The Body in Stress & Trauma

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The brain and the body are parts of a common interactive system. Any outside stimulus or input to the brain must first be registered by the sensory organ systems of the body, and the brain relies on the body to provide all information having to do with function in general, not just survival. What's happening in the body continuously changes the brain. The flip side of this relationship is that the brain, in response, also directs and changes the body. Learning of a motor skill by the brain is dependent on the body's ability to adapt and respond to feedback messages from the brain that direct the somatic musculature. The muscles of the viscera—the organs of the chest and abdomen—also operate through messages from the autonomic nervous system that are generated by the brain, while the sensory messages from these visceral organs inform the brain about one's emotional well-being. The relative health of the brain depends on the health of the body, and vice versa. If trauma has adversely affected either one, you've got to find a means of healing that incorporates both brain and body. You can't fix one without fixing the other.

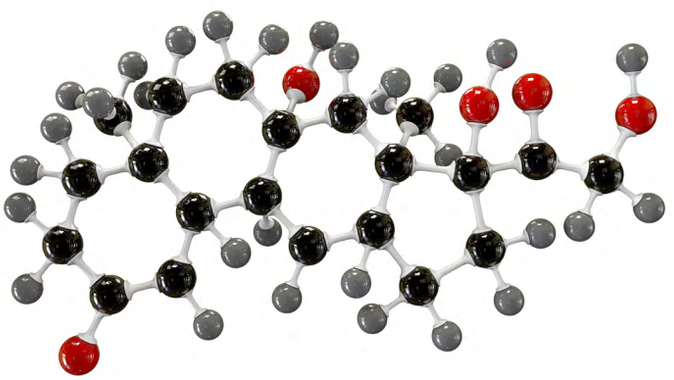
We've seen how stress and trauma place their own unique imprint on brain function. The spectrum of negative life experiences directly affects how the brain functions, and in some cases actually produces negative physical changes, such as the loss of neurons in the hippocampus through the effects of cortisol, the stress hormone. Stress and trauma can "damage" the brain. It should come as no surprise, then, that abnormal ways that the brain functions in stress and trauma might also "damage" the body. This particular concept has been around for quite a while in the medical field, giving rise to what we now call mind-body medicine, complementary medicine, and in some cases, alternative medicine. The therapeutic approaches employed by this field of practice often incorporate techniques derived from the practice of medicine in the Far East. Examples include meditation, acupuncture, herbs, massage, Qigong, and tai chi, as well as ayurvedic medicine and yoga from India. Most of these practices seek to balance the mind, body, and spirit as a means of preventing and healing disease. This concept certainly has appeal if the primary negative effects on the body in stress and trauma are at least in part due to a disruption in homeostasis, which intrinsically implies a disruption of balance and regulation of brain and body.

There's a dilemma that Western medicine seems to have in dealing with diseases related to brain function, especially alterations in homeostasis. Allopathic, or Western, medicine depends to a significant degree on measurements of the body's chemical/physiological state at a fixed point in time. X rays, scans, microscopic images, blood tests, and so on represent a picture of the body frozen in the moment of the test. One can monitor a person's heart rate, blood pressure, blood-oxygen level, and brain waves for a longer period of time, but this is costly and only gives a brief picture of what we might call the state of homeostasis. Homeostatic disruption almost by definition is associated with emotional disruption and distress. This emotional component often leads the allopathic physician to designate the medical syndromes of trauma as "psychosomatic" diseases, with an emotional and not a physical cause. I think a more accurate term would be "neurosomatic" diseases, as these disorders are related to abnormalities in the balanced function of the brain and autonomic nervous system. Although the abnormal body states in trauma are hard to pin down with tests, they still are quite real and definitely are "physical." And this dilemma of a changing, unstable state of abnormal physiology and its symptoms is primarily what we'll be dealing with in considering the body in stress and trauma.

In this article, I'll review in detail the effect of cortisol on many of the body's systems, a syndrome Hans Selye called the "general adaptation syndrome," or GAS. The GAS primarily describes what have been called the diseases of stress. We'll also be dealing with a number of diseases and medical syndromes that are prevalent in victims of life trauma but depart from the illness of the GAS. The medical syndromes that I relate specifically to trauma reflect the alterations in brain function

that occur in trauma. These include "false" body-based procedural memories, persistence of dissociative freeze states, and neurosensitization, or kindling. Obviously many of these syndromes of trauma represent disorders of regulation of the autonomic nervous system, and therefore involve the visceral organs. I'll also be exploring syndromes and diseases that reflect the frozen somatic procedural memory that characterizes the brain in trauma. This produces not only stuck emotions but also body states reflecting how the brain/body tried to protect itself in trauma. These body states are now frozen as "false" implicit memories—false because they represent memories for an event in the past that is perceived as still being in the present. Many posttraumatic body disorders reflect the kindled, sensitized nature of the brain, leading predictably to syndromes of hypersensitivity to many sensory stimuli. These sensitization disorders, which I call syndromes of kindling, may involve one or more of the body senses. And many trauma syndromes reflect the process of dissociation, or cutting off from awareness, of regions and parts of the somatosensory body that tried but failed to protect the trauma victim.

Cortisol and the Diseases of Stress:



The Price of Adaptation

Stress basically demands that the brain and body adapt to a stressor—an event or experience that disrupts homeostasis but is not sufficient to trigger the full-blown fight/flight response. There's an element of arousal in this process, though not as extreme as that in the fight/flight response, and the amygdala is mildly activated when the brain senses messages that imply even a subtle threat. There is a continuum between stress and trauma that is mainly defined by the degree of helplessness the person is experiencing. In fact, the escalation of a stressor to actually being a life threat is entirely possible. But if the stressor continues without ever becoming a life threat, the brain takes a different pathway than it does in trauma to adapt. This pathway is basically the same as the sympathetic nervous systems relationship to the hypothalamic-pituitary-adrenal (HPA) axis. The HPA axis is the origin of the hormonal response by the body's endocrine system to prepare the body to adapt to a stressor as long as it persists. The end result is the release of cortisol from the adrenal cortex, or outer layer of the adrenal gland.

Cortisol damages the neurons of the hippocampus and can contribute to memory and cognitive problems in trauma victims. In large amounts, it may also affect the cerebral cortex, producing arousal, vigilance, delusions, anxiety, rage, and even psychosis. As long as the stressor remains present, cortisol will remain elevated in order to help the body deal with the ongoing, low-grade threat. This state of threat will result in the gradual development of the GAS. Helping us maintain vigilance in the face of low-grade threat, the GAS state of autonomic tuning promotes the ability of our heart and circulatory system to deal with increased physical demands and our level of blood glucose to meet the increased caloric energy demands of the body and especially the brain. In the relatively short term, it promotes survival, but in the longer term it literally causes a breakdown of the body.

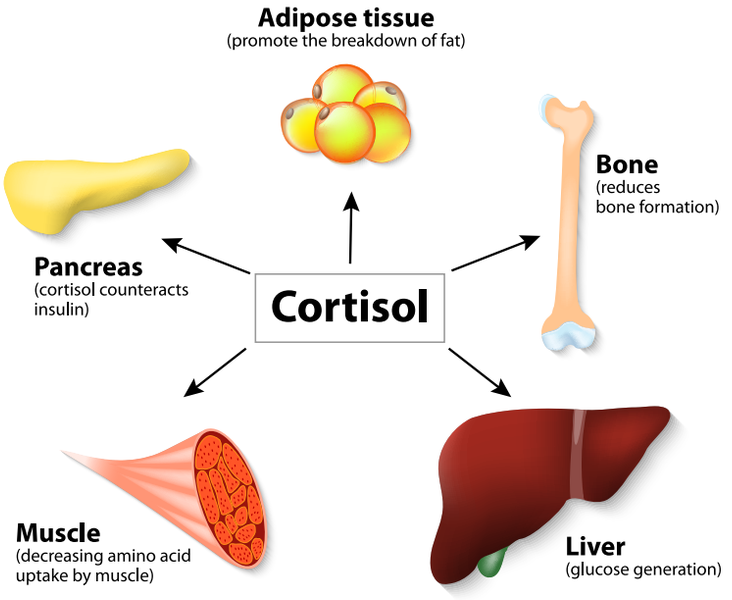
Cortisol also acts as a modulator of the immune system. In high amounts, it suppresses the immune system. In the early days of organ transplantation, chemicals related to cortisol were used to suppress the immune system to prevent organ rejection. Cortisol-related drugs have also been used in autoimmune diseases, such as rheumatoid arthritis, lupus, and multiple sclerosis. Autoimmune diseases are inflammatory in nature, and cortisol also suppresses inflammation. But improvement in the autoimmune diseases with cortisol is associated with the destructive effects of the GAS. Suppression of the immune system unfortunately also makes the person more prone to what are called "opportunistic" infections by bacteria and viruses that aren't normally very infectious. If taken for a lengthy period of time, cortisol also can contribute to the development of unusual forms of cancer that are generally held in check by the immune system. In many ways, prolonged exposure to cortisol leaves the person subject to many of the tumors and infections seen in the immune deficiency caused by the AIDS virus. As a result, during prolonged stress, persons are vulnerable to the development of viral diseases. That's why cold sores are common under stress.

Cortisol also causes the kidneys to reduce their excretion of salt in the urine. Retaining salt causes blood volume to increase, an important piece of survival insurance in case the threat becomes physical and the person

experiences injuries causing a loss of blood. Increased blood volume also guarantees the brain's access to circulation. Both of these effects are adaptive measures for dealing with stress in the short term. Cortisol also raises blood pressure, during both exertion and rest, and increases baseline pulse rate, both of which ensure maximal blood flow to the brain. It causes a significant increase in blood glucose levels. The brain counts solely on glucose as a source of energy. Increased vigilance, glucose, blood pressure, pulse, and blood volume help provide support for blood circulation and optimal oxygen and nutrients for brain function—in the short term.

But cortisol also causes an increase in serum cholesterol and other lipids. It causes an increase in secretion of stomach acid. You are probably beginning to see the price exerted by the adaptive GAS. Elevated blood pressure may contribute to sustained hypertension and stroke. Sustained elevated blood sugar may trigger clinical diabetes. Elevated blood lipids may lead to atherosclerosis and coronary artery disease. Immune suppression may lead to opportunistic infections and conceivably cancer. Elevated stomach-acid secretion may lead to peptic ulcers. Increased vigilance can lead to mental disorders, especially mania and psychosis.

Finally, cortisol in the long run is catabolic—it breaks down and changes tissues. It causes wasting of muscles, increased fat deposition about the abdomen, osteoporosis, swelling of the face, and the masculine effects of acne and increased facial hair growth in both genders. Many of these conditions have been called "the diseases of stress," and, in fact, this is partly true. During the early stages of recovery from serious injuries, many of my rehabilitation patients manifested some of these conditions, especially hypertension, acne, cold sores, weight gain, and hypervigilance. Usually these conditions spontaneously subside with time. But if prolonged, the adaptive GAS comes at considerable cost to the brain and body.



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Unfortunately the burden of the GAS may not always subside, progressing instead to the diseases and syndromes of trauma. The element of helplessness in an ongoing stressful situation may grow with the passage of time. The burden of financial loss, litigation, impairment of human relationships, and increasing social isolation may cause a shift in brain and body physiology. In this context, a significant number of my injured patients went on to develop what I've called the diseases of trauma, syndromes increasingly at the parasympathetic end of the spectrum of autonomic dysfunction.

The Vagal Freeze & the Viscera:

The Tempest in the Heart and Gut

You'll recall that the freeze response is basically governed by the dorsal vagal nucleus, the cluster of neurons in the upper medulla, or reptilian brain. The dorsal vagus drastically slows the heart and breath rate so reptiles can hibernate or dive under water for long periods without breathing. The dorsal vagal nucleus also governs the digestive process, increasing digestive secretions in the stomach, small intestine, and colon to regulate absorption of nutrients. It also controls contraction of the muscles of these abdominal visceral organs to move the lump of food products down the line, eventually getting rid of waste products of digestion after extracting water by the colon, or large intestine. Beginning with saliva in the mouth, the digestive secretions of each segment of the gut are released to break down the proteins, carbohydrates, and fats in the diet, readying the food for absorption by the small intestine. The last act of digestion controlled by the dorsal vagus is relaxing the anal sphincter, or valve, to promote defecation. Other sphincters between the esophagus, the stomach, the small intestine, and the colon serve to prevent reflux, or backflow, of the digestive products into the previous chamber. The dorsal vagus controls the smooth regulation of these sphincters so they open and close when they're supposed to. The whole process of digestion involves the parasympathetic nervous system. This vagal function regulates the state of resting and restoring.

The dorsal vagus also plays a role in the freeze response in both reptiles and mammals. Although this function is useful for diving or hibernating reptiles, it puts

mammals, which can't tolerate long periods of drastically reduced heart rate and respiration, in peril. Mammals may die from cardiac arrest in a prolonged freeze state. Studies of wild rats that had died in the freeze state were found to have dilated hearts filled with blood, arrested during the state of relaxation in the heart-beat cycle. Profound dorsal vagal prominence related to the freeze can literally freeze movement of the heart in mammals. It can also lead to a number of well-recognized but puzzling syndromes involving the lungs, heart, and gut. It should be noted that these syndromes often occur together, and they are associated with mood disturbances, including anxiety, depression, sleep disturbance, headache, and backache. In the United States, women constitute approximately two thirds of the population who suffer from these syndromes of the freeze. And all of these syndromes, except perhaps asthma, are more common in the population of patients being treated for trauma, especially those with an increased incidence of childhood trauma. The diseases of the freeze therefore reflect the physical, somatic collapse and paralysis of the freeze response, the overactivity of the glands and muscles of the viscera, and the exaggerated cycling of parasympathetic and sympathetic visceral states.

Fibromyalgia and Chronic Fatigue Syndrome

I consider fibromyalgia and chronic fatigue syndrome (CFS) to be the prototype for diseases of freeze/dissociation. Fibromyalgia is characterized by long-term, body-wide pain and tenderness in the joints, muscles, and tendons. Chronic fatigue syndrome is basically characterized by cycles of physical exhaustion to the point of being bedridden at times. All of the other syndromes of the freeze discussed in this Key are extremely common in fibromyalgia and form part of its spectrum. These include gastroesophageal reflux disease, irritable bowel syndrome, mitral valve prolapse, and multiple chemical sensitivities. Fibromyalgia and CFS occur together most of the time but may also occur independently.

Fibromyalgia may begin at any age, but it usually occurs in young adulthood, often in the context of a new life trauma. Many of my whiplash patients developed fibromyalgia in the context of recovering from their injury. It is a common syndrome, affecting around 5% of the general population, and is generally placed among the rheumatic disorders. As a result most cases get referred to rheumatologists. The problem with treating fibromyalgia is that the syndrome creates no tissue changes or

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consistent abnormalities that show up on blood or X-ray tests, leading it to be widely considered a psychosomatic disorder. Allopathic medicine offers no specific effective treatments for it.

A new designation for fibromyalgia is that of "chronic widespread pain," the major complaint of this condition. Other symptoms include diffuse tenderness over specific points or areas on the body, morning stiffness, nonrestorative sleep and daytime fatigue, numbness, tingling, cognitive impairment, hypervigilance, and emotional instability. CFS may occur by itself, but it is frequently allied with fibromyalgia. It is characterized by generalized, often profound fatigue, sometimes to the point of collapse. The remarkable breadth and complexity of fibromyalgia symptoms, and its cyclical nature, strongly suggest a disorder of diffuse autonomic regulation. The symptoms of weakness, collapse, and cognitive impairment mirror the state of freeze/dissociation. The widespread nature of the systems involved suggests an element of early-childhood, perhaps preverbal, trauma. Pain is a major part of fibromyalgia, leading to the latest treatment du jour, a drug called Lyrica, which is basically one of a group of mild anticonvulsants promoted for the treatment of chronic pain.

Asthma

The dorsal vagus causes increase in bronchial mucus secretions and constricts the bronchial tubes in the lungs. This reflects a relative state of rest, when the deep, rapid breathing necessary for the fight/flight response is no longer necessary and the lungs can relax and lubricate the bronchi. But, as with everything else in physiology, any natural state that is taken to an extreme can be pathological and dangerous. In the case of asthma, this is reflected in wheezing and cough. The constriction of the bronchi can be severe enough to be life-threatening. Normal constriction of the bronchial tubes and increased secretions in the resting state can, in the deep and persistent freeze state, become asthma. Asthma as a disease is one that closely reflects the unresolved physiology of the freeze response.

Asthma is somewhat unique among the syndromes discussed here. As you'll see, many of the other syndromes of the freeze often occur together, seldom occur in early childhood, and have prominent emotional symptoms. Asthma, on the other hand, often is a syndrome of early childhood. It frequently occurs before or in the absence of a history of personal trauma or abuse, although asthma attacks are commonly precipitated by highly emotional events. There is anecdotal evidence of increased incidence of birth trauma or other negative neonatal factors in asthma, but no solid evidence. I would suggest that asthma may reflect preverbal, or even intrauterine, trauma. We do know that the emotional state of the mother during pregnancy may have profound effects on the fetus, probably based on increased maternal cortisol levels that are passed on to the fetus through the placenta. In fact, emotional dis-

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tress in the mother during pregnancy appears to be related to hippocampal atrophy as well as reduced birth weight in the infant. But the posttraumatic nature of asthma based on the physiology of the freeze must still be considered speculative.

Mitral Valve Prolapse

The dorsal vagus lessens the rate and strength of heart contractions, reducing blood pressure and blood flow in the body. One result is an arrhythmia, or irregular heart beat. The heart also has valves, analogous to the sphincters in the gut, that prevent reflux of blood from one chamber to another. The left side of the heart contains the mitral valve, preventing reflux of blood from the left ventricle back into the left atrium. In trauma, the unstable physiology of the freeze results in a loss of synchrony between these two chambers, resulting in prolapse, or excessive backward extension of the mitral valve into the atrium when the ventricle contracts. The person with mitral valve prolapse (also known as dysautonomia) experiences palpitations, or a fluttering sensation in the chest, sometimes associated with a sense of panic. The irregular and exaggerated autonomic cycling of trauma triggers a sympathetic response with arousal, along with an alteration of the normal heart rhythm. The name dysautonomia reflects both the parasympathetic state of the freeze, with cardiac arrhythmias, and the underlying abnormal autonomic cycling, with sympathetically based arousal and panic. Although imaging studies demonstrate the abnormal prolapse of the mitral valve, there are no other anatomical explanations for this syndrome. As noted, it is commonly associated with all of the other freeze syndromes.

Gastroesophageal Reflux Disease

As I've implied, the freeze response is a dorsal vagal state, but because of autonomic cycling, there is also a sympathetic component to the syndromes associated with it. One must remember that the freeze response is always triggered by arousal related to some old posttraumatic cue, followed by a rapid descent into the freeze state. So all of these syndromes are also characterized by a disruption of synchrony. Gastroesophageal reflux disease (GERD) is similar to mitral valve prolapse, except that the reflux occurs between the stomach and the esophagus in GERD. The asynchronous contraction of stomach and esophagus prevents the valve from performing its function, resulting in reflux of gastric

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acid into the esophagus. The stomach lining contains chemicals that neutralize excessive acid, but the esophagus does not. As a result the acid literally "burns" the esophageal lining, resulting in what we call "heartburn" or "acid indigestion." An extremely common condition, GERD is allegedly related to stress but actually more linked to traumatic stress and the dorsal vagus/freeze state. The syndrome tends to occur in conditions of approach/avoidance conflict, with its implications of helplessness and therefore the freeze. The relentless marketing of stomach-acid-inhibitor drugs on television suggests how common GERD is in our society. It is one of the most common complaints of soldiers returning from Iraq and Afghanistan, and it is ubiquitous in those with PTSD.

Irritable Bowel Syndrome

Irritable bowel syndrome (IBS) is another cyclical bowel syndrome that is almost as common as GERD. It affects both the small and large intestines, leading to alternating constipation and diarrhea, with cramping abdominal pain, bloating and gassiness, and increased mucous in the stools. The alternating parasympathetic/sympathetic nature of these symptoms certainly suggests exaggerated autonomic cycling. IBS usually occurs in people under the age of 40. As with GERD, many physicians relate IBS to stress, but once again, it is a separate syndrome from those associated with Selye's GAS.

The symptoms of IBS blend with those associated with lactose and gluten intolerance, and it's often difficult to separate the two. In gluten intolerance, the genetic trait may progress to the more severe celiac disease, especially in the face of stress or trauma. This isn't surprising given the tendency for kindling, or neurosensitization, to occur in victims of trauma. Kindling in these posttraumatic cases clearly can amplify the symptoms of bona fide gluten intolerance and cause this to progress to full-blown IBS and ultimately celiac disease. This is another example of negative neuroplasticity.

Syndromes of Kindling

Because of the sensitized wiring of circuits in the brain, people who've experienced life trauma are easily sensitized to virtually any sensory input. Their brains are kindled to respond to sensory input as representing threat. Other states that reflect this sensitized brain wiring include hypervigilance and exaggerated startle (sympathetic), often alternating with fogginess, "spac-

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ing out," and dissociation (parasympathetic). Virtually any sense can be kindled, but smell is the most sensitive to kindling. In mammals it is the main sense used for detection of threat, although its function has atrophied in the urbanized human. Nevertheless, syndromes such as multiple chemical sensitivities, multiple environmental allergies, and sick building syndrome reflect the sensitivity of smell to kindling. All of these conditions are valid and definitely physiological. They are not based on the imagination of the person suffering from them. These people's brain physiology is actively engaging the process of sensory hypersensitivity in an effort to protect them.

Perhaps the prototype syndrome of kindling is the fairly recent diagnostic designation of "sensory processing disorder" (SPD). This is a theoretical model for the inherent difficulty in detecting, modulating, and interpreting all of the avenues of sensory input in some children. Children with SPD experience a wide range of abnormal perceptions and responses to ordinary body sensations. These responses may be oversensitive (kindling), or undersensitive (dissociation), and may involve any of the body sensory experiences: smell, vision, hearing, taste, vestibular sensation, touch, and proprioception. Such children may seek out, or avoid, any of these sensations. Most children with SPD will also show symptoms of attention deficit disorder (ADD). The disorder is related to negative early childhood experiences, including prenatal or birth trauma, attachment disorder, developmental childhood trauma and abuse, and even the autism spectrum. Exaggerated (sympathetic) or dulled (parasympathetic) sensitivity to any or all of the primary sensations may be present in these cases.

All of these syndromes of kindling are associated with abnormal autonomic regulation and are improved with techniques designed to promote homeostasis. Many of these techniques have been devised by the occupational therapy community. SPD in childhood can be diminished by treatment, but it generally persists into adult life, probably reflecting many of the syndromes of kindling that we've discussed.

All of the smell-based sensitization syndromes are basically products of an overactive sympathetic arousal response system. Recall that the olfactory nerve accesses the amygdala without going through the "filter" of the thalamus. The immediate response is arousal/anxiety triggered by the sensitized amygdala. Once the sequence of arousal/fear has been initiated, the intensity of autonomic cycling accelerates to the point of multiple physical symptoms, both sympathetic (fear, terror, tremor) and parasympathetic (nausea, weakness, cramps, trouble breathing). Symptoms reflect the

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intensity of the autonomic state driving them. And the detection of minute olfactory messages is quite valid. I sincerely believe that the kindled, environmentally sensitive person is able to detect the smell of tobacco in the house next door, or perfume coming from someone in a crowd across the room.

Sensitivity to light or visual cues can be related to the intensity of the light, the flickering of 60-cycle fluorescent lights, or the speed of movement of the visual object. Sensitivity to sounds may be due to the volume, the dissonance, or, in music, to the pitch, rapidity, intensity, or sequence of chords. The "white noise" of a vaporizer, hypnotic to many, can suddenly become irritating and intolerable to the kindled individual. Proprioceptive and vestibular sensitivity may be manifested by simple dizziness, but also by positional vertigo with minimal head movement and bouts of imbalance. The diagnosis in this case often is benign positional vertigo. Disembarkment syndrome is related to the long-term perpetuation of the feeling of instability and balance impairment one feels after getting off a boat. In most people, this feeling disappears in minutes, but it may persist indefinitely in the kindled individual. Hypersensitivity to rough fabrics such as wool, or to the label in a collar, may also be a form of kindling. The kindled lover may be able to tolerate firm touch but not the caress of his or her lover.

There also may be an element of suggestibility in sensitization disorders, a trait that has been called "effort after meaning." Sensitivity to the electrical field around power lines, or exposure to subclinical levels of carbon monoxide, may produce dramatic physical syndromes in the sensitized person but not in other members of the family. As I mentioned earlier, many people suffer from lactose and gluten intolerance on a genetic basis, and often are able to manage this easily with dietary measures. However, the kindled individual with a history of trauma may also experience worsening of the gastrointestinal symptoms in these sensitivities. They may spread to involve other related food groups and progress to full-blown IBS, especially in the context of new life trauma or threat. But the effect of suggestibility is neither a psychosomatic phenomenon nor an issue of secondary gain or reward. The pathological alteration in the person's physiology is perfectly real. The perception of threat itself will alter the brain of the sensitized individual and create the visceral, physical symptom via the unstable autonomic nervous system.

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Sensorimotor Syndromes and Chronic Pain:

"The Gain in Pain Lies Mainly in the Brain"

In my work I've talked a great deal about sensorimotor procedural memory, first as a method for learning complex motor skills, and second as a way of learning survival skills though unconscious classical conditioning. I've also talked about how, in trauma, body-based memories are stored as being in the present—even though the traumatic event is in the past—through the imprinting in memory of the sensory and motor patterns of the undischarged freeze response. This storage of "false" body memories plagues the trauma survivor in the form of intrusive memories, or flashbacks. These posttraumatic memories contain not only the explicit, declarative content and meaning of the event, but also the sensory experiences—smells, images, sounds, and body sensations that emerge in the form of sensory symptoms or unconscious movements, such as tics.

But one doesn't need to have a specific flashback memory for these unconscious sensations and incomplete movement patterns to emerge under certain circumstances. Like everything in the brain and body in trauma, the emergence of memories, sensations, or emotions associated with the trauma can be prompted by cues. These can be both internal (in the body, in memories of other events similar to the trauma) or external (actual, ambient experiences from our everyday life environment). When we experience such cues, they often go completely unnoticed. For example, one of my patients reported feeling inexplicably uncomfortable in the presence of a therapist she had been referred to, despite the therapist's personable demeanor. When I asked the patient how she would describe the therapist, she thought about it and suddenly flushed. She had recalled that the therapist used red nail polish, a favorite of her grandmother who had abused her.

In complex and repeated trauma, a person's environment may literally be packed with stimuli related in some way to old traumatic experiences. It's no wonder that trauma victims often suffer from agoraphobia—the fear of spaces, crowds, or any environment with many stimuli. These stimuli often trigger not only panic attacks but also many somatic complaints. Many of these somatic symptoms were just discussed in syndromes of

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the freeze and are predominantly visceral and autonomic symptoms. But many somatic complaints, particularly pain, stiffness, and muscular problems, are also related to triggers from environmental cues.

Possibly the most common source of chronic discomfort seen in doctor's offices, myofascial pain is stiffness and chronic pain mainly experienced in the spinal muscles, and especially in the neck and low back. It is the cause for what we call "tension headaches." It's usually more severe on one side than the other, and frequently is very specific and localized to a particular muscle group. The most common muscle involved is the levator scapulae, running from the middle region of the neck down to the scapula, or shoulder blade. Its primary function is to elevate the scapula and to pull the neck and shoulder forward. Another common muscle is the masseter, which attaches the lower jaw to the skull and tightens when we clench our teeth. In the lower spine, the primary muscle usually involved is the iliopsoas, a complex muscle that runs from the mid-lumbar spine down to the inside of the pelvis and then down to the femur, or thigh bone. It pulls the femur up to the abdomen, and pulls the lower spine down toward the pelvis, hyperextending it. The end result of all these muscles contracting at the same time replicates the posture of the "startle response." When we hear a sudden loud noise, we "flinch," pulling our neck down, our shoulders up, our arms forward across our body, our jaws open, and our legs up against the abdomen. All of these muscles susceptible to myofascial pain are instinctually wired for self-protection and survival. They protect the vulnerable body areas (throat and abdomen) that a predator will attack. The body's response to a threat is to contract these muscles automatically.

Myofascial pain, in other words, is regional spasm of muscles that tried to protect us in a traumatic event but failed to do so because we were helpless, froze, and didn't extinguish the trauma through the freeze discharge. Of course, muscles other than those just mentioned may also be involved. In other words, procedural memory for the use of any muscle group used in self-defense that was unsuccessful will imprint the procedural memory for that physical self-protective movement pattern in our survival brain. In the face of cues to that trauma, or any threat for that matter, our brain will automatically activate those muscle groups that tried and failed to protect us. This results in "nervous tics," tremors, torticollis (compulsive neck turning), or painful spasms, especially in spinal muscles. It will produce strange changes in our body posture, especially the neck-forward, slumped posture of "aging." As we age, our physical bodies and posture basically reflect the burden of our cumulative life trauma, driven there by our unresolved traumatic procedural memory.

This process also relates to the sensory experiences of trauma. All of the varied sensory experiences of an unresolved traumatic event will also be stored along with the motor responses. A prime example of this is the phenomenon of phantom limb pain. Procedural memory for the painful sensations accompanying an unresolved traumatic event will be stored just as the complex patterns of the failed muscular act of self-protection were. One doesn't need to have the limb amputated to experience posttraumatic "phantom" pain. In fact, doctors and their patients frequently face the common problem of a specific pain having no explainable cause despite multiple imaging tests. And it may be resistant to all efforts at cure, including medications, nerve blocks, and even spinal surgery for a "ruptured disc." In many cases, that's because the pain indeed is "phantom" pain due to its basis in posttraumatic procedural memory. It's also the type of pain that's eventually considered to be "psychosomatic." Any pain embedded in the brain's procedural memory by trauma will assume the state of phantom pain. Researcher Vilayanur Ramachandran was able to cure phantom limb pain by using a mirror box to effect a behavioral reversal of how the brain perceives the amputated limb.

Exercise

Not everyone has experienced the types of pain and movement disorders that I've described, but most are familiar with the common "crick in your neck"—the pain or soreness in the levator scapulae muscle that runs from one side of the middle of your neck to the inside tip of your shoulder blade. This is the muscle you often see people massaging when they're taking a class, working at their computer, or attending a lecture or concert. They'll often roll their head around at the same time. Pay attention to this muscle while you do the exercise.

To illustrate this point, I'd like you to do the following exercise: First sit comfortably with your feet on the floor and your arms by your side, and shut your eyes. Do a body scan for any tightness, tension, or discomfort in your muscles. Then reflect on your current life events and find one that is important and unresolved, and that has at least some slight element of conflict, threat, or uncertainty. When you find it, concentrate on the story of that event, particularly those elements that contain any negative energy or where you're not in control of the situation. Focus on the nuances and details of that conflict, its implications, and whatever frustration it generates. After 1 or 2 minutes, do another body scan for any tightness or discomfort.

You may not feel anything specific. But I would predict that some of you will indeed experience a sense of tightness or even discomfort in some region of your body—most likely, in the pesky levator scapulae region. But the discomfort may also occur in some other muscular body region. If so, search your memory bank for some negative life experience that may have involved that muscle group. You may find it. Some of you may actually get a "visceral" response—tightness or cramping in your gut, increased heart rate, a little heartburn, needing to take a deep breath. If any of this occurs, you have experienced the role of unconscious procedural memories in the creation of physical symptoms—symptoms that are quite real.

Of course, any sensory message in an unresolved traumatic event—not just pain—may also be stored in procedural memory. In other publications I've written a great deal about how "whiplash syndrome" may represent a broad array of sensory symptoms that reflect procedural memory for all of the sensations experienced in an auto accident. These include impairment of visual focus, positional vertigo (dizziness), ringing in the ears, bouts of nausea, impaired memory and cognition, TMJ (jaw clenching), sleep impairment and chronic fatigue, migraines, balance disturbance, and of course neck and low back pain. All of the basic sensations involved in movement may be stored—vision, hearing, vestibular sense, body proprioception, and patterns of muscular contraction—leading to recurrent replication of these sensations with cues based on procedural memory. A sizeable number of medical articles consider whiplash to be a psychosomatic syndrome. In fact, it's one of many poorly understood physical syndromes that have their basis in the brain physiology of trauma.

Whiplash is somewhat unique as a syndrome of somatic procedural memory, probably because of the complexity of the experience. I've also discussed phantom limb pain as a phenomenon of procedural memory for pain. It's very likely that most of inexplicable chronic pain may well be "phantom"—based on traumatic procedural memory, not ongoing disease of the painful tissues. "Failed" back surgery, where the surgery itself was successful but the pain remains unchanged, may be another example. In fact, whenever the physical injury is associated with helplessness, one must consider the possibility that persisting pain may be due to this physiological, not psychosomatic, cause. Helplessness in the injury experience is probably the best predictor of persisting pain. And unfortunately, the rigid requirements for safety, consistency, and accountability demanded of our hospital system may unwittingly sow the seeds of helplessness in patients who enter it.

We know from scientific studies that professional football players and demolition derby drivers occasion-

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ally get a temporary sore neck but virtually never get the constellation of symptoms seen in whiplash. The obvious reason is that men who participate in these sports are aggressors/predators, not prey. They are not helpless, and they don't freeze and store procedural memories for the injuries they may suffer. It's no surprise that the same behavioral therapies that cure phantom limb pain may cure the "phantom" constellation of symptoms seen in whiplash.

Somatic Dissociation:

Stigmata, Hysteria, and Reflex Sympathetic Dystrophy

Many of my patients who had suffered physical injuries were also traumatized by the violent nature of the experience and had elements of PTSD. These patients were all basically clumsy, constantly bumping into door jambs, bruising themselves, stepping off curbs and spraining ankles, or bumping their heads on kitchen cupboards. They seemed to have lost touch with their bodies in space. And indeed that's what they were experiencing—the splitting off from awareness of parts of their body, primarily those parts that had experienced the sensory messages of the traumatic event itself. And they had no conscious awareness of this disconnection. It's a lot like the brain was splitting off that dangerous body part from perception in order to protect itself. The body part carried the messages of the trauma, and now was being "figuratively" discarded. The brain literally "shot the messenger."

The more the body part had been involved in perceiving the traumatic event, or attempting to protect the person from it, the more it was "shut off" from awareness, or dissociated. And that body part or region at some point became vulnerable to developing abnormal autonomic changes, including the chronic burning pain of reflex sympathetic dystrophy (RSD). For example, one patient had fallen from a ladder, breaking her nose and spraining both wrists. Whenever she came in for a visit, and we talked about how she was doing, her nose and both hands became flushed. Similarly, when the patient of a colleague of mine reexperienced, during a therapy session, the memory of an assault by her husband, a handprint, fingers toward the ear, blossomed in red on the left side of her face. When a patient of mine who had been broadsided on the right side of her car came to see me, she said her hair was growing more slowly on the right side of her head. Upon inspection, she had bald spots only on the right side, her right-hand

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nails were split and broken, and her right hand was cooler than the left. While recalling a traumatic injury, these patients developed autonomic changes, some sympathetic, some parasympathetic, in the body parts, or even the region, where they had experienced the event. Those body parts were split off from normal awareness, and the circulation was altered. I have called this phenomenon somatic dissociation. The parasympathetic red spots mapping the sensory pattern of the traumatic event are a potential prelude for RSD, and in fact can be called stigmata.

Stigmata, of course, are associated with the replication of the wounds of Christ on Thursdays and Fridays, the days of Christ's Passion, in the Catholic Church. Many of the early saints in the Catholic Church experienced stigmata. The stigmata of somatic dissociation have no religious significance, but like religious stigmata, they occur in parts or areas of the body that experienced the sensory messages of a traumatic event. And in a few cases, I have observed such stigmata to progress to the cold, painful, and dystrophic symptoms of RSD in the affected body part. In my own personal case, a severe skiing injury involving a shattered shoulder led to this state. After surgery and unremitting pain, the dressings were removed, and there on the front of my shoulder were three red patches. At the time, I wondered what possibly could have caused them, but then I noted that I was having difficulty feeling the arm and hand, or finding where they actually were without looking for them. My entire arm was clearly dissociated. This rapidly progressed to burning pain, and I realized that I was actually getting RSD! I was experiencing a phenomenon that had been identified and addressed over a century ago in Paris, France. Fortunately I was acquainted with many local therapists who successfully treat RSD with trauma therapy, and in several weeks my pain, stigmata, and symptoms were gone.

The selective dissociation of a region or part of the body has been discussed by Onno van der Hart and his colleagues under the name of "somatoform dissociation," a state that represents what was called "conversion hysteria" in the language of late-19th-century psychiatry and psychology. This condition almost solely affected women, and the study of hysteria mainly took place in Paris. It was characterized by paralysis, bizarre involuntary movement patterns, seizures, blindness, loss of sensation, and a host of other neurological disabilities without any physical explanation. Stigmata in the affected body part often accompanied hysteria. Sigmund Freud, the father of modern psychiatry, studied these women and found that the common feature in their personal history was early sexual abuse. Suffice

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it to say, the sensorimotor disabilities of these unfortunate women replicated all of the same brain function that leads to the tics, stigmata, loss of awareness of selected body parts, and RSD that I've been describing in this section.

Like Freud's patients, many of my patients with conversion hysteria had suffered severe childhood physical or sexual abuse. Conversion hysteria is quite common in neurological practice—most of the symptoms have to do with neurological deficits. I have found in my patients that the tics, patterns of compulsive abnormal movements, and sensory loss quite accurately reflect those parts of the body that participated in a failed act of self-defense. These movement patterns were held in procedural memory for life, to be resurrected (unfortunately uselessly) under threat, or under cues in the environment of the original trauma.

You'd think that tics, hysterical postures, and movement patterns would be quite common in war veterans. Although they do occur, they are relatively rare in our soldiers returning from Iraq and Afghanistan. For one thing, hysteria is much more common in women, which gives a clue to its rarity among male soldiers from recent wars. This is so perhaps because women are more likely to freeze, or dissociate, than men. Some researchers in behavioral science feel that the freeze response in early hunter-gatherer women and their children enhanced their chances of survival in an attack by another tribe, where fighting or attempting to flee would be fatal. In addition, females and children lack the violence gene that is switched on at puberty in adolescent males.

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But in World War I, a syndrome called "shell shock" was rampant in many if its male combatants. At the time, the armed forces, and the psychiatrists treating these men, believed shell shock was a form of malingering, or hysteria—the odd symptoms of this syndrome had not been documented before. The key to this strange departure in behavior from other wars lies in the prolonged period of trench warfare. During artillery bombardments, as the soldiers cowered in the trenches, they were completely helpless to defend themselves. After the bombardments, as the soldiers tried to recover and prepare themselves for battle, a fairly large number of them remained frozen in the mud of the trench, locked in the posture of self-defense. Many of the soldiers never recovered from this posture. They remained physically frozen, blind, deaf, mute, and with numerous tics for the rest of their institutionalized lives. Shell shock and its sensorimotor responses reflected freeze/dissociation in the face of overwhelming helplessness.

So here we have a continuum of symptoms, experiences, and behavior that reflect all of the sensorimotor syndromes of trauma. The freeze "discharge" is a completion of the act of self-defense, and it extinguishes procedural memory of the trauma. When a "discharge" occurs in a patient during psychotherapy, it looks not only like the act of self-defense, but also very much like the patterns of movement in hysteria. Both of these states also reflect the repetitive movement patterns that we call "tics," which also represent incomplete replications of failed muscular acts of self-defense. And, finally, the body parts that take part in tics, shell shock, and hysteria are "dissociated" and vulnerable under further stress to develop the dissociative autonomic syndrome of RSD. You might even call it the tic–somatic experiencing discharge–conversion hysteria–RSD continuum.

Endnote

The spectrum of what can happen to the body in stress and trauma is broad and deep. Under stress, we see a diverse group of changes in many organ, endocrine, and immune-system functions of the body that

reflect their exposure to elevated levels of the stress hormone cortisol. This process begins in the arousal systems of the brain, the amygdala and the limbic system, but falls short of the physiology of the fight/flight response. The stress response engages the hypothalamus, pituitary, and adrenal glands. It becomes more an autonomic and endocrine response than an ongoing central nervous system response. The cerebral cortex is basically not involved in the stress response, although the neurons of the hippocampus may be damaged by the relatively elevated cortisol levels. The physical harm to organs and tissues is secondary to elevated cortisol, and includes elevated blood sugar (diabetes), elevated serum lipids (atherosclerosis), elevated stomach acid (peptic ulcers), osteoporosis, elevated blood volume (hypertension), and depressed immune function (opportunistic infections, cancer). These diseases are specific to an individual hormone rather than a locked-in change in the brain, and they depend upon the continued input of stress to the limbic brain by external, environmental influences. They will persist as long as the stress continues. If stress proceeds to helplessness, however, the physiology changes from a cortisol, endocrine reaction to an autonomic/freeze syndrome.

The diseases of trauma are caused by a much more complex fixed change in specific brain functions. They can't be cured by removing an environmental stimulus. They are based on corrupted procedural memory systems by an altered brain. The causes are diverse based on the shifting, unstable state of the brain and autonomic nervous system in trauma. When the freeze response and dissociation are most prominent, one tends to see cyclical extremes of abnormal function in the viscera, characteristics that allopathic medicine tends to call psychosomatic diseases. When sympathetic influences are most pronounced, one will primarily see syndromes of sensitization, or kindling, to one or many body sensory systems and environmental sources, especially smell. And when the somatic body experiences pain, especially related to the musculature, the source is primarily the problem of old, cue related, unresolved traumatic procedural memory. In extreme cases of trauma with prominent dissociative states, one may also see a combination of pain related to procedural memory along with abnormal regulation of circulation in the affected region of the body.

You must certainly be wondering how we can possibly treat and heal this wide-ranging, complex, incredibly diverse group of diseases and brain/body dysfunctions. Most of you will have already recognized a few, or even many, of these symptoms in yourselves. The traumatic sources for these syndromes are all over the place in our complex, hierarchical, demanding culture. They are driven by our daily work and family interactions and the limits and demands of a pyramidal, trickle-down urban culture, with its endless supply of "little traumas" and approach-avoidance stress. The good news is that we now recognize these abnormal states of health, and their basic brain physiology. If some of these diseases related to stress are due to the autonomic regulation in stress, then we need to find means of providing autonomic self-regulation skills. If many of these diseases are related to abnormal, locked-in conditioned procedural memory, we need to develop systems of fear extinction to bring these body memories out of the present moment and place them back in the past where they belong. Nothing, of course, is as easy as words might imply. But the tools are there, and they are also the tools that are emerging in using and treating the symptoms of the body in healing trauma. These tools and their principles I cover in my book *8 Keys to Brain–Body Balance*, published by Norton & Co.

This has been an excerpt from 8 *Keys to Brain–Body Balance* by Robert Scaer and published by Norton & Co. Used with permission.

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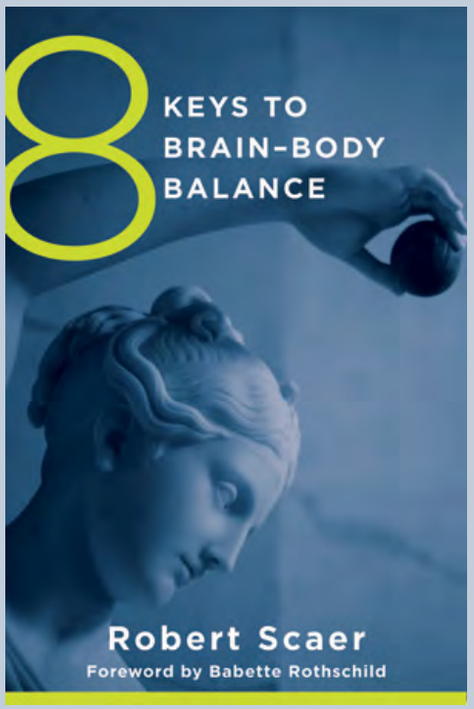
8 Keys to Brain–Body Balance

By Robert Scaer

Foreward by Babette Rothschild

Take-charge strategies to heal your body and brain from stress and trauma.



Understanding how our brains and bodies actually work is a powerful tool in mitigating the anxiety generated by unpleasant physical and emotional symptoms that we all may experience from time to time. Here, Robert Scaer unravels the complexities of the brain-body connection, equipping all those who are in distress with a plausible explanation for how they feel.

Making the science accessible, he outlines the core neurobiological concepts underlying the brain-body interface and explains why physical and emotional symptoms of stress and trauma occur. He explains why "feelings" represent physical sensations that inform us about the nature of our brain-body conflicts. He also offers practical, easy-to-implement strategies for strengthening motor skills, learning to listen to our gut to gauge our feelings, attuning to the present, and restoring personal boundaries to relieve symptoms and navigate a path to recovery.

Contents

Endorsements & Reviews

"In his latest comprehensive and accessible book, Robert Scaer has drawn from his deep understanding of neurology, neuroscience, and traumatology to offer the trauma patient practical knowledge for recovery and self-understanding. Presenting his material in a readable and enjoyable way, Scaer empowers his readers through his compassionate wisdom. This book will help anyone wishing to integrate their bodies and brains more effectively and harmoniously." — Peter Levine, PhD, Director, Somatic Experiencing Trauma Institute

"This book penetrates the world of neuroscience in a user-friendly, unpretentious yet scholarly manner, highlighting the critical relevance to clinical practice of past and current discoveries about the brain and its malleability. Scaer's perspective as a neurologist is unique, hopeful, and empathic, and this integrative book will prove an encouraging resource for anyone seeking to understand the effects of trauma on brain and body." — Pat Ogden, PhD, Founder/Director of the Sensorimotor Psychotherapy Institute, first author of *Trauma and the Body: A Sensorimotor Approach to Psychotherapy*