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STRESS AND THE BODY'S "WISDOM": FRIEND OR FOE?

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In general, "the wisdom of the body" refers to a multitude of inherited and instantaneous reactions that help us cope more successfully with situations that threaten our well-being. Some believe that such potentially lifesaving responses have been in place since Adam and Eve were created. Others view them as purposeful changes that have been progressively developed during the lengthy course of evolution to insure the survival of a species.

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Many are familiar with this notion of some natural innate power to protect and preserve from Walter Cannon's 1932 *The Wisdom of The Body*. It described in detail the bewildering ability of the body to keep blood pressure, temperature, and levels of oxygen, acidity, glucose, sodium and other vital elements within strict limits, despite daily stresses that disrupted these parameters of health.

Cannon had coined the term "homeostasis" to describe this amazing accomplishment. And since all of the complex and constantly coordinated mechanisms required to maintain homeostasis were completely automatic and involuntary, they were attributed to the "wisdom" of the body. However, he was not the first to use this phrase, nor was Cannon the first to suggest the concept of homeostasis. Although discussed in previous Newsletters, both of these beliefs require further clarification, particularly because of confusion about how "the wisdom of the body" differs from the healing forces of nature (*vis medicatrix naturae*).

The Wisdom Of The Body, The Internal Environment And The Fluid Matrix

"The Wisdom of the Body" was the title of Ernest Starling's 1923 Harveian Oration before the Royal College of Physicians and Surgeons. This annual address had been established to celebrate William Harvey's achievement in proving that the heart circulated blood throughout the body some three centuries earlier. Starling had a special interest in the heart and he began his lecture with the biblical quotation **"Who hath put wisdom in the inward parts? Or who hath given understanding to the heart?"** A renowned physiologist, Starling had previously introduced the term "hormone" in a 1904 address to the College, and this presentation dealt not only with adaptive changes in the heart when subjected to stress, but also similar progress in hormone research. It included a discussion of Cannon's early "fight or flight" research, the recent discovery of insulin by Banting and Best, as well as advances in our understanding of how the pituitary, thyroid and sex glands functioned on a daily basis. Starling carefully explained how nature had skillfully integrated endocrine and nervous system activities in a mysterious manner that was designed to maintain health and preserve life. He emphasized in his conclusion that "only by understanding the wisdom of the body can we hope to attain that mastery of disease and pain which will enable us to relieve the burden of mankind." As Cannon acknowledged nine years later in the Preface to his *The Wisdom of the Body*, "Because my convictions coincide with those of Professor Starling, and because the facts and interpretations which I shall offer illustrate his point of view, I have chosen to give the title of his oration to the present volume."

Cannon had defined what he meant by homeostasis in a prior paper as

The coordinated physiological processes which maintain most of the **steady states in the organism are so complex and so peculiar to living beings** - involving, as they may, the brain and nerves, the heart, lungs, kidneys and spleen, all working cooperatively - that I have suggested a special designation for these states, homeostasis.

He derived homeostasis from the Greek *hómos* (similar), and *histēmi* (standing still). However, it was never meant to imply a condition that was immobile and fixed in humans, but rather a situation of "steady states" that fluctuated within limited ranges and were therefore relatively constant or stable. Subsequent researchers also used homeostasis to refer to the physiological processes and mechanisms responsible for maintaining this metabolic equilibrium. Cannon obviously recognized that similar homeostatic balancing mechanisms operated elsewhere in nature, when he explained, **"All that I have done thus far in reviewing the various protective and stabilizing devices of the body is to present a modern interpretation of the natural *vis medicatrix*."** Thus, it is clear that he viewed the body's "wisdom" as a manifestation of the healing power of nature, rather than

being unique for humans, especially since all of his conclusions were based on experiments in laboratory animals. (Emphasis added)

Sir Charles Sherrington, who coined the terms "neuron" and "synapse", was also intrigued by Starling's interest in integrative functions and the body's "wisdom". He had delivered a series of lectures on how this had been achieved in the nervous system and was awarded a Nobel Prize in 1932 for his contributions. His 1940 book, *Man On His Nature*, was an attempt to reconcile such scientific discoveries with his religious beliefs. Sherrington was fascinated by the fact that although primitive cells could be programmed to perform many different activities, only a particular function persisted in a specific cell despite its repeated divisions and multiplications. He illustrated this in Chapter 4 by carefully tracing how an embryo had developed from a single cell into its ultimate human shape. Because there seemed no other way to explain how this information for both form and function was extracted from the original cell, he also entitled this chapter "The Wisdom of the Body". Almost seven decades later, Sherwin Nuland's *The Wisdom Of The Body* provided a clinical tribute to the mysterious marvels and resilience of the human body to preserve health from the perspective of a practicing physician. A Clinical Professor of Surgery at Yale School of Medicine, Nuland appears almost awestruck as he explains how various body systems are able to automatically adapt to sudden unanticipated stresses based upon his experiences with patients.

The integration of all parts of this effort has a seeming wisdom about it, by which the multiplicity of processes is somehow guided into a harmonious whole. The essence of success is the dynamism that allows each cell to respond instantaneously to even the most minor threat to its integrity, and therefore the integrity of the entire organism.

Cannon's concept of homeostasis had essentially been expressed seven decades previously by Claude Bernard, who asserted that good health depended on maintaining the stability of the *milieu intérieur*, or internal environment. Often called "The Father of Physiology", Bernard pointed out in his lectures that the same general environment surrounded both living organisms and inanimate objects. However, living things also had an internal environment in which vital elements of the body had an optimal habitat or range that must be maintained in order to preserve health. As he noted in his 1865 *Introduction to the Study of Experimental Medicine*,

C'est la fixité du milieu intérieur qui est la condition d'une vie libre et indépendante, et tous les mechanisms vitaux . . . n'ont qu'un but, celui de maintenir constants les conditions de vie dans ce milieu interne. (It is the constancy of the internal climate that is the condition for a free and independent life. All the mechanisms of life

have only one end, that of keeping constant the conditions of life in this internal climate.)

Bernard initially viewed blood as the sole constituent of his *milieu intérieur*, but later added lymph. Over a decade later, in his 1878 *The Phenomenon of Life in Plants and Animals*, he again changed this to include "the totality of the circulating fluids of the organism". Cannon called this "the fluid matrix". Like Bernard, he believed that the key to understanding the wisdom of the body and its ability to preserve health was to uncover the mechanisms responsible for insuring the stability of the fluid matrix.

Learning How The Wisdom Of The Body Works Via Vivisection

Bernard had been strongly influenced by the mechanistic views of René Descartes, the celebrated 17th century philosopher, scientist and mathematician. Descartes viewed the human body as a complex machine comparable to a complicated clock or the spectacular statues in French water gardens that moved in response to changes in hydraulic pressure. Illness occurred when the body's machinery broke down and it was the physician's "job" to find the source of the problem and repair it. As with most other machines, this could best be accomplished by gaining a better knowledge of the body's smallest working parts. Descartes believed that man was unique because nothing else on earth had a mind (or soul). In his *Passions of the Soul* and *The Description of the Human Body*, he argued that like all other devices that produced motion, the machinery of the body obeyed the laws of physics. However, since mind/soul was a non-material and motionless gift from God, it was separate from the material mechanics of the body and not subject to any known laws. Mental disorders were also a mystery and beyond human comprehension. Like many other illnesses, they were often viewed as a punishment from God for some sin, or possibly even due to possession by an evil spirit that required exorcism. As a result, mental problems were more properly within the province of the Church, and should be treated by priests rather than physicians. This split persisted well into the 19th century until it was replaced by the germ theory promoted by Louis Pasteur and the advent of psychiatry as a medical specialty.

Descartes picked the pineal gland as the seat of the mind/soul because it was located near the ventricles of the brain and he suspected that the cerebrospinal fluid in the ventricles acted through the nerves to control the body. He also mistakenly believed that only humans had a pineal gland and a mind, and therefore that animals could not feel pain. This led to the practice of dissecting live animals, and even subjected them to torturous experiments to study various physiological functions. Claude Bernard was one of the prime proponents and practitioners of such procedures, and was known as the "prince of vivisectionists". His wife vehemently disapproved, particularly since his laboratory had been funded by her dowry, and made

his home life miserable. She divorced him in 1869 and left with her daughter to campaign for animal rights, and founded the first anti-vivisection society in France in 1883. Many others were also disgusted by stories of Bernard's experiments, especially since these tales of horrors were frequently magnified. George Hoggan, a physician who spent four months working with Bernard, provided one of the few contemporary accounts of what actually transpired. Although acknowledging that the achievements made in understanding the physiology of the stomach, pancreas and liver could not have been otherwise accomplished, he wrote that his experiences in Bernard's lab had made him "prepared to see not only science, but even mankind perish, rather than have recourse to such means of saving it."

Bernard constantly came under attack and one of his severest critics was Anna Kingsford. The daughter of a wealthy London merchant, she was well educated, strong willed and convinced that she had psychic powers because of unusually accurate premonitions of unexpected deaths in family and friends. Another talent was the alleged ability to leave her body and travel through the universe and time. She believed in reincarnation and said that she had visited her past lives spent as Anne Boleyn, Joan of Arc, and Faustina, wife of the Roman emperor Marcus Aurelius. She also claimed that she could communicate with the spirit realm and that during some of these séances she had been contacted by the spirits of animals. This confirmed her belief that animals had souls, and as a result, she became a strict vegetarian and refused to wear or use anything made from dead animals, including furs and leather shoes and belts. She decided to become a physician to promote her animal welfare and vegetarian views, and went to Paris in 1874 to further her training. Although women were allowed to study medicine in France, they were not welcomed. Anna was continually discriminated against by her teachers and fellow students, particularly when she protested against what she considered to be cruel animal experiments that bordered on torture. As she wrote to a friend,

I have found my Hell here in the Faculté de Médecine of Paris, a Hell more real and awful than any I have yet met with elsewhere. It came strongly upon me one day when sitting in the Musée of the school, with my head in my hands, trying vainly to shut out of my ears the piteous shrieks and cries which floated incessantly towards me up the private staircase. Every now and then, as a scream more heart-rending than the rest reached me, the moisture burst out on my forehead and on the palms of my hands, and I prayed, "Oh God, take me out of this Hell; do not suffer me to remain in this awful place."

She eventually graduated in 1800, being the first student to obtain a medical degree without ever having experimented on a single animal. Her final thesis was on the benefits of vegetarianism, which she later turned into a book,

L'Alimentation Végétale de l'Homme, or (The Perfect Way in Diet). She returned to England, where she was only the second woman to practice medicine, and became President of the Theosophical Society in 1883. However, she is best remembered for her attacks on Claude Bernard.

According to one account,

While studying in the medical library one afternoon, she heard weird screams coming from a nearby laboratory. She learned from an attendant that Dr. Claude Bernard, one of her instructors, was dissecting a live dog in one of his medical experiments. Revolted by this example of what she considered hideous torture and murder, she became a fierce and vocal opponent of the surgical use of live animals in medical research. She wrote pamphlets and articles urging the university to denounce and stop the practice, and once offered herself for vivisection if their professors would stop experimenting on live animals. In December of 1877, while listening to Dr. Bernard lecture on his latest experiments, in which he had slowly baked animals to death in a specially constructed oven in order to study body heat, Anna jumped up and screamed, "Murderer!" There followed an argument between Anna and Bernard over the morality of his "torturing of defenseless animals." After storming out of the classroom, Anna stopped and summoned all of her powers. Feeling as though she were a "spiritual thunderbolt," she launched her occult self against Bernard, cursing his existence, and then collapsed. Soon after that Bernard fell ill. Six weeks later, when Anna arrived at his classroom, she found a note tacked to the door announcing his funeral. She exultantly wrote "Woe be to the torturers.... I will make it dangerous, nay, deadly, to be a vivisector. It is the only argument that will affect them. Meanwhile, thank God the head of the gang is dead." In 1886 her attention turned to Drs. Paul Bert and Louis Pasteur. Occupants of buildings near Bert's Parisian laboratory frequently complained about his habit of leaving partially dissected animals alive overnight. Their cries of agony made it impossible for these neighbors to sleep. Anna again hurled her thunderbolt, and Bert slowly but surely fell ill and wasted away and died a few months later. She noted in her diary: "I have killed Paul Bert, as I killed Claude Bernard; as I will kill Louis Pasteur if I live long enough ... it is a magnificent power to have, and one that transcends all vulgar methods of dealing out justice to tyrants."

Shortly after Bert's death in February 1887, Pasteur did become severely ill from a mysterious malady. His physicians were baffled, but Kingsford was certain it was due to one of the many thunderbolts she had directed at him. He recovered spontaneously within a few weeks but Kingsford died in London in February 1888. A cold she had caught while investigating

Pasteur's laboratory during a torrential rainstorm had exacerbated her previously quiescent tuberculosis. While Bernard is portrayed by Kingsford and other critics as being heartless, cruel and oblivious to the suffering of his experimental animals, nothing could be further from the truth. He was clearly influenced by Descartes body machine views when he wrote,

A living organism is nothing but a wonderful machine endowed with the most marvelous properties and set going by means of the most complex and delicate mechanism.

However, he did not share Descartes' view that man was unique and that animals did not have minds and therefore could not experience pain. He was very sensitive to this and was one of the first to use morphine and chloroform in his experiments if he was certain there was no danger this would jeopardize the results. He was convinced that all meaningful advances in medicine could only come from animal experiments, no matter how distasteful or repugnant they seemed. He explained his position in *Introduction to the Study of Experimental Medicine* as follows:

The physiologist is not a man of the world, he is a scientist, a man caught and absorbed by a scientific idea that he pursues; **he no longer hears the cries of the animals, no longer sees the flowing blood; he sees only his idea**: organisms that hide from him problems that he wants to discover. He doesn't feel that he is in a horrible carnage; under the influence of a scientific idea, he pursues with delight a nervous filament inside stinking and livid flesh that for any other person would be an object of disgust and horror.

Have we the right to make experiments on animals and vivisect? I think we have this right, wholly and absolutely. **It would be strange indeed if we recognized man's right to make use of animals in every walk of life, for domestic service, for food, and then forbade him to make use of them for his own instruction in one of the sciences most useful to humanity.** No hesitation is possible; the science of life can be established only through experiment, and we can save living beings from death only after sacrificing others. Experiments must be made either on man or on animals. Now I think that physicians already make too many dangerous experiments on man, before carefully studying them on animals. I do not admit that it is moral to try more or less dangerous or active remedies on patients in hospitals, without first experimenting with them on dogs; for I shall prove, further on, that results obtained on animals may all be conclusive for man when we know how to experiment properly.

It is important to emphasize that none of Bernard's discoveries could have been made without experimenting on animals and to appreciate that this

practice exposed him to constant threats and dangers. Other early stress researchers, including Walter Cannon and Hans Selye had to endure similar problems, but these were not as severe or frequent. Walter Cannon summed things up over 100 years ago as follows, "The antivivisectionists are the second of the two types Theodore Roosevelt described when he said, 'Common sense without conscience may lead to crime, but conscience without common sense may lead to folly, which is the handmaiden of crime.'" Although animal research is much more humane today due to protective laws and advances in anesthesia, the debate continues. In its 1988 position paper defending animal experimentation, the AMA noted, "In fact, virtually every advance in medical science in the 20th century, from antibiotics and vaccines to antidepressant drugs and organ transplants, has been achieved either directly or indirectly through the use of animals in laboratory experiments." It specifically supported Bernard's claim that "there is, in principle, no other method (save immoral and illegal human experimentation) which could yield the same results."

Hippocrates Four Humors And The Healing Forces Of Nature

Bernard's view of the body as a "wonderful machine" was very different from the mechanical device proposed by Descartes. The wisdom of Bernard's body machine came from the multitude of mechanisms that maintained the stability of the internal environment. He had demonstrated that these homeostatic and health preserving mechanisms followed fixed physical as well as chemical laws. In addition, they were not unique for man, were the same in animals, and could be found in other living organisms. As Cannon later explained, this was merely a manifestation of the *vis medicatrix naturae* (nature's healing powers), a concept attributed to Hippocrates. Twenty five hundred years ago, Hippocrates taught that good health depended on the proper balance of the four "humors" that permeated the body: blood, phlegm, yellow and black bile. Illness resulted when injury or disease upset this balance, but equilibrium could be restored by taking advantage of and assisting the body's natural healing powers. These humoral components of the internal environment were strongly influenced by nature, since each humor was linked with one of the four seasons and four elements. These determined their physical qualities as well as associated temperaments, as noted below.

<u>HUMOR</u>	<u>SEASON</u>	<u>ELEMENT</u>	<u>QUALITIES</u>	<u>TEMPERAMENT</u>
Blood	Spring	Air	Hot and Moist	Sanguine
Phlegm	Winter	Water	Cold and Moist	Phlegmatic
Yellow Bile	Summer	Fire	Hot and Dry	Choleric
Black Bile	Fall	Earth	Cold and Dry	Melancholy

The doctor's duty was primarily to assist natural healing efforts to restore

humoral balance. Since fever was a hot and dry disease due to yellow bile, they would prescribe cold baths to increase phlegm. Conversely, a cold or upper respiratory infection that produced excess phlegm required bundling up in bed and a liquid diet consisting of barley gruel and lots of water and honey and/or wine. Other treatments to correct a presumed excess or deficiency of a particular humor were removing blood, purging and inducing sweating or diuresis. The only medicines available were those obtained from natural sources, such as the leaves of the willow tree or juice from the poppy plant to relieve pain during childbirth or following injury. These were the precursors of aspirin and morphine, and it is estimated that about one fourth of modern drugs originated from plants or trees. In some instances, primitive man learned to develop remedies from observing animals. Elephants, pigs and chimpanzees had long been observed to enjoy eating fallen mangoes, apples and other alcohol rich fermenting fruits. Excavations of stone wine presses indicate that the Greeks had learned to make wine from grapes at least 4,000 years ago, and by Hippocrates' day, wine supplied a steady source of a product with a predictable effect on mood and behavior that also had medicinal properties.

Hippocrates was born on the Greek island of Cos around 460 BC and became such a famous physician and teacher that he is considered to be "the Father of Medicine." None of his original writings exist and all that we know about him comes from some seventy textbooks, lectures, research notes and philosophical essays compiled by his students and followers after he died. These reveal that he was the first person to reject superstitions, legends and beliefs claiming that supernatural or divine forces caused illness. He separated medicine from religion by insisting that disease was not a punishment inflicted by the gods but rather the product of environmental factors, diet, and living habits. He believed that the body was not passive to injury or disease and could rebalance itself to restore normalcy through its natural healing powers. In many instances, the signs and symptoms of an illness really represented the body's attempt to restore equilibrium via its natural healing powers. In certain respects, this anticipated the concept of homeostasis, with the four humors representing the components of Hippocrates' internal environment. It was this capacity to correct imbalances that differentiated us and other organisms from non-living matter. The doctor's chief role was to assist the body's *vis medicatrix naturae* as noted above. It was also important to promote proper nutrition and exercise and to avoid unhealthy air, water or other environmental hazards. Hippocrates' philosophy was based on common sense and the underlying principle that it was preferable to leave things to the healing power of nature and intervene as little as possible with unproven remedies or surgical procedures that might do more harm than good.

Some examples of his wisdom include the following quotations:

Disease is not caused by demons or capricious deities but rather by natural forces that obey natural laws. Hence, therapeutic procedures can be developed on a rational basis.

The well-being of man is under the influence of the environment, including in particular air, water, places and the various regimens. **The understanding of the effect of the environment on man is the fundamental basis of the physician's art.**

Health is the expression of a harmonious balance between the various components of man's nature (the four humors that control all human activities) and the environment and ways of life.

Whatever happens in the mind influences the body and vice versa. In fact, mind and body cannot be considered independently one from the other.

Health means a healthy mind in a healthy body. It can be achieved only by governing daily life in accordance with natural laws that insure **equilibrium between the different forces of the organism and those of the environment.**

Generally speaking, all parts of the body which have function, if used in moderation, and exercise in labors to which each is accustomed, become thereby healthy and well developed, and age slowly; but **if unused and left idle, they become liable to disease, defective in growth and age quickly.**

Hippocrates emphasized the inseparability of mind and body. Since the four humors that circulated throughout the body carried messages from the mind to other structures, the concept of psychoneuroimmunology is in some respects old wine in a new bottle. Although he was unaware of the existence of bacteria and other germs, he believed that diseases and especially epidemics could be transmitted through unhealthy air. The Black Death plague was attributed to such a *miasma* (Greek for poisonous air or vapor) and malaria comes from the Italian *mal aria* (bad air) that surrounded stagnant swamps. He recognized that fever might be a manifestation of the body's natural attempt to restore normal balance that had been upset by illness, and was therefore beneficial. He allegedly said, "Fire will cure when medicine will not." Artificially induced fever has been used to treat syphilis, arthritis and other illnesses, and some studies show that patients with viral illnesses who receive aspirin to lower an elevated temperature take longer to recover. It is doubtful that bloodletting would have persisted for over 2,000 years had it not provided significant and consistent benefits. Some of these are being rediscovered and this is still the treatment of choice for hemochromatosis.

How The Wisdom Of The Body Can Boomerang Due To Stress

Hippocrates is probably best remembered for the Hippocratic oath traditionally taken by physicians when they graduate. It emphasizes the need to practice in an ethical fashion that respects the dignity and needs of the patient, with the strict warning "*primum non nocere*", (first of all do no harm). Unfortunately, this seems to have been forgotten, as medicine has increasingly become a profit driven business rather than a caring profession. The wisdom of the body also seems to have suffered, particularly with respect to how we react to acute and severe stress. The nature of stress for our primitive ancestors was an occasional physical threat from a hostile tribe or predator, flood, hurricane or other natural disaster. Contemporary stress is characterized more by repeated mental and emotional challenges such as: conflicts with family, co-workers and customers, getting stuck in a traffic jam on the way to the airport, and a host of other daily hassles. Unfortunately, our bodies still automatically respond with the same archaic "fight or flight" responses that serve no useful purpose. Instead of helping to preserve life, they have become harmful and potentially lethal. Repeatedly invoked, it is not difficult to understand how they contribute to hypertension, stroke, heart attacks, ulcers, low back and neck pain due to muscle spasm and other "diseases of civilization".

Contemporary stress is also more likely to be insidious and sneaky. Its only manifestation may be depression due to persistent poverty, discrimination, frustration, or the death of a loved one or loss of some other important relationship. There are relatively few of the cardiovascular, musculoskeletal or other symptoms associated with acute stress, since the major response is increased production of cortisol, which has more of an impact on immune system function. Increased cortisol impairs the immune system's ability to ward off viral infections, resulting in increased susceptibility to illnesses ranging from the common cold and herpes, to AIDS and certain viral linked cancers. There is also evidence that pro-inflammatory immune system components accelerate the deposition of atherosclerotic plaque. Under normal circumstances, cortisol prevents inflammation from getting out of control. Stress can disrupt this mechanism so that there is nothing to put the brakes on inflammation when it is no longer needed. Normal healthy tissue may be perceived as a foreign invader, and repeated immune system attacks can cause rheumatoid arthritis, lupus, and other autoimmune diseases. Additional excess cortisol effects include loss of memory for names and recent events and difficulty in concentration due to shrinkage of the hippocampus and prefrontal cortex. Cortisol also increases growth in the amygdala, a region of the brain associated with anxiety and emotional memory. Increased amygdala activity can lead to a condition called "learned helplessness", in which people can feel that their actions in high risk situations don't matter, and they are apt to act irresponsibly.

What does the future hold with respect to our ability to respond to acute and/or chronic stress? Will things improve or worsen as humans continue to evolve? Followers of Darwin would argue that this depends on what is best to insure survival in a new environment. Creationists and other proponents of intelligent design believe that the future is unknown and depends on the will of God or some supernatural power. And fundamentalists, some of whom claim that nothing has changed since the earth was created on October 23, 4004 B.C., are convinced that things will continue to remain the same. A 2008 Gallup poll revealed that **44 percent of Americans believe that "God created human beings pretty much in their present form at one time within the last 10,000 years or so."** Nevertheless, it seems clear that evolutionary changes consistent with Darwin's natural selection theory have occurred in various short lived species over the past 100 years in an effort to adapt to a novel environment. (For humans, this would be the equivalent of more than 50,000 years). However, these were changes in physical characteristics rather than emotional or cognitive responses, and scant information is available about their evolution.

It had been widely believed that adult brain structure doesn't change. The structure and function of the brain determine how you think and feel, and if a stroke killed brain cells they were gone forever. Researchers have now shown that you can re-grow brain cells, and that **brain function and structure can be changed by the way you think.** Studies in the new science of neuroplasticity reveal that the brain can adapt, heal, renew itself after trauma, and generate new neurons, even in the elderly. As Sharon Begley explains in *The Plastic Mind*, these claims, which are supported by PET scans and functional MRI's, confirm the benefits of the Buddhist practice of mindfulness meditation in achieving such rewards. The bottom line is that we have the potential to change how we respond to stress by changing our perceptions and how we think. As the Greek philosopher Epictetus noted 2,000 years ago, **"We are disturbed not by things, but by the views we take of things."** So first we think, then we feel, and then we act. And we don't have to wait 500 centuries for evolutionary changes; the future has already arrived. For more on advances in neuroplasticity — stay tuned!!

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