may be the restoration of limbic, autonomic, endocrine and immune homeostasis.

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