EQUILIBRIUM THEORY,

New Understanding of Human Physiology and Homeostasis, New Answers in Functional Medicine.

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Significant advances in science often come through theories, for example Pasteur's germ theory, Darwin's theory of evolution, and Einstein's theory of relativity. In these and many other theories, an underlying general principle explains complicated observations and phenomena. By finding this general principle, a theory organizes and simplifies knowledge in a particular field. It transforms thinking – the old familiar world gives way to new understanding.

This paper presents a groundbreaking new theory of human health and disease, "Equilibrium Theory," which condenses the large body of medical knowledge on human physiology into an easy-to-understand, easy-to-use general principle. The theory conforms to all known medical science, and then goes beyond that science to resolve baffling physiological evidence. In addition, Equilibrium Theory identifies human nutritional requirements in a fundamental new way – a direct correlation between physiology and nutrition. Here physiology is the template, delineating and explaining the need for and use of each nutrient within these nutritional categories: macronutrients (carbohydrates, proteins, fats and fibers), B vitamins, fatty acids, and trace metals (minerals). This permits the straightforward application of nutrition to current needs, lifestyle demands, general health maintenance, and the treatment of disease. Remarkably, Equilibrium Theory also solves the mystery of chronic diseases, revealing the pathogenesis, correct pathology, and physiological remedies (needed to restore homeostasis) for osteoarthritis (OA), rheumatoid arthritis (RA), multiple sclerosis (MS), amyotrophic lateral sclerosis (ALS), lupus, fibromyalgia, chronic fatigue syndrome, and many more. One paradigm encompasses and describes all the major chronic diseases! These two discoveries – a new template for nutrition, and a new chronic disease paradigm – provide exciting, breakthrough answers in functional medicine.

Introduction

Excepting genetic and environmental factors, physiology and nutrition largely control health. Physiology is internal functions and activities, especially how glands and organs work. Nutrition provides the raw materials, such as vitamins and trace elements, for glands and organs to synthesize and secrete hormones, enzymes and other end products necessary for life. Targeted nutrition for each gland, organ and function in the body builds vigorous health and long life, and eliminates diseases and their root causes.

The sciences of physiology and nutrition currently exist in isolation. Equilibrium Theory links these two fundamental health providers with precise correlations, thereby enabling one to truly live Hippocrates' words, "Let food be your medicine." To help achieve this coupling, the theory further defines and characterizes the medical term, "HOMEOSTASIS: stability and

equilibrium in a physiological system through feedback." Homeostasis is the internal dialogue of harmony going on in all living things. The great philosophers throughout history teach harmony too – in your life, mind and relations with others. Equilibrium Theory extends that work in progress to the delicate, complicated physical self. And physical harmony, working with and not against your own internal homeostasis, nurtures and builds health and mind-body-spirit wellness.

The physical world confounds and thwarts the human mind at every turn, but it often hides a solution in plain sight. Not so many centuries ago, our ancestors looked up at the sun and full moon in wonder and saw only round, sacred objects. A new perspective would change the world forever. During the Renaissance, a corps of discoverers including Copernicus and Galileo saw spheres and the shadow of a sphere on the moon, and realized that that said something profound about the earth and its place in the solar system. Somewhere health hides a similar secret and simple key… perhaps as follows.

The delicate, complicated physical body lives a hard reality indeed. Eat, drink and breathe or there's no thinking, acting, living output. Food is the primary input, and food consists of four distinct compositional types: carbohydrates, proteins, fats and fibers. Why "four," and does that say something profound about the human body, how it works, and how it handles the challenges of life?

The general principle of Equilibrium Theory is the following new understanding of the inner workings of physiology and homeostasis. Within the human body and its network of glands and organs, four interconnected functions – ENERGY, HEALING, STRESS and IMMUNE – work in healthy equilibrium, or internal balance. The body's response to all internal needs and external forces lies within and must adhere to this four-part harmony. Moreover, these tasks are the template for nutrition. Thus with the perfect symmetry of nature, each food type nourishes one of these four functions: carbohydrates for energy, proteins for healing, fats for stress (cells burn fat instead of glucose, a true definition of stress!), and fibers including phyto-compounds for immune. Significantly, the same direct relationship and necessary equilibrium apply to other nutrients and their nutritional categories: B vitamins, fatty acids, and trace metals.

Physiology and especially homeostasis are the basis of natural therapeutics including nutrition and acupuncture, and therefore important keys in finding natural solutions to health and disease. Using Equilibrium Theory, on-target nutrition can build health and eliminate dysfunctions and disease in crucial energy, healing, stress and immune systems. Such complete nutrition is life giving, restorative and forgiving. Of course, nutrition does not produce instant results; rather it's a slow building process of one nutritional factor upon another until there is synergy, a nutrition and resulting health effect much greater than the sum of the parts. Good raw material input equals good end product output – here is the inviolable rule of all chemical systems including life's most advanced creation.

Like other theories, Equilibrium Theory involves subjective insight and discovery, and will require objective testing and confirmation. However, two objective findings give immediate

credence and weight to this theory: (1) the central concept of a four-part harmony in Energy, Healing, Stress and Immune functions explains all observed human physiology including zinc-copper antagonism[1] and the puzzling results of beta-carotene cardiovascular and cancer studies;[2,3] and (2) Equilibrium Theory correctly predicts the pathologies of chronic diseases, for example, it reveals why arthritis divides into two main types, and then describes the pathology of both osteoarthritis and rheumatoid arthritis precisely, i.e. osteoarthritis is a degenerative disease in the protein structures of cartilage,[4,5] while rheumatoid arthritis is an autoimmune disease in the connective tissue of cartilage.[6]

Universal in its application, Equilibrium Theory also agrees with the wisdom of traditional medicine. In particular, the theory fits perfectly into Chinese medicine, the principles of Qi and the yin and yang duality of life. Equilibrium Theory reveals many new yin and yang homeostatic balances essential for health.

EQUILIBRIUM THEORY PHYSIOLOGY

The endocrine system largely controls physiological activity in the human body. Major endocrine glands are pituitary, adrenal, thyroid, pancreas and liver. Other glands act in supporting roles: hypothalamus, pineal gland, sex glands (ovaries or testes), parathyroid gland, and the lymphatic system including thymus and spleen. While the pituitary gland regulates this complicated endocrine system, the physiology of the adrenal gland dictates the action – how the body responds to ALL internal needs and external forces. For this reason, the adrenal gland is critical to homeostasis and health.

Functions

Functions are tasks that the creator, evolution or the life force have programmed into the human body to meet all challenges of our environment. The adrenal gland runs the most important task program, with four primary functions – Energy for today's activities; Healing of the body, whether normal breakdown and repair or from injury; Stress, i.e. handling stress; and Immune response and system – and many lesser or subfunctions within these primary ones. While in fact only Energy and Stress function chemistry is adrenal centered, when thinking in terms of physiology, placing all four primary functions in the adrenal gland purview facilitates easy understanding of their dynamic interactions. In reality, physiology is not governed by anatomy.

Figure 1 is a construct, a simple model to explain and predict how complex adrenal gland physiology works. The figure does not depict physical structure; rather it is a schematic of the primary functions, dependent body systems and normal functional flow or communication within the endocrine system, pituitary → adrenal medulla → adrenal cortex → pituitary feedback. Figure 1 reveals a four-part harmony in the adrenal tasks of Energy, Healing, Stress and Immune. This is the key discovery and central concept of Equilibrium Theory. The adrenal gland works four jobs, often at the same time: energy czar, healing supervisor, stress manager, and minister of defense.

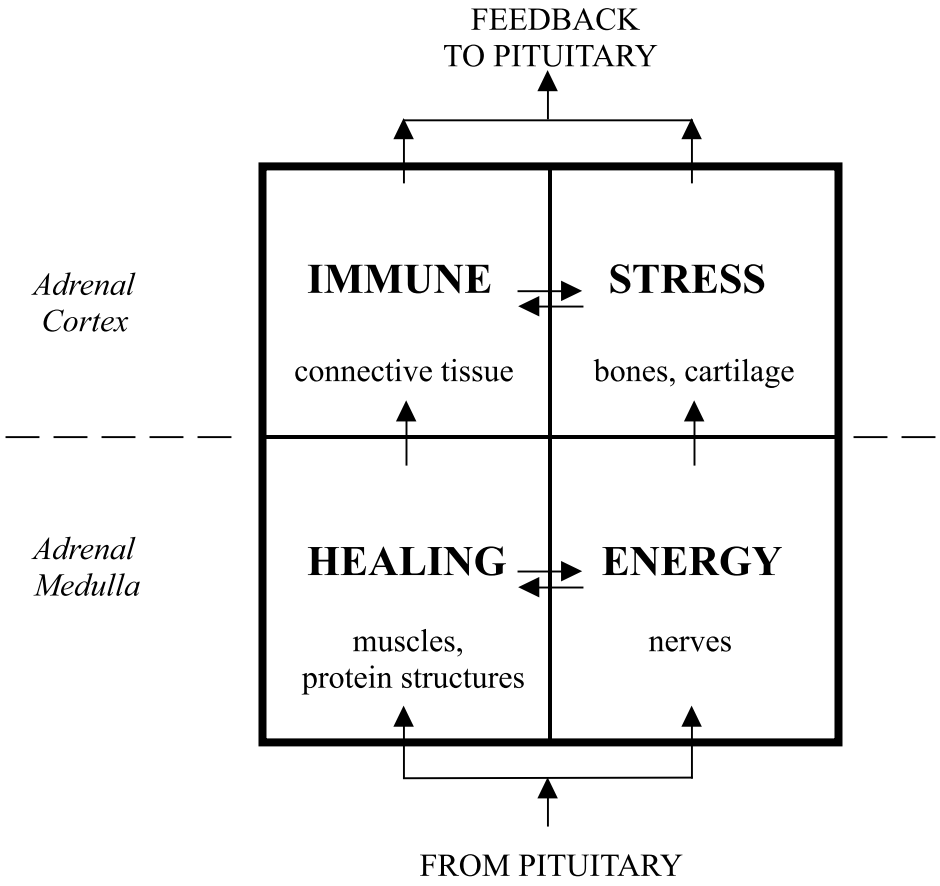

FIGURE 1. ADRENAL GLAND PHYSIOLOGY. *Two identifiable physical parts: medulla and cortex. Four primary functions: ENERGY, HEALING, STRESS and IMMUNE with "dependent body systems" listed under each. Arrows indicate normal functional flow; equilibrium arrows (⇌) denote balance between functions within the medulla and cortex.*

Adrenal Medulla is divided into two functional (not physical) parts, Energy and Healing. These parts have to be in balance or equilibrium with each other as represented by "⇌" in Figure 1. Neither primary function dominates over the other. Basically, Energy and Healing share medulla resources in a give-and-take relationship, going back and forth depending on current body needs. Energy comes principally from the medulla hormone epinephrine (adrenaline). Nerves are interconnected with and dependent upon Energy/epinephrine, thus the term "dependent body system." If something goes wrong with Energy functioning, something will go wrong with the nervous system. The other half of medulla equilibrium is Healing (primary adrenal function) and muscles and protein structures in the body (its dependent body system). All muscle diseases lie in this Healing province.

Common medical knowledge… The adrenal medulla receives pituitary instructions

(signified by →) through the central nervous system and neurotransmitters. Reacting, it synthesizes and secretes two major hormones, epinephrine and norepinephrine. Epinephrine directs *fight or flight* response, increasing heart rate, cardiac output, blood pressure and carbohydrate metabolism. Norepinephrine, both hormone and neurotransmitter, has like but limited hormonal action, constricting blood vessels and dilating bronchial tubes. Meanwhile, Healing activities largely take place outside of the adrenal gland. Keep in mind, Figure 1 does not clarify chemistry or where that chemistry takes place; it models functions and how they interact.

Adrenal Cortex is similarly divided into two functional parts, Stress and Immune, which have to be in equilibrium. Neither primary function has an absolute right to cortex resources. Stress and Immune are coupled in a dance for life, as are medulla Energy and Healing. Stress, or better said, "the ability to handle stress," comes from the cortex hormone cortisol. The often-prescribed steroid cortisone is an imperfect copy of cortisol, and an imperfect attempt to restore proper function here. The dependent body system of Stress is bones and cartilage. Stress diseases manifest in bone and cartilage, typically arthritis. Immune system is the other primary function in the back and forth cortex equilibrium *tango*. Connective tissue is its dependent body system.

Common medical knowledge… The adrenal cortex synthesizes and secretes two steroidal hormones: cortisol (known as a glucocortiocoid) for fighting stress and for inflammatory and immune system suppression, and aldosterone (mineralocorticoid) to control sodium/potassium and water balance in the body. The cortex also releases some male hormones. In both sexes, the cortex is directly involved in sexual functioning and connected to the ovaries or testes. Immune system activities occur mostly outside of the adrenal gland and within bone marrow, thymus, spleen and the lymphatic system, there producing B-lymphocytes, T-lymphocytes, and other specialized white blood cells.

Dependent Body Systems

Dependent body systems are systems seemingly in no way connected to the adrenal gland, yet they require proper adrenal functioning and health to maintain their own well being. How can this be? How can these distant, large systems – nerves, muscles and protein structures, bones and cartilage, and connective tissue (from Figure 1) – be brought down to dysfunction and disease by the tiny adrenal gland and its physiology?

The best explanation is an example, the common worldwide scenario of a lifetime of too much stress wearing out the Primary Stress Function and causing permanent imbalance between Immune ⇌ Stress. Immune system dominates, leading to autoimmune diseases, i.e. the body attacks itself. Responding all the time but with no foreign invaders to fight, Immune instead attacks injured tissue. In this case, the autoimmune complaint is arthritis, an attack on bone cartilage, which in Figure 1 is the dependent system of a worn-out, exhausted Stress function. In essence, Figure 1 predicts where the attack will occur and what the underlying cause is; therefore the figure becomes a powerful tool in understanding and solving this and many other chronic diseases.

Under appreciated and little understood, functional exhaustion is a critical factor in human dis-ease, especially chronic disease. Rheumatoid arthritis involves Stress function exhaustion and resulting Immune ← Stress imbalance (instead of normal, healthy Immune ⇌ Stress). Constant inflammation from the attack and mounting cartilage damage produce painful symptoms. Treating symptoms is endless folly and in the end counterproductive. Cure comes only by correcting the adrenal exhaustion and imbalance, the underlying cause. Restore cortex equilibrium and the attack on cartilage will instantly stop. Then, the body can begin healing.

Stress-arthritis is the archetype for chronic diseases. In the same way, other primary functions and subfunctions give rise to distant disease. Energy function disorders can lead to serious nerve diseases such as multiple sclerosis (MS) and amyotropic lateral sclerosis (ALS, Lou Gehrig's disease). Healing problems can manifest in muscles with fibromyalgia and other muscle diseases. For Immune, lupus (systemic lupus erythematosus) is an autoimmune assault on connective tissue. Like arthritis, lupus is autoimmune in character but the initiating cause is Immune/autoimmune dysfunction with decreased natural killer (NK) cells and Th1/Th2 imbalance (Th2 dominates),[7,8] not an exhausted, hypoactive Stress function. Meanwhile, an exhausted, hypoactive Immune function wreaks primary – NOT dependent body system – havoc with susceptibility to infections, colds and flu, candidiasis (yeast infection), shingles (herpes zoster), Legionnaire's bacteria, cancers, etc.

Where any dependent body system attack comes depends on where the adrenal gland physiology first goes *haywire*. Sometimes, though, "where" is more complicated than the dependent systems of Figure 1. Interactions occur, and other dependent systems exist and are tied to adrenal functions in more complex ways. For example, skin depends upon total medulla health, Energy and Healing together. Heart and red blood cells rely mostly on Stress mechanisms, while white blood cells obviously require well-maintained Immune mechanisms.

Where exactly chronic disease strikes also depends on specific underlying adrenal causes, including subfunction variations and multiple dysfunctions of first cause (the setup for disease) and second cause (precipitating event, often trauma). All these contribute to unique final outcomes and explain the myriad of disease possibilities. The modus operandi of attack on a dependent system is almost always hyperactive Immune (autoimmune) or hypoactive Healing (degenerative) in character, or both.

To cite a complex disease process, osteoarthritis actually develops from two separate dysfunctions. First-cause Stress exhaustion induces arthritis, an autoimmune attack on cartilage. Subsequently, a dominating second-cause Healing exhaustion modifies the disease to a degenerative attack on the protein structures (Healing's dependent system!) of cartilage. And, in fact, this is the exact pathology of osteoarthritis reported in the scientific medical literature.[4,5]

Normal Functioning

The arrows (→, ⇌) in Figure 1 indicate the course or flow of functioning or tasking. The adrenal gland receives instructions via neurotransmitters and hormones from the pituitary, the

master control gland of the body. General instructions come first to the adrenal medulla as indicated in Figure 1. The medulla in turn can stimulate the cortex, which then sends feedback to the pituitary to further regulate adrenal response to exactly meet body needs.

This 'feedback loop' is one of thousands in the human body; many involve pituitary oversight. Feedback produces stability and equilibrium in a physiological system, and is technically known as homeostasis or homeostatic mechanism. Loss of homeostasis leads directly to poor health and disease.

The usual work of the adrenal gland, such as handling the daily stress (cortex) of life must first involve energy and epinephrine (medulla). In like manner, the immune system must be brought to action by healing, and in fact healing and immune activities together share the inflammation mechanism. And so a natural division exists in adrenal functioning, not between medulla and cortex, but between the two functional sides of medulla and cortex. Energy and Stress functions go together to form one "action plan" (from one set of general instructions), and likewise for Healing and Immune.

Adrenal equilibriums, Healing ⇌ Energy and Immune ⇌ Stress in Figure 1, operate at cross-purposes to and yet blend with the two actions plans of Energy → Stress and Healing → Immune. Good adrenal health requires both equilibriums, which move back or forth as needed, and the action plans. Complicated? A little. Adrenal functioning is woven like tapestry, producing a beautiful design in form and function.

The pituitary gland at any time can override general instructions (the two action plans) and adrenal equilibriums, and write specific instructions to achieve any task, for example, "*Immune Function: URGENT, fight the flu!*" Or, pituitary ACTH (adrenocorticotropic hormone) orders the Stress hormone cortisol into action. Direct feedback to the pituitary on specific instructions guarantees a correct, measured response. Again, pituitary regulates and controls, but the physiology of the adrenal gland dictates the action. In effect, it is easier to think of the adrenal gland, say, adjusting Healing ⇌ Energy to fix a skinned elbow.

An adrenal equilibrium can be temporarily out of balance. Recovering from surgery, Healing function dominates over Energy function and one feels like staying in bed – no energy! Fighting that flu, Immune function dominates over Stress function, and the stress of one's job is just too much that day. If this person decides to go to work anyway, adrenal physiology will try to adjust to these two opposites, probably with poor results for both. Not surprisingly, the adrenal gland and body have great difficulty achieving opposite functions in the extreme.

Worse than opposites, however, is constant effort. For instance, workaholism – constant job stress, bringing it home, taking it to bed – can leave an individual susceptible to minor immune lapses and in time to serious disease. The cornerstone of good health is TEMPORARILY out of balance. When temporarily becomes CONSTANTLY, homeostasis and health get out of sync and fall apart. Adrenal equilibriums plead for equilibrium in one's life. Balance, equanimity, harmony – the spiritual teachings of the great philosophers may be rooted in our physical

nature, the internal physiology of homeostasis and a four-part harmony in Energy, Healing, Stress and Immune functions and systems.

Most of life's tasks are easily handled by adrenal gland physiology, even opposite functions. Only in the extreme are internal mechanisms revealed. To illustrate, consider Immune again and various degrees of difficulty. If healthy, an individual's immune response to the everyday environment is not a problem. It involves killing bacteria, viruses, fungi and other pathogens that attempt to invade the body all the time, and with no apparent effect on Stress ability, the opposite function. However, as the difficulty increases – cold, flu, pneumonia – Primary Stress Function loses importance as the endocrine system marshals all its forces to fight the invader. Immune ⇌ Stress equilibrium swings more and more resources to the immune system and attempting any stressful activity at this time proves counterproductive to disastrous. One's approach to health should always be... don't get in the way of the body's natural response.

Example #1: Circadian Cycle

The human body has its own biological clock, a rhythmic cycle of approximately 24 hours. The two adrenal action plans of Figure 1, Energy → Stress and Healing → Immune, are part of this circadian rhythm or wave. In the morning, the adrenal gland stirs before a person wakes and begins to prepare for the day ahead with energy hormones. When night comes, the bias shifts toward healing and immune, their tasks and sleep… *going gently into that good night.* This natural ebb and flow between action plans – a dance to the music of time – is regulated by the pineal gland in the brain, which then influences the pituitary gland and, in turn, these adrenal equilibriums. Interfering with this circadian rhythm disrupts normal, healthy sleep. Thus, the energy/nerve stimulant caffeine is harshly on the wrong side of sleep.[9,10]

Example #2: Zinc-Copper Antagonism

Figure 1 functional equilibriums such as Healing ⇌ Energy necessitate corresponding nutrient equilibriums. Medical science describes nutrient equilibriums as "antagonisms," and zinc-copper antagonism (more correctly Zn ⇌ Cu) is documented in the scientific literature.[1] Here the risk of zinc deficiency or copper deficiency increases with high intake of the other. Given that zinc is necessary for protein and DNA synthesis and proper wound healing,[11,12] and copper plays a fundamental role in the human nervous system and its development,[13] Figure 1 provides the first physiological explanation for zinc-copper balance. Similarly, Vitamin A ⇌ Vitamin D[14,15] is a natural consequence of Immune ⇌ Stress. Another example, on a broader nutritional level and not yet proven, Omega 3 nourishes immune and stress systems, while Omega 6 nourishes healing and energy systems. In the same way, the 2 x 2 functional matrix/template of Figure 1 delineates and explains the need for and use of each nutrient within the macronutrient, B vitamin, fatty acid, and trace metal nutritional categories. This permits the precise application of on-target nutrition to current needs, lifestyle demands, general health maintenance, and the treatment of disease.

Example #3: Theory Insight into ALS

Review of key medical literature… Amyotrophic lateral sclerosis (ALS, Lou Gehrig's disease) is a progressive, fatal paralytic disease of motor neuron death in the brain cortex, brainstem and spinal cord.[16] ALS has considerable clinical variability, with major subsets of sporadic ALS (SALS), comprising 90%-95% of cases, familial ALS (FALS), comprising 5%-10% of cases, and a small cluster of Western Pacific/Guam ALS. Additionally, the disease develops as lower-limb onset, upper-limb onset, or bulbar onset, with median survival of 39, 27 and 25 months, respectively. Another factor affecting survival is age at onset. In general, ALS has a fatal outcome in about three years, but survival time is difficult to predict in individual cases. ALS-plus syndromes, which involve atypical clinical features such as dementia, also occur, as well as related syndromes of primary lateral sclerosis (pure upper motor neuron findings), progressive bulbar palsy, and progressive muscular atrophy.[17-19] Still, ALS is a biologically heterogeneous disorder in which genetics, environment, and aging all play a role.[20]

Jean-Martin Charcot gave the first description of ALS in 1869.[21] In 1993, mutations in the SOD1 gene encoding the enzyme copper-zinc superoxide dismutase (CuZnSOD) were found to play a key role in the pathogenesis of familial ALS. Although SOD1 mutations account for only 2% of total cases, this discovery was a major breakthrough and had significant impact on the field.[20,22,23] Expression of the defective human SOD1 gene reproduces the disease in transgenic mice.[16]

While the exact mechanism underlying ALS and its characteristic motor neuron degeneration remains elusive,[21] normal oxygen metabolites such as superoxide (O_2^-), unstable hydrogen peroxide (H_2O_2), and hydroxyl (OH^-) free radicals can damage biological systems if not eliminated by antioxidants.[24] Such oxidative stress must be countered by free radical scavengers, specifically endogenous antioxidant enzymes and exogenous protective chemical substances. Therefore, it has been postulated that defective free radical defense is the pathway of most neurodegenerative diseases.[25] Oxidative stress has been implicated in many degenerative processes and diseases, not only central nervous system disorders such as familial ALS, but also atherosclerosis, myocardial infarction, stroke, ischemia/reperfusion injury, chronic and acute inflammatory conditions, Parkinson's disease, Alzheimer's dementia, and other age-related disorders. Among the various biochemical events associated with these conditions, emerging evidence suggests that superoxide formation and expression and activity of its scavenger antioxidant enzyme, superoxide dismutase (SOD), may be a common denominator.[26] The CuZnSOD enzyme protects against superoxide damage in the cytoplasm of cells.[27]

In the early stages of ALS, cytoplasmic inclusions lead to neurofilament accumulation and aggregation within motor neurons.[28] Studies of animals and human postmortem tissue reveal multiple pathological processes: oxidative stress, neuroinflammation, alterations in neurofilaments and neurotubules, aggregation of proteins, glutamate excitotoxicity (which disturbs normal glutamate-mediated communication between neurons and can lead to neuronal death), abnormalities in growth factors, mitochondrial damage and degeneration, and apoptosis.[29-31]

ALS etiology is complex. For familial ALS (FALS), one hundred nineteen diverse SOD1 mutations have been discovered so far;[20] and SOD1 accounts for only 20% of FALS cases.[32] Most FALS cases are clinically homogeneous, with autosomal dominant, X-linked or autosomal recessive transmission. Worldwide, the most frequent mutation is A4V SOD1, with dominant transmission and causing a rapid, severe form of the disease. The second most frequent mutation is D90A, transmitted recessively and predominantly found in the Scandinavian countries.[33]

In the 1950s, the incidence of ALS on the island of Guam was much higher than anywhere else in the world. During the last 40 years, however, the average annual incidence of the disease has declined steadily. This rapid decrease is not likely due to genetic factors, but rather to radical socioeconomic, ethnographic, and ecologic changes brought about by the rapid westernization of Guam.[34] Consumption of the Cycas circinalis seed, a traditional staple of the indigenous diet, may be an important factor in the etiology of ALS here. The resulting cycad flour contains three sterol beta-d-glucosides compounds, which have been identified as potential neurotoxins. These compounds induce alterations in the activity of specific protein kinases, and release glutamate. The most probable mechanism leading to cell death may involve glutamate neuro-excitotoxicity.[35]

For sporadic amyotrophic lateral sclerosis (SALS), epidemiology finds increased incidence with age, and the emergence of smoking as the first "more likely than not" exogenous risk factor.[36] Environmental toxicants such as heavy metals, pesticides, and chemicals also appear to be risk factors for SALS.[37] Notably, reported cases of ALS in young veterans of the 1991 Gulf War were 2 to 3 times greater than expected, suggesting a war-related environmental trigger.[38] To date for SALS, with many more patients compared to FALS, critical or causative genes have not been discovered and no disease models have been established.[21] Nevertheless, sporadic and familial ALS affects the same neurons with similar pathology,[39] and the biochemical processes causing the characteristic pathological changes and neurodegeneration may be very similar.[31]

Zinc, copper and iron are essential for normal central nervous system (CNS) development and function, and imbalances in these metals, either excess or deficiency, can result in neuronal apoptosis.[40] Zinc plays a key role in all the pathological processes associated with ALS. Alterations in the disposition of zinc ions may be important in ALS initiation and development. SOD1 binds zinc, and many of the mutant forms of this enzyme associated with ALS have altered zinc binding. Furthermore, alterations in the expression of metallothioneins (MTs), which regulate cellular levels of zinc, have been reported in mutant SOD1 mice, and MT deletion accelerates disease progression in these animals.[29] SOD1 gene mutations structurally weaken SOD, which decreases its affinity for zinc; and zinc-deficient SOD induces apoptosis in motor neurons. Significantly, zinc-deficient SOD is just as toxic as zinc-deficient ALS mutant SOD, suggesting that the loss of zinc could be involved in the other 98% of ALS cases.[23]

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Applying Equilibrium Theory to ALS, where a chronic disease attack occurs depends on

where homeostasis is first lost. Thus an attack on motor neurons indicates that Energy function is the site of the initial dysfunction in the four-part harmony of energy, healing, stress and immune systems. In addition, because ALS involves motor neuron degeneration, a hypoactive Healing (degenerative process) is occurring. CuZnSOD enzyme synthesis is a subfunction of the body's healing system, as are all endogenous free radical defenses. Basically, healing such as protein, lipid and DNA repair and microglial maintenance of motor neurons is not viable without antioxidant protection. Loss of CuZnSOD protection from mutations in SOD1 gene accounts for 2% of ALS cases, but functional exhaustion of CuZnSOD synthesis is also possible and would have the same effect. CuZnSOD functional exhaustion with its resultant hypoactivity could be one cause of SALS, within a new overall SALS disease model of zinc mismanagement and loss of zinc and Healing ⇌ Energy homeostasis.

Zinc and copper are necessary ingredients for CuZnSOD synthesis; and as shown in Example #2 above, zinc is the metal nutrient associated with Healing, and copper is the metal nutrient associated with Energy/nerve functioning. Moreover, functional equilibriums such as Healing ⇌Energy necessitate corresponding nutrient equilibriums, and zinc ⇌ copper is documented in the scientific literature. These remarkable associations between theory and evidence show the beauty and simplicity of Equilibrium Theory, and are especially useful in explaining chronic diseases – a first cause/initial dysfunction of sustained energy use beyond the body's ability to handle with the nutrients provided combined with a second cause/trauma of zinc mismanagement such as zinc deprivation could trigger ALS. Consider Lou Gehrig's "Iron Horse" baseball record of 2,130 consecutive games. Such sustained high-energy output together with zinc deprivation could: (1) impair Energy functioning, targeting the nervous system for attack, (2) push CuZnSOD synthesis and possibly related zinc defenses to partial or complete functional exhaustion, and (3) send the endocrine system over a "disease cliff and into a deep valley" of enduring functional exhaustions and imbalances. This seemingly permanent loss of homeostasis is chronic dis-ease. Of cause and effect, loss of homeostasis is the underlying cause of all ALS. The endlessly varied and complex pathology is but the effect.

More insight from Equilibrium Theory, loss of homeostasis in first Energy function and then Healing function would directly target the nervous system, as in the case of ALS. For the other major nerve disease of multiple sclerosis (MS), the first cause/initial dysfunction is again an Energy breakdown, but what turns this relatively minor dysfunction into debilitating disease? The MS attack is not directly on nerves, rather it's slightly altered to the surrounding and insulating fatty acid myelin sheath, indicating a second cause/triggering event of Stress trauma, since only Stress function directly affects fat/fatty acid metabolism (from the theory, the definition of stress is cells switch from burning glucose to burning fat, thereby doubling metabolism). Stress trauma, i.e. extreme hyperactive fat burning, quickly depletes fat/fatty acid nutrients and reserves, bringing on severe Stress exhaustion with glucocortiocoid hypoactivity and consequent severe autoimmune/inflammatory attack, which is the dominant pathology of MS.[41,42] Stress trauma also impairs fat/fatty acid metabolism and, in accordance with the theory, would shift the target from the nerve itself to its now vulnerable fatty acid sheath.

Curing ALS or MS requires climbing the "disease cliff" of functional exhaustions and

imbalances, and restoring homeostasis to all systems. Unfortunately, Western pharmaceuticals, which stimulate but do not nourish physiology, cannot repair and restore homeostatic mechanisms, and are probably not the answer to ALS and its complicated loss of zinc and Healing ⇌ Energy homeostasis. What is needed is the potency of pharmaceuticals somehow combined with the nourishment of nutrition (nature's original and subtle chemistry) to bring functional exhaustions back to life and functional imbalances back into equilibrium. Fortunately, this can be done with what could be described as "super nutrition" – a synergy of functionally on-target and homeostatically balanced B vitamins, fatty acids, and trace metals (prime example, zinc and copper for ALS) produces a totally nourishing functional hyperactivity throughout affected systems, and thereby overcomes and washes away all functional hypoactivities and imbalances caused by past toxicants, traumas and deprivations. Anecdotally, this type of protocol restores healthy homeostasis permanently, but clinical studies are needed to prove this new paradigm.

One caveat for ALS. Unlike other chronic diseases where complete recovery is possible, ALS is extremely pernicious in nature – it involves motor neuron death, and dead cells are gone forever. Restoration of CuZnSOD synthesis, related zinc defenses and overall zinc and Healing ⇌ Energy homeostasis should halt the ALS disease process, but cannot reverse damage already done. Consequently, early intervention is necessary for a good ALS outcome.

Overview

Equilibrium Theory has compelling applications in physiology, nutrition and chronic diseases. The theory provides the following new understanding of physiology and homeostatic mechanisms: within the human body and its network of glands and organs, four interconnected functions – Energy, Healing, Stress and Immune – work in healthy equilibrium, or internal balance. The body's response to all internal needs and external forces lies within and must adhere to this four-part harmony. This simple key unlocks the inner world and fundamental mechanisms of health and disease.

Life is a balancing act. As we grow older, we learn moderation and limits. These lessons really reflect the necessity for this four-part harmony of tasks. With this new and detailed understanding of the internal mechanisms of homeostasis, we can optimize health using on-target nutrition for each gland, organ and function in the body. Nutrition supplies the raw materials, and physiology turns out the end products of life's amazing chemistry.

The sciences of physiology and nutrition currently exist in isolation. Equilibrium Theory links these two fundamental health providers with precise correlations, as the four-part harmony of Energy, Healing, Stress and Immune functions is the template for macronutrient, B vitamin, fatty acid, and trace metal nutrition. Also, functional equilibriums necessitate corresponding nutrient equilibriums. A notable example, Healing ⇌ Energy explains zinc-copper antagonism (Zn ⇌ Cu). The theory similarly resolves other baffling nutritional, physiological and chronic disease evidence, as the 2 x 2 matrix of Figure 1 gives powerful new insight into the duality of human life first recognized in Chinese medicine and then much later with homeostatic

principles.

Lastly, Equilibrium Theory solves the "Gordian knot" of chronic diseases. In examining the four-part harmony of Energy, Healing, Stress and Immune functions and systems and what happens if this homeostasis is lost, the theory reveals the pathogenesis, pathology and physiological remedies (needed to restore normal, healthy homeostasis) for osteoarthritis, rheumatoid arthritis, multiple sclerosis, amyotrophic lateral sclerosis, lupus, fibromyalgia, chronic fatigue syndrome, and many more chronic diseases. Current treatment of chronic diseases consists mainly of ameliorating symptoms. Such treatment is temporary relief, but long-term counterproductive because symptoms are the resulting effect, not the underlying cause. The body's never-ending, incorrect response (chronic dis-ease) to internal needs and external forces has a physiological root cause and cure. The cure involves correcting functional exhaustions and imbalances with powerful on-target B vitamin, fatty acid and trace metal nutritional synergies, thereby restoring life-sustaining homeostasis. Importantly, this new chronic disease paradigm has the potential to help millions of patients.

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The complete explanation of and evidence for Equilibrium Theory including on-target nutrition and specific chronic disease remedies are given in the author's 579-page book, "To Health… Naturally!" The book contains over 2000 relevant, supporting references from the medical literature. For more information, go to the Internet site: http://www.tohealthnaturally.com.

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