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WHERE ARE EMOTIONS FELT?

HOW DO THEY AFFECT HEALTH?

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Stress and Emotions

by Paul J. Rosch, MD, FACP

Editor–in-Chief

Stress comes in all shapes and sizes. We usually think of stress as bad, such as the death of a loved one, but it can also be good, like winning a race or lottery jackpot. We may also react to the same stressor differently; some people have "agita," diarrhea or other GI symptoms, others experience angina and palpitations, headache, cold and sweaty palms or neck and low back pain due to muscle spasm. How we respond depends on inherited factors, prior experience, autonomic nervous and endocrine system function, gender, age, socio-cultural and other influences. For some individuals, stressful events take a greater toll and seem to stick like Velcro. Not only do they get more upset, but they also continually dwell on problems despite the fact there is nothing they can do about them. Others react as if they have a Teflon coating and stressors slide off without any apparent lasting effect. As the Greek Philosopher Epictetus wisely noted over 2,000 years ago, "*It's not what happens to you, but how you react to it that matters*."

Many of our responses to sudden and severe stress have been exquisitely honed over the millenia of human evolution as life saving measures. "I was so scared I got 'goose bumps' and the hairs on the back of my neck stood up" doesn't seem to fall into that category. Never-

theless, the stimulation of those same arrector pili muscles causes the flying fur on the arched back of an aroused cat make it look more ferocious to a potential assailant. Similarly, thousands of bristling quills provide a potent means of defense for the porcupine. Diarrhea might not seem useful, but could lighten the weight and increase the speed of an antelope fleeing from a predator.

Such teleological analogies are predicated on the Darwinian theory that humans and animals developed from a more primitive form of life through a process that favored the "survival of the fittest." Walter Cannon later similarly proposed that "fight or flight" responses to life threatening stressors were originally purposeful because they facilitated survival in our ancestors. Increased tension in the large muscles of the extremities provided greater strength in physical combat or speed to escape from a scene of potential peril. A rise in blood sugar furnished more energy, blood clotted more rapidly to minimize loss from laceration or internal hemorrhage, higher heart rate and blood pressure increased blood flow to the brain to improve decision making, pupillary dilatation broadened the range of vision, etc. These immediate and automatic reactions are beyond our control, as are the associated emotional states of fear, anger, sadness or surprise.

However, the nature of stress today is not an occasional life-threatening situation like an encounter with a sabre tooth tiger or a hostile tribe a few times a year, but rather a host of daily hassles, like disputes with customers, coworkers and family members or traffic jams. Unfortunately, our bodies still react in that same archaic fashion, and repeatedly invoked, it is easy to understand why this can lead to hypertension, stroke, heart attacks, diabetes, ulcers, musculoskeletal pain and other diseases of civilization. More often, contemporary stress stems from persistent poverty, discrimination, disability and other insidious stressors that do not elicit "fight or flight" responses, but impair immune system function and resistance to infections.

Conversely, it has been proposed that happiness, joy, love and positive emotions have the reverse effect and represent "good stress," which Selye referred to as *eustress*. Winning a race or election can be even more stressful than losing, but is there any evidence that this has health rewards? Critics point out that there is no apparent difference in our physiological responses. In addition, the Holmes-Rahe Social Readjustment Rating Scale, long the gold standard for measuring the severity of life change events and demonstrating their ability to predict the frequency and severity of future illness, makes no such distinction. Marriage and other joyous events were deemed more stressful than losing your job, and outstanding personal achievement ranked higher than difficulties with your boss.

It is also claimed that optimists with an upbeat attitude are healthier and live longer than pessimists. The Women's Health Initiative study, which has followed more than 100,000 women ages 50 and over since 1994, found that women who ex-

pect good rather than bad things to happen, were 14% less likely to die from any cause than pessimists and 30% less likely to die from heart disease after eight years of follow up. Women who were hostile and highly mistrustful of others were 16% more likely to die and 23% more likely to die from cancer. Although there are additional studies showing the health benefits of seeing your glass half full rather than half empty, other research contradicts this.

In one report in which respondents were interviewed and asked to describe how satisfied they were with their current lives and how satisfied they expected to be in five years, follow-up revealed that being overly optimistic in predicting a better future was associated with a 9.5% rise in disabilities and a 10% increased risk of death over the next decade. As the authors explained, pessimism about the future may encourage people to live more carefully and take more and better health and safety precautions. The problem with all of these studies is that people are not optimistic or pessimistic all of the time due to various life change events, and our outlook and attitude can reflect those changes. Additionally, other pertinent factors are not always taken into consideration, like income, age, gender, illness, personal losses, medical treatment, and disabilities, as well other lifestyle influences such as social support, smoking, drinking and exercise.

Emotions, Feelings And Thoughts - Which Comes First?

Another obstacle in proving that health is influenced by our emotions is the difficulty in differentiating between emotions, feelings and thoughts and how these are related. Emotions and feelings are immediate and automatic in "fight or flight" responses, regardless of what we think. But in other stressful situations, we think, then generate certain emotions or feelings and react appropriately. As Epictetus also noted, *Men are disturbed not by things, but by the view which they take of them*," so that our attitude and our interpretations can be crucial in determining the likelihood and nature of adverse health effects. For example, anger has long been known to be associated with a higher incidence of heart attacks and strokes, especially in patients with cardiovascular disease. This was confirmed in a recent review, which found that within two hours after an outburst of anger, the risk of angina and heart attack increased by nearly five times and ischemic stroke and cardiac arrhythmias more than tripled. The reasons for this included: a rise in adrenaline levels, increased myocardial oxygen demand, coronary vasospasm, increased platelet clumping, transient ischemia, disruption of vulnerable plaque and greater potential for thrombus formation. Studies have also shown that acute mental stress can cause as much, or more severe, ischemia than treadmill testing in 40–70% of patients with coronary artery disease. In some with implantable defibrillators, ECG changes induced by mental stress predicted the likelihood of future ventricular arrhythmias that might otherwise prove fatal.

All of these responses to sudden bouts of anger

result from increased activity of the sympathetic nervous system. Other emotions such as chronic sadness may not produce any significant signs or symptoms but still have adverse health effects such as increased susceptibility to infections and cancer due to impaired immune system function. However, these links are not as consistent and the mechanisms of action are not as well delineated. A major problem in that regard is the difficulty in defining what constitutes an emotion and how emotions are formed. The James-Lange theory proposed that an external stimulus leads to physiological responses and the resultant emotion depends upon your interpretation of those responses. For example, you are walking alone in a forest and are suddenly confronted by a large grizzly bear. You start to tremble and your heart begins to race and you conclude that you are frightened. ("I am trembling, therefore I am afraid.") It was generally thought that such physical responses were due to fear, but as William James explained, "*My thesis on the contrary is the bodily changes follow directly the PERCEPTION of the exciting fact, and that our feeling of the same changes as they occur IS the emotion*." (James, William. What is an emotion? *Mind*, 9: 188-205, 1884).

This theory was generally accepted until Walter Cannon showed that "fight or flight" responses to stress were due to stimulation of the sympathetic nervous system and secretion of epinephrine (adrenaline). If awareness of trembling, palpitations and other responses were what caused fear, then inducing these artificially in the absence of any threatening stimulus should have the same effect. But when Cannon injected adrenalin,™ into normal volunteers, although it produced the identical visceral responses, the subjects experienced no specific emotions. It was only when he discussed disturbing topics like sick children or their dead parents and then injected adrenalin™, that an emotion was induced. In another experiment, cats were kept alive and healthy after having their sympathetic nervous systems completely removed. However, this had little effect on their emotional responses. Cats displayed the typical signs of terror in response to a barking dog, while organs whose connections to the brain had not been completely destroyed reacted normally. Moreover, the sympathetic nervous system acts as a single stereotyped unit in responding to different emotional states such as fear and rage, as well as stimuli such as lack of oxygen and exposure to freezing temperatures. Cannon reasoned that if emotions resulted from these responses, one would expect fear, rage, chilliness, and asphyxia to induce the same feelings, which was not the case.

The James-Lange theory proposed that sympathetic and other involuntary nervous system reactions responsible for emotions were coordinated by the vasomotor center, located in the medullary portion of the brain stem. Cannon not only disproved this, but demonstrated that emotions were controlled by the thalamus. It had been observed that patients with unilateral lesions of the thalamus react excessively to pinpricks, painful pressure, and excessive heat or cold on the

damaged side of the body. Conversely, satisfying stimuli such as warmth caused intense pleasure, as reflected by facial expressions of enjoyment and exclamations of delight. These exaggerated responses were attributed to the liberation of the thalamus from cortical inhibitions. If the thalamus is removed, there were no discernable emotional responses to stressful stimuli. As a result, Cannon proposed that sudden life threatening situations stimulated the thalamus to evoke both sympathetic nervous system responses and the feeling of fear. (Cannon, WB. The James-Lange theory of emotions: A critical examination and an alternative theory". *The American Journal of Psychology* 39: 106–124. 1927).

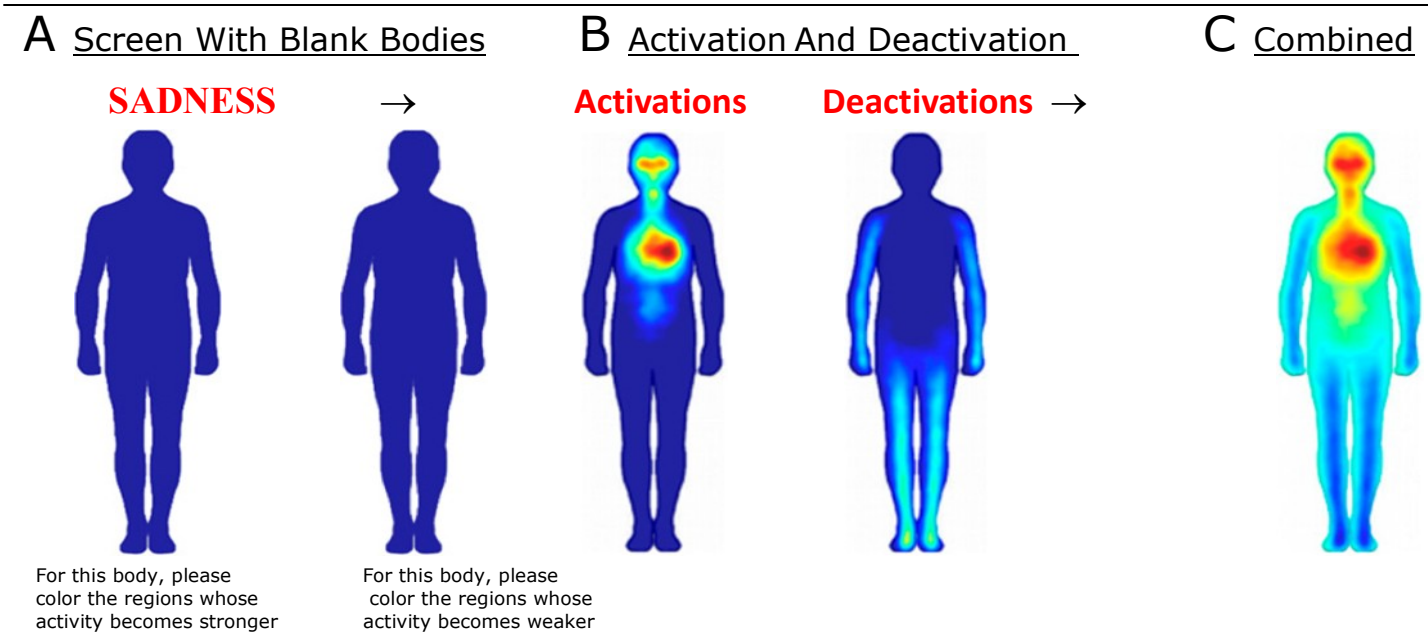
This is often referred to as the Cannon-Bard theory, since a decade later, it was extended by Philip Bard, a psychologist who worked under Cannon, and confirmed that both emotions and physiologic responses occurred simultaneously but independently. James Papez and Paul MacLean made further modifications by showing that persistent or intense emotions also involved the limbic system as well as the thalamus. Two psychologists, Stanley Schachter and Jerome Singer subsequently proposed that experiencing an emotion requires not only a physiologic response, but also a consideration of its cause. According to the 1962 Schachter-Singer theory, if you feel your heart racing because you are being chased by an alligator, you might experience fear or anxiety. But if your heart is pounding because you are in a passionate embrace with someone you love, the predominant emotion is apt to be excitement or pleasure. The 1974 Opponent-Process Theory of Emotion proposed by Richard Solomon and John Corbit was a radical change. It suggested that the experience of an emotion disrupts the body's state of balance and that our basic emotions typically have their opposing counterparts. The opposite of pleasure is pain, the opposite of fear is relief and the opposite of depression is elation. When we experience one emotion, it suppresses the opposite one but after the initial emotion subsides, we experience the opposing emotion to balance things out. For example, you feel elated and happy when you are with someone you love, but when deprived of this for a week or more, you become depressed. You might feel a high level of fear before bungee jumping off a high ledge but after the jump, this is replaced by relief. This theory is also commonly used to explain drug addiction. The pleasure associated with taking an addictive drug makes us feel the subsequent painful withdrawal effect of the drug. The only way to prevent this is to take more of the drug as soon as possible, and the amount needed may increase.

There are other theories, but none of these help you to explain to researchers exactly what you feel or where you feel it. It has been proposed that humans have six basic emotions: sadness, happiness, surprise, fear, anger and disgust. However, there can be numerous gradations of each. Sadness can mean feeling sorry, glum, "down in the dumps," unhappy, "blue," gloomy, melancholy, miserable, mournful, dejected, desolate, tearful, downhearted, or depressed.

Each of these has a subtle but different connotation. When you ask a child who appears forlorn to describe how they feel, the answer might be "like the time when I got lost at the mall." Saying "I feel sad" or any of the above synonyms doesn't quite capture this sensation because it is a medley of diverse feelings like "scared", ashamed, surprised or angry that are experienced in different parts of the body. And since it is these bodily feelings that may give rise to emotions, researchers were interested in learning where in the body different emotions are experienced. You can tell someone you are afraid or angry and what caused this, but not why you have different feelings with different emotions.

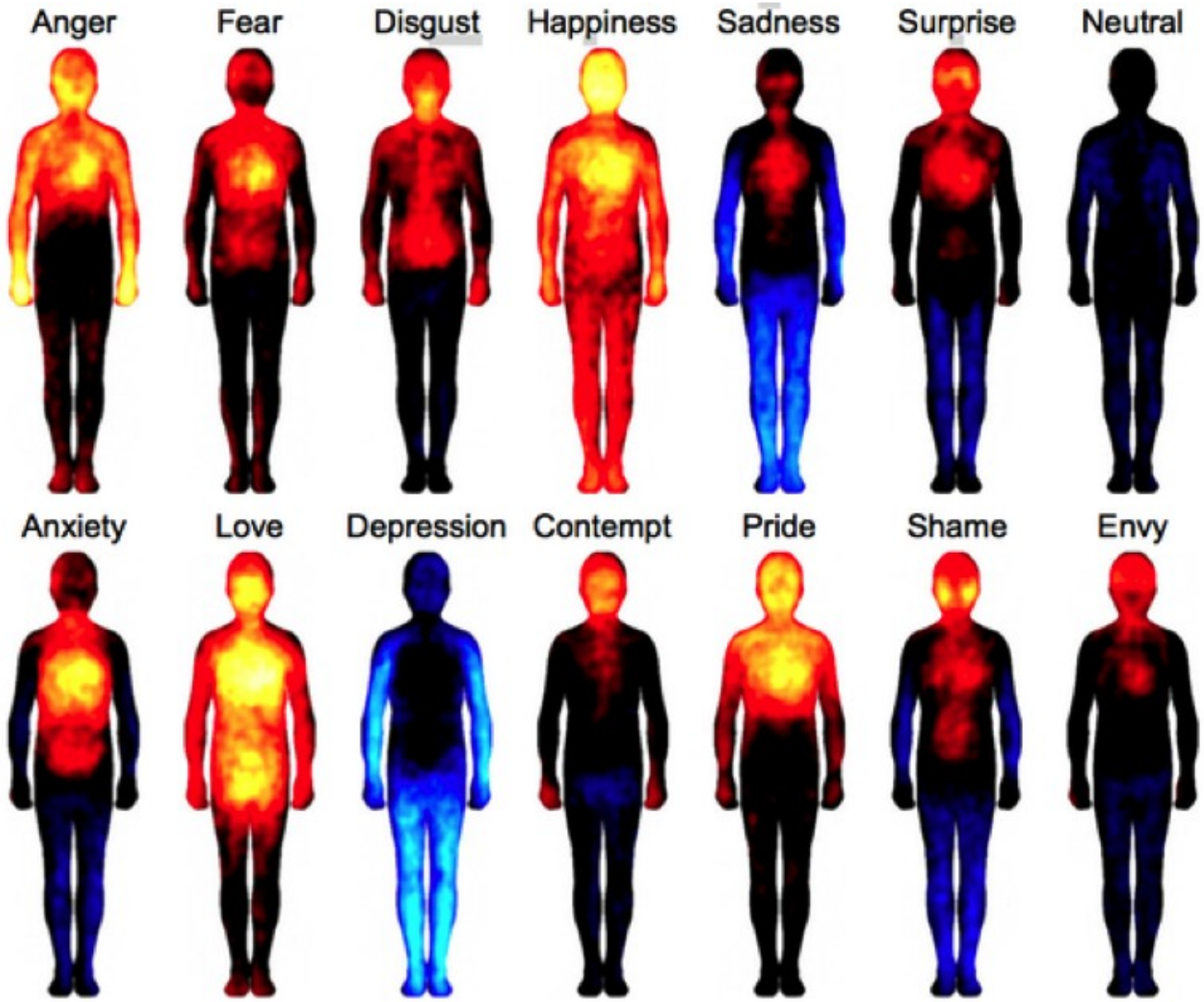
Mapping Where Different Emotions Are Experienced In The Body

To determine this, 700 volunteers from Finland, Sweden and Taiwan were surveyed to determine where they felt certain emotions. They were shown two blank silhouettes or shadows of bodies while viewing words, stories, movies, or facial expressions designed to induce a specific emotion. They were asked to color the bodily regions whose activity they felt was increasing in red and yellow in the first shadow and to color decreasing activities in light and dark blue in the second. These two maps were then integrated to produce a combination map showing how an emotion was felt throughout the body at that time, as illustrated below for sadness.



Participants colored the (A) two blank body regions whose activity was felt to be stronger or faster (left body) and weaker or slower (right body) during emotions and these are shown in (B) as Activation and Deactivation body maps. This data was stored in a mathematical format to indicate intensity of color, size and location, with the whole body being represented by 50,364 data points. These maps are then combined to produce the color image seen in (C).

The three countries chosen were selected to confirm that there were no significant cultural differences, since Finnish is a Uralic language (also spoken in Hungary, Romania, Slovakia and Ukraine), Swedish has Germanic Indo-European roots and Taiwanese is derived from Chinese and East Asian languages. Results were not affected by age, gender or educational level. In addition to the six core emotions of anger, fear, disgust, happiness, sadness and surprise, variations of these (love, depression and pride) as well as others like shame and envy were also mapped, as illustrated below.



Bodily topography of basic (Upper) and nonbasic (Lower) emotions associated with words. The body maps show regions whose activation increased (warm colors) or decreased (cool colors) when feeling each emotion. (From Nummenmaa L, Glereana E, Harib R, Hietanend JK. Bodily maps of emotions. *PNAS* 111: 646–651 Nov, 27, 2013)

Most emotions were associated with feelings of increased activity in the upper chest area resulting from changes in breathing and heart rate. Almost all emotions showed changes in the head due to increased tension in facial muscles, skin temperature or crying. There may be a reason why angry people are called hot-heads and others who are happy say they "feel good all over," since this is the only emotion associated with enhanced sensations all over the body, including fingers and toes. Sadness was characterized by decreased limb activity and "feeling blue" in most other areas. Love and anger showed increased activity in the upper extremities, possibly in anticipation of hugging or striking someone. Sensations in the digestive system and around the throat region were mainly found in disgust, so it is not surprising that something repulsive can make you "sick to your stomach." Similarly, you really are apt to "stick your chest out and hold your head up high" if you are very proud of some achievement.

As the authors point out, "*This link between emotions and bodily states is also reflected in the way we speak of emotions: a young bride getting married next week may suddenly have 'cold feet,' severely disappointed lovers may be 'heartbroken, and our favorite song may send 'a shiver down our spine'*." However, it's important to note that the bodily sensations reported in this study were not due to any changes in blood flow, heat or anything else that could be measured objectively but were based solely on physical signals or "twinges" that were experienced at different sites. Most emotions cause only minor changes in heart rate or skin temperature, and although you might feel like your face is red when you are very jealous, there is no objective evidence of this. On the other hand, your facial expression may be the best indicator to others of how you feel.

Is Your Face The Window To Your Soul And Your Emotions?

Over 2,000 years ago, Cicero wrote, "*The face is a picture of the mind, as the eyes are its interpreter*." The belief that the eyes are the "window to the soul" or "mirror of the soul" has been attributed to the Bible, da Vinci, and Shakespeare, and is also frequently cited as Hebrew or French proverbs. Our eyes developed from the pineal gland, which Descartes regarded as the principal seat of the soul and the place in which all our thoughts are formed. It is sometimes referred to as the "third eye," which allegedly provides unusual perception, and is sometimes depicted in the middle of the forehead in Hindu deities, and can also be seen in some reptiles. While there is no proof of these esoteric properties, the pineal is an important gland that, like the retina of the eye, is sensitive to light and regulates sleep-wake cycles. Facial expressions are likely the best way to assess someone else's emotions and feelings. As an old saying goes, "The face is more honest than the mouth will ever be."

Charles Darwin is most famous for his 1859 *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the*

Struggle for Life. As noted above, it proposed that humans and animals evolved from some primordial ancestor. This led to a heated debate that continues today because it conflicts with the entrenched belief that man was created in God's image. According to church doctrine, humans are unique (*sui generis*) since only they have immortal souls and thus are distinct from all other species, which similarly have not changed since their initial appearance. Darwin's *The Expression of the Emotions in Man and Animals* published in 1872 was designed to demonstrate that humans and animals had common roots. This book was unusual because Darwin used the new technology of photography to illustrate how facial expressions in humans were similar to those of other animals in similar situations, such as pursing the lips when trying to concentrate and tightening of the muscles around the eye during anger. Thus the "sneer" of a snide and scornful individual and the raised lips and exposed canine teeth of a snarling dog both convey specific emotional states that theoretically could provide adaptive and life preserving advantages.

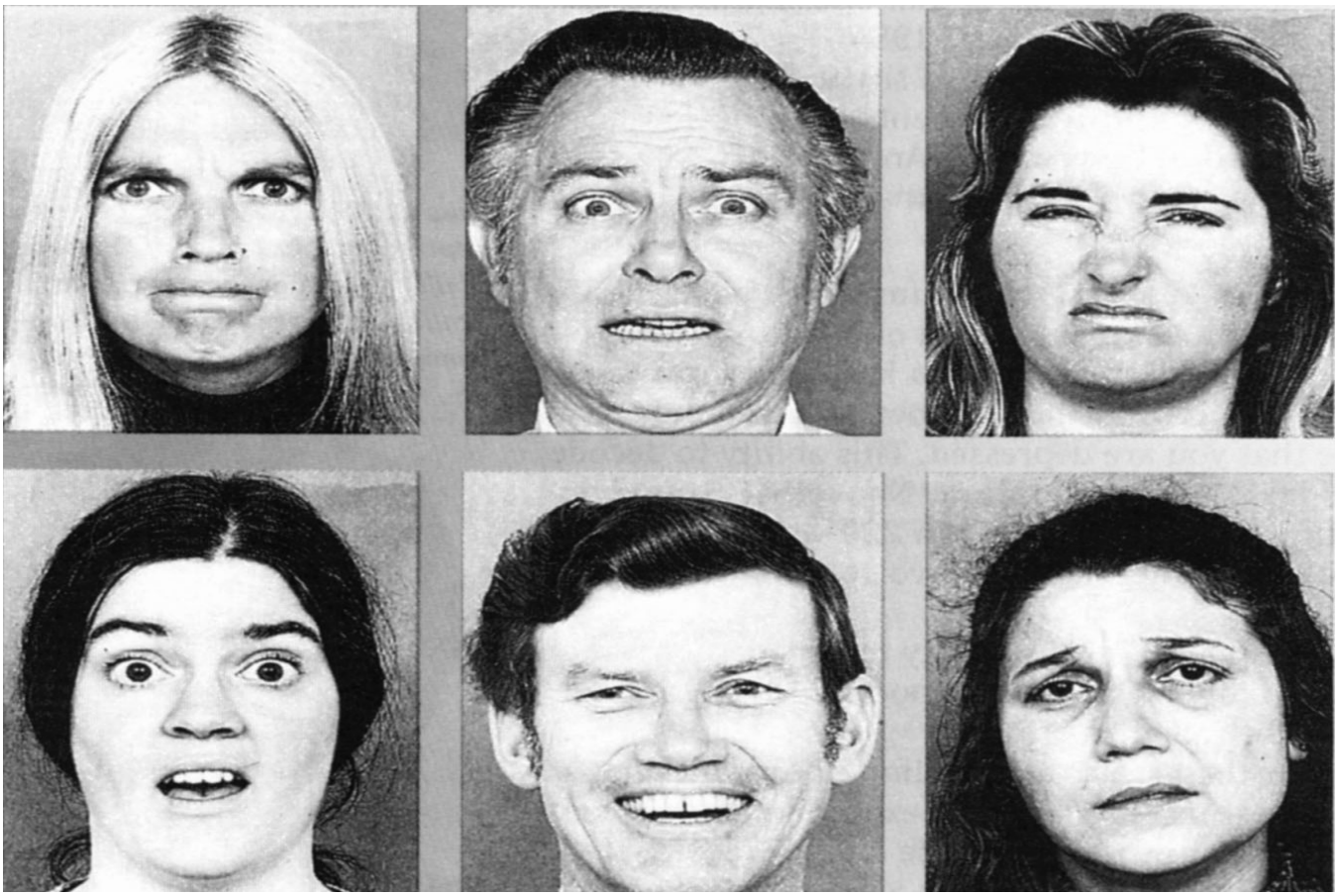
Darwin covered the entire gamut of emotions with chapters devoted to "low spirits" (anxiety, grief, dejection and despair) as well as "high spirits" (joy, love, tender feelings and devotion). Other chapters dealt with "ill-temper, sulkiness and determination," "hatred and anger," "disdain, contempt, disgust, guilt, pride, helplessness, patience and affirmation" as well as "surprise, astonishment, fear and horror." Throughout these chapters, Darwin's concern was to demonstrate how human expressions link human movements with emotional states derived from purposeful animal reactions that were genetically determined. This shared human and animal ancestry was in sharp contrast to Charles Bell's 1824 *Anatomy and Philosophy of Expression,* which claimed that there were divinely created human muscles to express uniquely human feelings and that "*Expression is to the passions as language is to thought*."

Darwin's answer to this was that "*The force of language is much aided by the expressive movements of the face and body*." However, he conceded that there were some complex human emotions that did not seem to have their origins or equivalents in animals, such as shame, shyness, modesty and especially blushing. As Mark Twain later wrote, "*Man is the only animal that blushes. Or needs to.*" People tend to blush when they are embarrassed or feel ashamed because they have violated some taboo. Most responses are genetically determined or stem from repeated habits, and animals apparently have no comparable societal prohibitions. By blushing when we're embarrassed, we show others that we recognize having made a social faux pas and are acknowledging this. Others who see us blushing understand from experience the unpleasant feelings we are experiencing at that moment, so that blushing often serves as a nonverbal, physical apology for our mistake. An analogous situation might be your pet dog rolling over after being caught digging in a flower bed, or is guilty of some other transgression it knows could be punishable. Exposing its belly to you is designed to demon-

strate remorse and submission, since most people would find it difficult to continue feeling anger after the dog continues to maintain this vulnerable position. The propensity to blushing develops around kindergarten age, when children begin to grow conscious of others' feelings and thoughts. Although animals don't blush, all humans do.

Darwin demonstrated this in an albino African woman who felt ashamed and guilty when her nude body was accidentally exposed.

Darwin similarly emphasized that certain facial expressions of emotions were the same regardless of race or color to establish the unity of mankind to challenge the current racist claims that white Europeans had descended from a different and more advanced progenitor than blacks. Darwin's assertions were confirmed 50 years ago by Paul Ekman, who took numerous photographs in different literate civilizations as well as stone age cultures in New Guinea, and demonstrated they were the same for the following six:



One can instantly identify anger (lips pressed firmly together, eyes bulging), fear (brows raised, eyes open, mouth opens slightly) disgust (upper lip is raised, nose bridge is wrinkled, cheeks raised, brows lowered), surprise (brows arched, eyes open wide to expose more white, jaw drops slightly) happiness (widening of mouth corners and big smile), and sadness (lowering of mouth corners, raising of inner portion of brows).

Shifting and rolling the eyes or changes in pupil size can emphasize these emotions, and although some are easy to feign, a trained observer can usually detect this since some of the muscles involved are not under voluntary control. Fake or contrived smiles can be performed at will since they are controlled by the conscious part of the brain that stimulates the zygomatic cheek muscles to contract and pull the corners of the mouth out.

This produces the social or "say cheese" smile flashed by politicians and celebrities as shown below. The unconscious brain automatically generates the genuine smile on the right, since involuntary muscles that raise the cheeks contract, making the eyes crease up and the eyebrows dip slightly. This smile is not learned since it is seen in babies and is identical in individuals who are born blind. It is frequently referred to as the "Duchenne smile" in honor of Guillaume-Benjamin-Amand Duchenne, a French physician considered to be the "Father of Neurology."

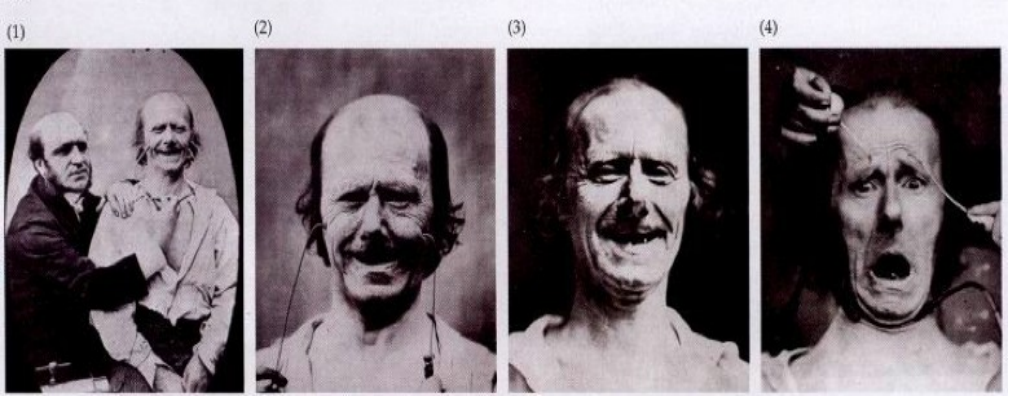
Duchenne was particularly interested in determining how the muscles in the human face produced expressions that he believed could reveal an "*accurate rendering of the soul's emotions*". He was the first to demonstrate that muscle groups like the orbicularis oculi surrounding the eye cannot be activated willfully, but only "*put into play by the sweet emotions of the soul*." After painstaking investigations, he concluded it was the automatic emotion-driven stimulation of this muscle group together with the zygomaticus major, which draws the angle of the mouth superiorly and posteriorly, to form a smile that produces the genuine experience of happiness, joy and laughter. Whereas we can control the zygomaticus major to create a fake smile, but it will not be accompanied by the characteristic changes seen around the eyes. To facilitate his research, he pioneered the use of transcutaneous electrical stimulation (called "faradization" after the British physicist Michael Faraday) to activate single muscles and small groups of muscles in the face, dorsal surface of the head, and neck, and then photographed his subjects with the recently invented camera,

as shown to the right.

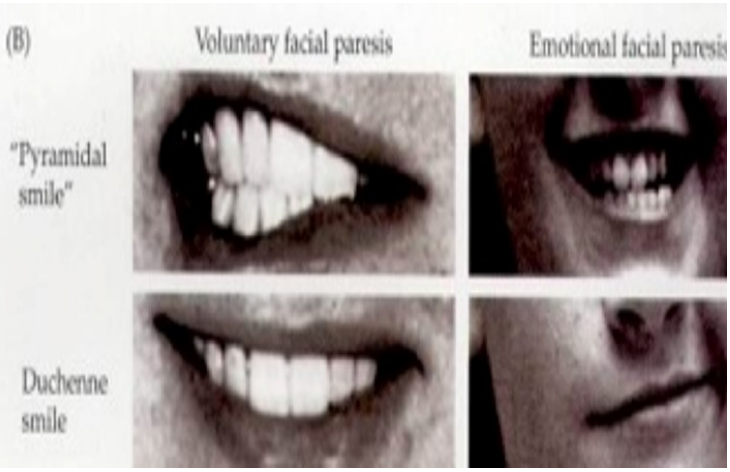
It is of particular interest that the subject reported no discomfort or any emotional experience consistent with the evoked contractions since many claim that putting on a smiling face will make you feel happy, or that Botox injections that keep you from frowning have a similar effect. Recent studies support Duchenne's beliefs as shown to the right.

This seems to support Darwin's theory, and although the monkey seems happy, there is no way to prove this nor is it clear whether this same facial expression occurs under other circumstances.

Duchenne published his findings in an 1862 book entitled *The Mechanism of Human Physiognomy*. It included numerous photographs to support his belief that he was uncovering a God-given language of facial signs, since expressions were too transitory to be drawn or painted. As he wrote, "Only photography, as truthful as a mirror, could attain such desirable perfection," and went on to explain:



Duchenne and one of his subjects undergoing "faradization" of the muscles of facial expression (1) Bilateral electrical stimulation of the zygomaticus major mimicked a genuine expression of happiness. However, closer examination (2) shows insufficient contraction of the orbicularis oculi surrounding the eyes, compared to (3) showing spontaneous laughter. Stimulation of neck and brows evoked an expression of "terror mixed with pain, torture … that of the damned" in (4).



B) Left panels: Mouth of a patient with a lesion that destroyed descending fibers from the right motor cortex displaying voluntary facial paresis. When asked to show her teeth, the patient was unable to contract the muscles on the left side of her mouth (upper left), yet her spontaneous smile in response to a humorous remark is nearly symmetrical (lower left). Right panels: Face of a child with a lesion in the left forebrain that interrupted descending pathways from nonclassical motor cortical areas, producing emotional facial paresis. When asked to smile volitionally, the contractions of the facial muscles are nearly symmetrical (upper right). In spontaneous response to a humorous comment, however, the right side of the patient's face fails to express emotion (lower right). The photo on the right shows the similarity between a genuinely happy smile in a young girl and her pet monkey's facial expression, presumably due to the same joyful feeling.

In the face our creator was not concerned with mechanical necessity. He was able in his wisdom or – please pardon this manner of speaking – in pursuing a divine fantasy … to put any particular muscles into action, one alone or several muscles together, when He wished the characteristic signs of the emotions, even the most fleeting, to be written briefly on man's face. Once this language of facial expression was created, it sufficed for Him to give all human beings the instinctive faculty of always expressing their sentiments by contracting the same muscles. This rendered the language universal and immutable.

Darwin was a great admirer of Duchenne, and included many of his photos in his own book. Having spent two years as a medical student, he was familiar with physiology, but anatomy "disgusted" him. As he later wrote, "*It has proved one of the greatest evils in my life that I was not urged to practice dissection, for I should soon have got over my disgust; and the practice would have been invaluable for all my future work*."

However, he later studied anatomy and made his own careful observations on animals, particularly apes and monkeys, since he lived close to the London zoo. He also had sketches made by artists to support the link between emotions in humans and animals. The one below depicts a disappointed and sulking chimpanzee.

Darwin believed that in addition to love and sympathy, animals exhibited other unselfish qualities that in humans would be viewed as behaving in a moral and righteous fashion because they showed concern for others. Animals could also be more intelligent or sensible, since "*An American monkey, after getting drunk on brandy, would never touch it again, and thus is much wiser than most men*."

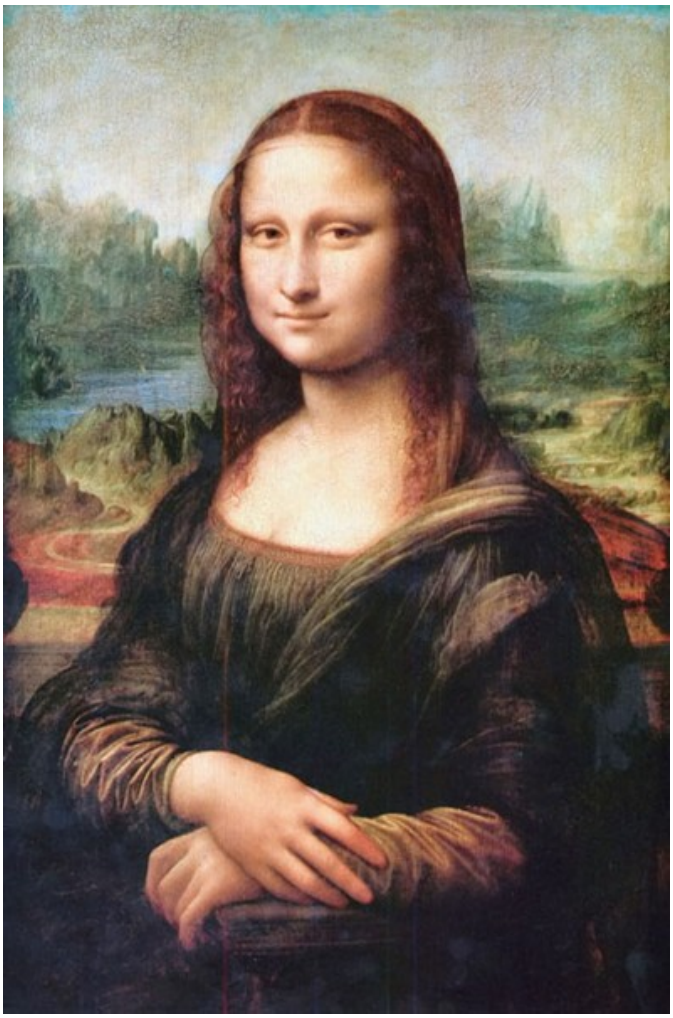
What's So Great About The Mona Lisa And Especially Her Smile?

Darwin was the first person to write about human beauty from a biological perspective, but he relied on correspondence with missionaries to obtain details about beauty in remote societies. Unfortunately, these data were flawed or biased because they were based on idealized British beauty standards, and later studies showed significant cross-cultural differences. Duchenne was particularly interested in what determined an attractive or appealing face and tried to identify those specific "*conditions that aestheti-*

cally constitute beauty" to see if he could reproduce them, since "*Armed with electrodes, one would be able, like nature herself, to paint the expressive lines of the emotion of the soul on the face of man. What a source of new observations!*" The full title of his book was *The Mechanism of Human Physiognomy: The Electro-Physiological Analysis of the Expression of the Passions, Applicable to the Practice of the Plastic Arts*. The final portion was "An Aesthetic Section," in which he criticized and tried to correct classical and revered Greek and Roman sculptures that did not conform to his findings, especially with respect to facial expressions of emotion.

Ancient Greco-Roman and Renaissance artists could only depict emotions based on those they asked their subjects to simulate while posing, or from past memories. But as Pablo Picasso asked, "*Are we to paint what's on the face, what's inside the face, or what's behind it*? *Who sees the human face correctly: the photographer, the mirror, or the painter*?"

The Mona Lisa is the most recognized face, not only in the Western hemisphere, but all over the world. And it has enjoyed this status ever since Leonardo da Vinci (1452-1519) painted it over 500 years ago! Why? She was in her late 20's or early 30's, not particularly beautiful and there is nothing revealing about the title. Mona is a contraction of Madonna, (Madam in English), so it simply means Madam Lisa. She is also frequently referred to as La Giocanda, or the happy and smiling one. However, although this was one of Leonardo's favorite paintings and he carried it with him until he died, he never named either this portrait or the person who posed for it. One reason may be, that as with most of his other paintings, he never finished it. Critics point out that there are hardly any visible eyebrows or eyelashes, and that he probably intended to include these and other refinements at a later date.



Giorgio Vasari, an artist, architect, historian and writer, called it Mona Lisa. He had identified the subject as Lisa Gherardini, the wife of Francesco del Giocondo, a Florentine merchant, based on earlier accounts, details scattered in Leonardo's manuscripts, and the memories of his heirs and other individuals who knew

him, since this was 50 years after it was painted and over 30 years after Leonardo died in France, where he spent the last three years of his life. These and other details appeared in Vasari's massive tome, *Lives of the Most Eminent Painters, Sculptors, and Architects,* which indelibly established him as the most respected authority on the history of Italian art and artists, since it contained some 200 biographies. However, none of these were as lavish as his description of da Vinci's talents and achievements, which he said could only be described in superlatives. They included Leonardo's physical beauty, grace, and strength, a "*divine and marvelous*" mind in which "*memory and intellect formed a mighty union*, a musical virtuoso who could "*sing and improvise divinely"* and a dazzling conversationalist who *"could so clearly express his ideas in discourse, that he was able to confound the boldest opponents*." In addition, "*his interests were so numerous that his inquiries into natural phenomena led him to study the properties of herbs and observe the movements of the heavens.*"

Because of Vasari's stature, it is easy to see why the following excerpt from this biography became the source of all subsequent Mona Lisa accolades.

> Leonardo undertook to execute, for Francesco del Giocondo, the portrait of Mona Lisa, his wife; and after toiling over it for four years, he left it unfinished; and the work is now in the collection of King Frances of France, at Fontainebleau. In this head, whoever wished to see how closely art could imitate nature, was able to comprehend it with ease; for in it were counterfeited all the minutenesses that with subtlety are able to be painted, seeing that the eyes had that lustre and watery sheen which are always seen in life, and around them were all those rosy and pearly tints, as well as the lashes, which cannot be represented without the greatest subtlety. The eyebrows, through his having shown the manner in which the hairs spring from the flesh, here more close and here more scanty, and curve according to the pores of the skin, could not be more natural. The nose, with its beautiful nostrils, rosy and tender, appeared to be alive. The mouth, with its opening, and with its ends united by the red of the lips to the flesh-tints of the face, seemed, in truth, to be not colours but flesh. In the pit of the throat, if one gazed upon it intently, could be seen the beating of the pulse. And, indeed, it may be said that it was painted in such a manner as to make every valiant craftsman, be he who he may, tremble and lose heart. He made use, also, of this device: Mona Lisa being very beauti-

ful, he always employed, while he was painting her portrait, persons to play or sing, and jesters, who might make her remain merry, in order to take away that melancholy which painters are often wont to give to the portraits that they paint. And in this work of Leonardo's there was a smile so pleasing, that it was a thing more divine than human to behold; and it was held to be something marvelous, since the reality was not more alive.

Since Leonardo died in 1519 when Vasari was only 8 years old, it is not clear when he saw the painting, which had been in the Palace of Fontainebleau since then. Perhaps the exquisite lashes and eyebrows he described along with the pores in the skin have faded away over the following 5 centuries, or Vasari added a few embellishments, as he was known to do.

In addition to the mystique surrounding Leonardo created by Vasari, much of Mona Lisa's allure has been attributed to her enigmatic smile. A recent computerized facial analysis judged this to be 83% happy, 9% disgusted, 6% fearful, and 2% angry. Since "*Beauty is in the eye of the beholde*r" you will have to make your own evaluation. This requires standing in long lines at the Louvre to spend 30 seconds looking at it through bulletproof glass at a distance of 6 feet, while everyone around you is taking flash bulb pictures of the small (31" by 21") painting. Although most people are disappointed, the crowds keep increasing every year, and will likely continue to do so.

Paul J. Rosch, M.D., FACP

Editor-in-Chief

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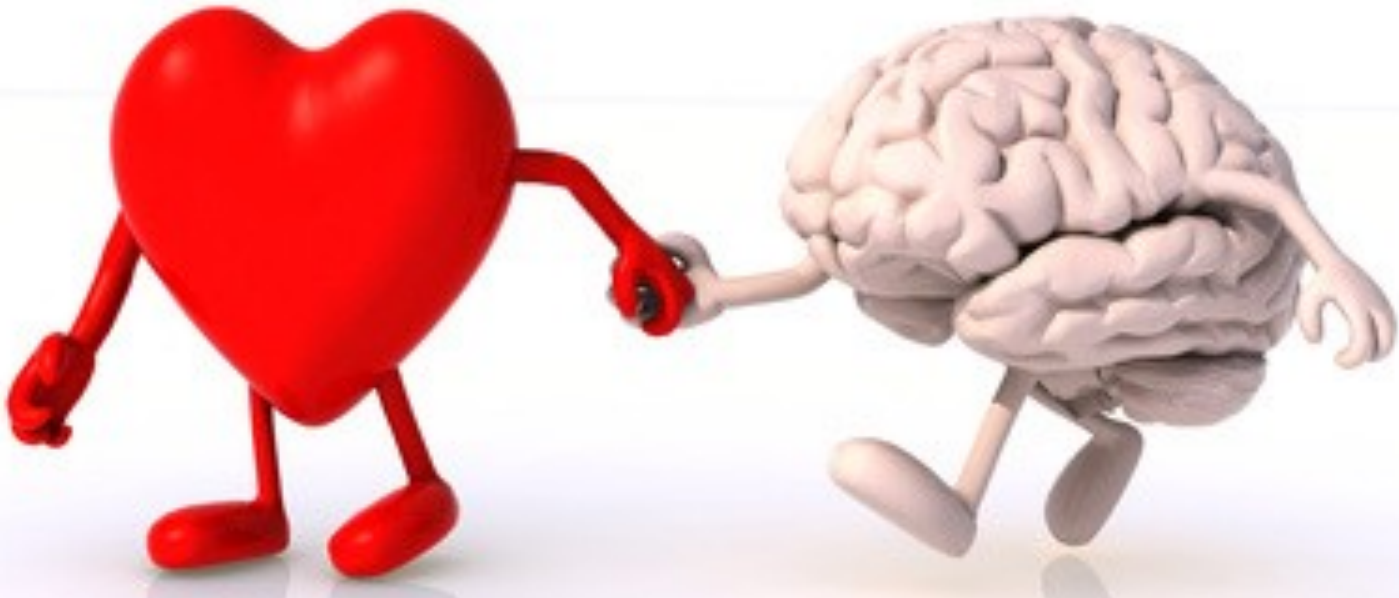

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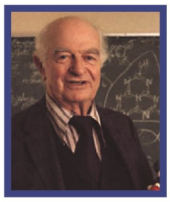
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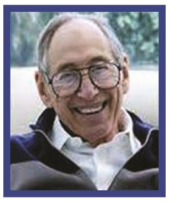
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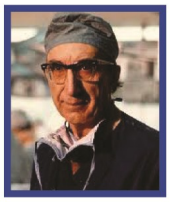
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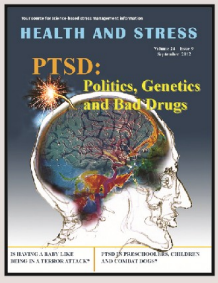

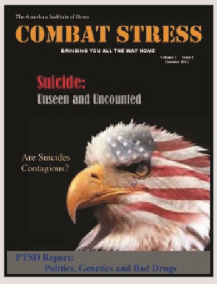

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