The Adrenal Glands

One of the most common clinical patterns seen in health care clinics is stress-related illness. Some health care practitioners report as high as 85% of their patients fitting this category. Persons with this condition have reactions to stress which are either causing their illness or aggravating it. Adrenal glands are the anti-stress glands of the body—the reserve which the body falls back on when it is faced with stressful situations. It is their job to enable your body to deal with stress from every possible source, ranging from injury and disease to work and relationship problems. Your resiliency, energy, endurance and your very life all depend on their proper functioning. Your adrenal glands respond to every kind of stress in the same way, whatever the source. Adrenal fatigue occurs when the amount of stress overextends the capacity of the body to compensate and recover from that stress or the combined stresses. Once this capacity to cope and recover is exceeded, some form of adrenal fatigue occurs. The number of stresses, whether or not you recognize them as stresses, the intensity of each stress and the frequency with which it occurs, plus the length of time it is present, all combine to form your total stress load.

There are four major categories of stress:

1. Physical stress—such as overwork, lack of sleep, athletic over-training, etc.

2. Chemical stress—from environmental pollutants, diets high in refined carbohydrates, allergies to foods and additives, endocrine gland imbalances (due to the interaction of all of the endocrine glands).

3. Thermal stress—over-heating or over-chilling of the body

4. Emotional and mental stress

Early studies by Hans Selye, M.D., identified a pattern of stress-related illness in both test animals and humans. Selye discovered a series of events that occur as a reaction to chronic stress. This series of events is known as the *General Adaptation Syndrome* (GAS). The GAS has three stages:

1. The alarm reaction. The body's initial complex chain of physical and biochemical responses to stress brought about by the interaction of your brain, nervous system and a variety of different hormones, involving an increased amount of adrenal activity. Your body goes on full alert. The adrenals produce extra amounts of hormones. The adrenals are working

harder to respond to an immediate stress situation. That is a function for which they are designed. There is actually an initial *hyperadrenic* response to stress. After the alarm reaction is over, you body goes through a temporary recovery phase that lasts 24-48 hours. During this time there is less cortisol secreted, your body is less able to respond to stress, and the mechanisms over-stimulated in the initial alarm phase by the involved hormones become resistant to more stimulation. In this let-down phase you feel more tired and listlessness, and have a desire to rest. If the stress is continued long enough, the adrenals will finally be overtaxed to the point of depletion as a reaction to this alarm state. Sometimes a person will seek a doctor's help for the symptoms caused by this type of *hypoadrenia*.

2. The resistance stage. After a period of time of continued, severe stress, the adrenals begin to adapt and to re-build themselves. The adrenals have a great capacity for increasing their size and function. If one adrenal is surgically removed, the other adrenal can hypertrophy to twice its normal size, giving the person the same amount of adrenal tissue he previously had. This capacity for increased size and function is the basis for the resistance stage. The prolonged alarm reaction starts as a hyperadrenia which leads to a hypoadrenia which then progresses into another state of hyperadrenia as the resistance stage takes over. This phase of resistance can last months or even up to 15-20 years. The adrenal hormone cortisol is largely responsible for this stage. It stimulates the conversion of proteins, fats and carbohydrates to energy through gluconeogenesis so that your body has a large supply of energy long after glucose stores in the liver and muscles have been exhausted. Cortisol also promotes the retention of sodium to keep your blood pressure elevated and your heart contracting strongly. If the stress is prolonged and severe, it will continue beyond the resistance stage and into the third stage of the GAS. Dr. Selye and subsequent researchers produced this GAS pattern over and over, resulting in hemorrhaged adrenal glands, atrophied thymus glands (the chief gland in immunity), and biochemically devastated bodies of animals exposed to repeated stress. The adrenal glands were the pivotal glands in the countless experiments involving stress.

3. The exhaustion stage. The exhaustion stage of the GAS is a hypoadrenia to the point where the person loses the ability to adapt to stress. The adrenal cortical enlargement of the triad of chronic stress is due to the hypertrophy of the resistance stage. However, adrenal function in the exhaustion stage is severely limited. In the exhaustion stage, there may be a total collapse of body function, or a collapse of specific organs or systems. The body has little or no ability to resist any further stress. Two major causes of exhaustion are loss of sodium ions (decreased aldosterone) and depletion of adrenal glucocorticoid hormones such as cortisol, leading to decreased gluconeogenesis, rapid hypoglycemia,

sodium loss and potassium retention. Simultaneously, insulin levels are still high. Body cells function less effectively in this condition as they rely heavily on a proper amount of blood glucose and the ratio of sodium to potassium. As a result, your body becomes weak. When energy is not available, every energy-requiring mechanism of the cell slows dramatically. This lack of energy, combined with the electrolyte imbalance produces a cell in crisis. This is when the person will surely seek a physician's help because he or she has symptoms which will not go away. Most hypoadrenic persons seen clinically are in this third or exhaustion stage of the GAS. The anti-stress mechanisms are lost and there is no more reserve potential for the person to fall back on.

Life's stresses at their worst come in the form of such cataclysmic events as the death of a loved one, an automobile accident or a serious illness. But stress can also take its toll in less obvious ways, like an abscessed or infected root canal tooth, a bout of the flu, intense physical exertion, a severe quarrel with a loved one, pressure at the workplace, an unhappy relationship, environmental toxins, poor diet, etc. If these smaller stresses occur simultaneously, accumulate or become chronic, and the adrenals have no opportunity to fully recover, adrenal fatigue is usually the result.

Your adrenal glands command powerful hormones to extend their influence throughout your body and your life. No bigger than a walnut and weighing less than a grape, each of your two adrenal glands sits on top of a kidney. From this location they not only significantly affect the functioning of every tissue, organ and gland in your body, they also have important effects on the way you think and feel. You cannot live without your adrenal hormones and how well you live depends a great deal on how well your adrenal glands function. The adrenal glands largely determine the energy of your responses to every change in your internal and external environment. Whether they signal attack, retreat or surrender, every cell responds accordingly, and you feel the results.

The hormones secreted by your adrenal glands influence all of the major physiological processes in your body. They closely affect the utilization of carbohydrates and fats, the conversion of fats and proteins into energy, the distribution of stored fat, normal blood sugar regulation, and proper cardiovascular and gastrointestinal function. The protective activity of anti-inflammatory and anti-oxidant hormones secreted by the adrenals helps to minimize negative and allergic reactions to alcohol, drugs, foods and environmental allergens.

After mid-life (menopause in women), the adrenal glands gradually become the major source of the sex hormones circulating throughout the body in both men and women. These hormones have a host of physical, emotional and psychological effects, from the level of your sex drive to the tendency to gain weight. Even the propensity to develop certain kinds of diseases and your ability to respond to chronic illness is influenced significantly by the adrenal glands. The more chronic the illness, the more critical the adrenal response becomes. The worse the overload relative to the ability of the body to respond is, the worse the adrenal fatigue is. Each person has a different capacity to handle the total stress load, and the capacity of each person varies over time and events.

Adrenal fatigue, or hypoadrenia, has been one of the most prevalent, yet rarely diagnosed conditions for over fifty years. Adrenal fatigue affects millions of people around the world in many ways and for many reasons. Despite being described in medical texts back in the 1800s, and despite a development of an effective treatment back in the 1930s, most "conventional" physicians are unaware that this problem even exists!

Hypoadrenia

The most common symptom seen by the hypoadrenic patient is that of low energy. The person may have barely enough energy to make it through the day, or may be tired all the time. Many middle-aged or older persons will attribute their low energy to "getting older." A more accurate assessment of the situation is that they have had more years to accumulate stress's adverse effects on their health.

A person may slow down a little as he gets older, but it is not normal for a person to be fatigued all the time merely because he is past 40, or even 80 years of age. Other physiological systems operating inefficiently may also cause fatigue or low energy, but any person in this category must have hypoadrenia ruled out as a primary cause for the lack of energy. Hypoadrenia and stress-related illness must also be suspected in any person whose symptoms begin after a stressful event, such as an accident, flu, pregnancy, etc. It is not necessary that the symptoms originate during or immediately following one of these stressful situations. They may develop several months later. Or there may not be a specific event, but merely prolonged exposure to stress.

The human system can take only so much abuse, and after years of abuse many people become lack the energy to do the things they did in their youth. This need not be the case, but it is accepted behavior in our society. People take such a change of life style for granted, never understanding the reasons behind the change and the associated long-term adverse effects on their health. If they would eliminate the unnecessary stresses in their life, they would be able to continue the same activities for a much longer period of time. But the body will only take so much abuse before it makes the person stop.

Hypoadrenia is not a readily identifiable entity, rather a collection of signs and symptoms, known as a “syndrome.” People with adrenal fatigue often look and act relatively normal. They may not have any obvious signs of physical illness, yet they are not well and live with a general sense of dis-ease or “gray” feelings. They often use coffee, colas, sugar, and other stimulants to get going in the morning and to prop themselves up during the day. These people may appear to be lazy and unmotivated, or to have lost their ambition, when in reality quite the opposite is true; they are forced to drive themselves much harder than people with healthy adrenal function merely to accomplish life’s everyday tasks.

People who suffer from adrenal fatigue frequently have erratic or abnormal blood sugar levels in the form of hypoglycemia. In fact, people who have functional hypoglycemia are usually suffering from decreased adrenal function. With hypoadrenia there is more of a tendency to experience allergies, arthritic pain and decreased immune response. The adrenals also have an effect on mental states.

As a result, people with adrenal fatigue show a tendency toward increased fears, anxiety and depression, have intervals of confusion, increased difficulties in concentrating and less acute memory recall. They often have less tolerance than they normally would and are more easily frustrated. When the adrenals are not secreting the proper amount of hormones, insomnia is also one of the likely outcomes.

Addison’s Disease, the extreme pathological form of hypoadrenia, was named for Sir Thomas Addison, who first described it in 1855. It is life-threatening if untreated and can involve actual structural and physiological damage to the adrenal glands. People suffering from Addison’s usually have to take corticosteroids for the remainder of their lives in order to function. Fortunately, it is the rarest form of hypoadrenia with an occurrence of only about 4 persons out of 100,000. Approximately 70% of cases of Addison’s disease are the result of auto-immune disorders. The other 30% arise from a variety of other causes, including very severe stress.

In the more serious cases of adrenal fatigue, the activity of the adrenal glands is so diminished that the person may have difficulty getting out of bed for more than a few hours per day. With each increment of reduction in adrenal function, every organ and system in your body is more profoundly affected. Changes occur in your carbohydrate protein and fat metabolism, fluid and electrolyte balance, heart and cardiovascular system, and even sex drive. Many other alterations take place at the biochemical and cellular levels. Even your body shape can transform when your adrenals are fatigued.

Normally functioning adrenal glands secrete minute, yet precise and balanced amounts of steroid hormones. But there are numerous factors that can interfere with this finely tuned balance. Too much physical, emotional, and/or psychological stress can deplete your adrenals, causing a decrease in the output of adrenal hormones, particularly cortisol.

The adrenal glands are often depleted from stress. Since the adrenal glands give the body something to fall back on in times of stress, when they are run down a person loses his reserve capacity and has lowered resistance to disease processes. When a hypoadrenic person becomes sick, he becomes sicker for a longer period of time, and with a greater likelihood for recurrence of the problem than if his adrenals were functioning at full capacity. This person gets into a chronic state of ill-health and that is when they show up in a practitioner's office. But modern medicine does not recognize hypoadrenia as a distinct and fully recognizable syndrome. Modern medicine only officially recognizes the pathological Addison's disease as hypoadrenia and not the functional hypoadrenia. Nevertheless, it can wreak havoc with your life.

Hypoadrenia is such a common complaint and occurs in so many other conditions, that today's medical doctors rarely consider pursuing an adrenal-related diagnosis when someone complains of fatigue. Very few physicians have read and understood the entire range of medical journal reports that have been around for over one hundred years. Fifty years ago, physicians were far more likely than their modern counterparts to correctly diagnose this ailment. Information about non-Addison's hypoadrenia has been documented in medical literature for over one hundred years but unfortunately, this milder form of hypoadrenia is missed or misdiagnosed in doctors' offices every day, even though the patient clearly presents its classic symptoms. The fact that it usually remains undiagnosed does not lessen its debilitating influence on their health and feelings of well being.

Two reasons why conventional medical treatment for hypoadrenia is so hard to find is 1) Money: There are no patentable treatments for hypoadrenia produced by the pharmaceutical companies. There is no money to be made. 2) Politics: Since the 1970s, the FDA has "outlawed" and actively persecuted one of the chief natural remedies for hypoadrenia, an extremely safe remedy called adrenal cortical extract (ACE).

Symptoms

People will develop a variety of different complaints depending on which of the adrenal's functions have been the most compromised and the general areas of susceptibility which they have inherited or acquired. The adrenals produce a variety of hormones, and it is quite likely that the same combination of symptoms will not be seen twice in a whole series of hypoadrenic patients. The body's reaction to stress is different in different people. The symptoms will depend on the nature of the person and the nature of the hormone depletion. In chronic stress states, the lymphatic system, particularly the thymus gland, atrophies, and there is also a tendency for development of stomach and duodenal ulcers in these persons. The person with stress-related illness might also have symptoms from lowered output of the adrenal glucocorticoids: cortisol, corticosterone, and cortisone. Of these, cortisol is the most important.

Heart Sounds and Hypoadrenia

Another common finding during the physical examination of the hypoadrenic person is made during auscultation of the heart. Normally the first and second sounds of the heart make a "lub-dub" sound, with the first sound being louder than the second. If you record the heart sounds on a phonocardiograph Endocardiograph), the second sound should be one-third the intensity (height) of the first sound. In the hypoadrenic person, the second sound will be equal to or greater than the first sound in the pulmonary valve area. The same may be true in other valve areas also, but in hypoadrenia, at least, the pulmonary second sound is greater. This accentuated pulmonary second sound is due to the pulmonic valve slamming shut because of pulmonary hypertension. Epinephrine causes vasoconstriction throughout most of the body, including the lungs. In the lungs this vasoconstriction causes a shrinkage of the mucosa and decreased mucus secretion. Epinephrine also relaxes the bronchiolar musculature, creating a bronchodilation.

This is why epinephrine inhalers are so helpful for asthma sufferers. The bronchodilation, which normally occurs with epinephrine, cannot occur in a person with hypoadrenia. Instead, he gets a bronchoconstriction—a constriction of all the bronchial musculature with subsequent symptomatology. Likewise, the hypoadrenic person does not have the benefit of epinephrine's action on the pulmonary capillaries and mucous membranes, with a resultant swelling of the mucous membrane and an increase in mucus production or secretion. In the hypoadrenic person, physical evidence of this is heard as the loud second heart sound at the pulmonary area. The bronchoconstriction, combined with the vasodilation and mucous membrane swelling, creates a back pressure in the pulmonary circulation that causes the pulmonary valve to slam shut, thus creating the louder second sound over the pulmonic valve.

Any person who has abnormal lung function, especially asthma or bronchitis, should be checked for hypoadrenia. This is particularly true if the person's symptoms are relieved by using an epinephrine inhaler. The muscles related to the lungs (deltoid, serratus anterior, etc.) are usually strong in these persons. Many lung problems are related more to the adrenals than to the lungs. The sartorius and gracilis, etc. should be checked in any lung case.

Several years ago, it was reported that asthma was totally a psychosomatic illness. Patients were put under emotional stress and an asthma attack would ensue. Therefore it was concluded that the asthma problem was all in the patient's head. If the adrenals are in the exhaustion stage of the GAS, they will be unable to respond to the added burden of emotional stress since there is no reserve available to fall back on. The epinephrine will not be available for normal function and the person will experience bronchoconstriction, swelling of the mucous membranes, and increased mucus production. The result is an asthma attack triggered by the increased emotional stress. The attack has nothing to do with the emotional stress except that the stress affects the adrenals. Fix the adrenals and the person can physically tolerate the emotional stress.

It is important to note that lung pathology, such as malignancy, tuberculosis, etc. will also create a loud second heart sound at the pulmonic valve area. Also, if there is an increased second heart sound only at the tricuspid valve area, this is usually indicative of liver congestion. There will be a weakness of the pectoralis major sternal, in these cases, and the sound can be normalized by treatment directed at the liver.

Hemmorhoids are another problem which is associated with blood pooling in the abdomen. A hemorrhoid is a vein which has pushed its way (or been pushed) to bulge outside the anal sphincter. The anal sphincter then becomes very tight, and the hemorrhoid, with the pressure of the abdominal and pelvic blood above it, and gravity pulling from below it, cannot get back inside the rectum. Treatment of hemorrhoids must be directed at two areas. First, the hemorrhoids must be treated locally, and second, the source of intra-abdominal and intra-pelvic pooling of blood must be corrected.

Most commonly, the cause of the blood pooling in the abdomen and pelvis is from hypoadrenia. But severe liver congestion can also cause portal hypertension and result in hemorrhoids. You must differentiate between liver and adrenal problems as the underlying cause of the hemorrhoids. For this reason, whenever a person complains of hemorrhoids, one of the first things to be done is listen to the heart. The person does not understand this, but you are listening for the relative loudness of the second sounds at the pulmonic valve area (for the adrenals) and the tricuspid valve area (for the liver).

In treating hemorrhoids locally, it is necessary to recognize that the hemorrhoidal veins can not get themselves back inside the rectum, due to the tightness of the anal sphincter. In order to treat the hemorrhoids successfully, the anal sphincter must be dilated. This is done by putting on a glove (not a finger cot) and, using a lubricant, inserting your index finger into the rectum. Stretch the anal sphincter with the index finger. Then insert the first two fingers and stretch the sphincter. Then insert three fingers and insert them slowly about as fat as they will reach. Finally (if the person is still on the table) insert all four fingers, stretching the sphincter up to the point which the size of the patient will tolerate.

This is a difficult procedure for the patient, but there will be an immediate and dramatic reduction in the extent of the hemorrhoids protruding through the anus. If done correctly, this procedure may only have to be performed once. Then again, you may only get one chance! Occasionally it is necessary to repeat the sphincter dilation once or twice in the future.

Varicose veins in the lower extremities are frequently caused by hypoadrenia for the same reasons that cause hemorrhoids. This can be seen in many pregnant women who only have a flare up of varicosities during pregnancy. It may be difficult to eliminate the varicosities, but it is possible to arrest their progression and to keep them in check throughout the pregnancy.

The pooling of blood in the abdomen and pelvis also creates and contributes to other symptoms. The patient with this problem will often complain of fullness or bloated feeling in the abdomen. Sometimes the sluggish circulation in the abdomen and pelvis actually affects digestion. Since the GI tract depends on an adequate supply of blood not only for its function, but for the absorption of nutrients, one can readily imagine how hypoadrenia can affect digestion. Symptoms of indigestion as well as inadequate absorption of nutrients can be caused or aggravated by hypoadrenia.

Other Symptoms of Hypoadrenia

One of the commonly overlooked sources of stress and resistant adrenal fatigue is chronic or severe infection. Adrenal fatigue is often precipitated by recurring bouts of bronchitis, pneumonia, asthma, sinusitis, or other respiratory infections. The more severe the infection, the more frequently it occurs or the longer it lasts, the more likely it is that the adrenals are involved. Adrenal fatigue can occur after just one single episode of a particularly nasty infection, or it can take place over time as the adrenals are gradually fatigued by prolonged or recurrent infections. If there are other concurrent stresses, such as an unhappy marriage, poor dietary habits or a stressful job, the downhill ride is deeper and steeper.

People who are involved in a weekly rotating shift have magnified stress because their bodies never have a chance to adjust to the new circadian rhythm produced by each sleep change. People on alternating shifts with less than three weeks between shift changes are continually hammering their adrenal glands. Every time the wake/sleep cycle is altered, it takes several days to weeks to establish a normal pattern for the new wake/sleep cycle.

The glucocorticoids are the body's own anti-inflammatory hormones. Persons who have had inflammations such as arthritis, bursitis, or other joint problems which have been helped by the injection or oral ingestion of cortisone and cortisone derivatives are usually persons who have had insufficient production of these substances by their own adrenal glands. This is particularly the case in the person who was originally helped by cortisone treatment once or twice, but on whom further attempts at cortisone therapy were fruitless. Any person who has been benefited by a course of cortisone therapy should be examined for hypoadrenia. Not only is this true of the obvious reason that the adrenals' cortisone output may be lowered, but also for the reason that cortisone therapy tends to lower adrenal gland output in the long run.

Cortisone causes a negative feedback to the pituitary, causing a diminished pituitary output of adrenocorticotropic hormone (ACTH). In prolonged cortisone therapy, the person's adrenal glands will atrophy, even to the point of non-function. Since the adrenal cortical hormones are necessary for life, a person on cortisone products should never have them withdrawn rapidly, as this could cause a life-threatening crisis. When a person is withdrawn from cortisone, it should be done so very gradually, over a long period of time in order to allow the adrenal glands to rebuild themselves to an adequate level of activity.

The adrenal glands are also implicated in most types of allergies. Most allergies involve an inflammatory process. Frequently, the allergen is merely the straw that breaks the camel's back. The allergen would not cause the person any trouble if he had an adequate level of his own adrenal production of the anti-inflammatory glucocorticoids. The same anti-inflammatory effect is important in limiting the lung congestion in asthma and bronchitis, as has been previously discussed.

As the adrenal glands become depleted, the blood glucose levels will tend to drop below normal levels. In an effort to counter this potential low blood glucose, the person will get cravings for anything which will rapidly increase the blood glucose. He will eat a candy bar, drink a cup of coffee, smoke a cigarette, or drink a soft drink. Everybody has their favorite “fix.” The abuse of alcohol, marijuana, and hard drugs fits this pattern as well. But the rapid rise in blood glucose provided by the “fix” only serves to re-initiate the whole cycle again.

The symptoms of the hyperinsulinism/hypoadrenia/hypoglycemia person are too numerous to mention here. Basically, though, epithelial tissue, nervous tissue, and the retina of the eye do not store glucose. Hence, these tissues are the most likely to be affected. Low blood glucose creates symptoms of blurred vision, headache, nervousness, unstable behavior, allergies, and on and on. Another symptom which is occasionally encountered in hypoadrenia is that of increased pigmentation of the skin. There may be unusual brown patches or areas of bronzing somewhere on the body’s surface. When the adrenal function is low, the pituitary responds by making ACTH. In the exhaustion stage of GAS, the ACTH effect on the adrenal is like whipping a tired horse. Since the adrenal can not respond to this pituitary drive, the pituitary keeps elaborating ACTH until its levels in the circulation are quite elevated.

The extra ACTH will affect other areas of the body. For example, ACTH has somewhat of an effect on the ovary, causing it to increase estrogen production. Also, ACTH has about 1/100th of the effect of melanocyte stimulating hormone (MSH), the pituitary hormone which stimulates melanocytes in the skin to produce the dark pigment melanin. In a severe hypoadrenia, the effect of bronzing or increased areas of pigmentation of the skin will sometimes be seen as a result of the ACTH mimicking the effect of MSH. Although this symptom is more common in the pathological hypoadrenia, Addison’s disease, it is occasionally seen in functional hypoadrenia as well.

Mercury and the Adrenal Glands

Mercury Detoxification

Mercury accumulates in the adrenal glands and disrupts adrenal gland function. Two primary nutrients for the adrenal glands are pantothenic acid and vitamin-C. A deficiency of pantothenic acid can lead to adrenal exhaustion (chronic fatigue) and ultimately to destruction of the adrenal glands. A deficiency of pantothenic acid also causes a progressive fall in the level of adrenal hormones produced. One of the largest tissue stores of vitamin-C is the adrenals; it is exceeded only by the level of vitamin-C in the pituitary. Physical and mental stress increases the excretion of adrenocorticotropic hormone. The increased adrenal activity, in turn, depletes both vitamin-C and pantothenic acid from the glands.

Humans cannot produce vitamin-C. They therefore attempt to replenish the needs of the adrenals by taking the vitamin from other storage locations in the body. If your overall ascorbate status is low, there may be an insufficient amount available to satisfy the needs of the adrenals. Under this condition, normal adrenal hormone response may become inadequate, leading to an inadequate immune function. Mercury builds up in the pituitary gland and depletes the adrenals of both pantothenic acid and vitamin-C. Stress and the presence of mercury will have a very negative effect on the adrenal production of critical steroids. The ability of the adrenal gland to produce steroids is called steroidogenesis and is dependent upon reactions mediated by the enzyme cytochrome P-450. Cytochrome P-450 reacts with cholesterol to produce pregnenolone, which is then converted to progesterone. Cytochrome P-450 can then convert progesterone to deoxycorticosterone which is then converted to corticosterone or aldosterone by other enzymes in the adrenals. These adrenal functions are also affected by metal ions.

All steroid hormones produced by the adrenal glands are derived from cholesterol through a series of enzymatic actions, which are all stimulated initially by ACTH. Steroid biosynthesis involves the conversion of cholesterol to pregnenolone, which is then enzymatically transformed into the major biologically active corticosteroids. cAMP is produced from adenosine triphosphate (ATP) by the action of adenylate cyclase. Adenylate cyclase activity in the brain is inhibited by micromolar concentrations of lead, mercury, and cadmium. One of the key biochemical steps in the conversion of adrenal pregnenolone to cortisol and aldosterone involves an enzyme identified as 21-hydroxylase.

Mercury causes a defect in adrenal steroid biosynthesis by inhibiting the activity of 21a-hydroxylase. The consequences of this inhibition include lowered plasma levels of corticosterone and elevated concentrations of progesterone and dehydroepiandrosterone (DHEA). DHEA is an adrenal male hormone. Because patients with 21-hydroxylase deficiencies are incapable of synthesizing cortisol with normal efficiency, there’s a compensatory rise in ACTH leading to adrenal hyperplasia and excessive excretion of 17a-hydroxyprogesterone, which, without the enzyme 21-hydroxylase, cannot be converted to cortisol.

The inhibition of the 21-hydroxylase system may be the mechanism behind the mercury-induced adrenal hyperplasia. Adrenal hyperplasia can stress the adrenal glands by their accelerated activity to produce steroids to the point that production begins to diminish and the glands will atrophy. The result is a subnormal production of corticosteroids. Both lead and mercury can precipitate pathophysiological changes along the hypothalamus-pituitary-adrenal and gonadal axis that may seriously affect reproductive function, organs, and tissues. Leukocyte production, distribution, and function are markedly altered by glucocorticosteroid administration. In Addison's disease (hypofunction of adrenal glands), neutrophilia occurs 4-6 hours after administration of a single dose of hydrocortisone, prednisone, or dexamethasone. Neutrophilia is an increase in the number of neutrophils in the blood. Neutrophils are also called polymorphonuclear leukocytes (PMNs). Mercury not only causes a suppression of adrenocorticosteroids that would normally have stimulated an increase of PMNs, but at the same time also affect the ability of existing PMNs to perform immune function by inhibiting a metabolic reaction that destroys foreign substances. Still today, the ADA and other governmental agencies tell us that the mercury in your mouth, or from vaccinations, is perfectly safe. Scientists say this is a ridiculous statement that is in violation of science and common sense.

Adrenal Gland–Related Muscles

Dr. Goodheart identified five specific skeletal muscles which are related to adrenal gland function. These are 1) sartorius, 2) gracilis, 3) posterior tibialis, 4) gastrocnemius, and 5) soleus. There will be weakness in one or more of these muscles when the adrenal glands are malfunctioning. Because of the attachments of the sartorius and gracilis on the pelvis, (sartorius—anterior superior iliac spine; gracilis—pubic ramus), their weakness in persons with adrenal stress problems may allow the sacroiliac joint to subluxate posteriorly. The sartorius and gracilis stabilize the innominate (one side of the pelvis), holding it in an anterior direction. Many persons with hypoadrenia seek chiropractic help for the care of sacroiliac pain and/or low back pain which is due to the lack of pelvic stabilization normally provided by these muscles.

The sartorius and gracilis have a common insertion (along with the semitendinosis) on the medial side of the knee and rotate the tibia medially on the femur. When weakness of these muscles occurs, there is a loss of stability on the medial side of the knee. The sartorius and gracilis (along with the semitendinosis) act as dynamic ligaments, protecting and supporting the medial knee joint during various ranges of motion. Their function is particularly important in situations where the knee ligaments alone offer inadequate support.

It is very important to check for hypoadrenia in any person with knee problems. One can see how one hypoadrenic person will present with knee problems and another with back problems, and some persons will have both.

Due to the relationship of the posterior tibialis, gastrocnemius, and soleus to the stability of the foot and ankle, many hypoadrenic persons will complain of symptoms of tired feet, weak ankles, or aching calves. The posterior tibialis holds up the medial longitudinal arch of the foot, especially during gait. In some persons exhibiting hypoadrenia-related weakness of the posterior tibialis, the medial arch will drop, causing a pronation problem and strain to the foot and ankle. The one common factor in persons with the above-mentioned musculoskeletal complaints will be the weakness of one or more of the five adrenal gland related muscles accompanied by improvement of their symptoms following treatment of the adrenal glands.

The adrenal gland cortex produces three major categories of hormones:

1. mineralocorticoids,

2. glucocorticoids, and

3. gonadal (sex) hormones (testosterone, estrogen, progesterone, etc.).

Depending on the relative amount of depletion of each of these hormone groups, one will see varying symptoms in the person suffering from stress-related hypoadrenia.

Cortisol and Epinephrine

The adrenal cortex and the adrenal medulla are the two parts of the adrenal gland. Although each has separate functions, it is no mistake that they are placed next to each other anatomically, since some of the functions of one are dependent on the other.

Epinephrine is a vasoconstrictor. But for epinephrine to have its vasoconstricting effect on the body's arterioles, it is imperative that cortisol be available. Cortisol sensitizes the arterioles to the constrictive action of epinephrine. If there is low adrenal cortical output and adequate cortisol is not produced, epinephrine will have a reduced effect in its function of constricting the blood vessels. These two hormones work together in affecting blood pressure. Therefore, in the hypoadrenic patient one of the major findings observed on physical examination is related to blood pressure.

Normally when a person goes from lying down to standing, the systolic blood pressure should elevate 4-10 mm Hg. (millimeters of mercury). In hypoadrenia, the systolic blood pressure from lying to standing will either stay the same or drop. This systolic drop is usually between 5 to 10 mm. Hg., but sometimes as much as 30-40 points. This is a classic sign in the hypoadrenic person which is known as the Ragland effect, or postural hypotension, and which is reported in over 90% of hypoadrenic persons. Blood pressure should always be checked in three positions: sitting, then lying, then standing. From recumbence to standing, the systolic blood pressure should rise 4-10 points. If the blood pressure drops, suspect functional hypoadrenia.

There are valves in the veins of the lower extremities which keep the blood from pooling in the feet when a person maintains an upright position. The fact that there are no valves in the veins of the abdomen and pelvis means that the only mechanism which prevents the blood from pooling there when the body goes from lying to standing is the vasoconstriction of the local vessels. If there is a low cortisol level, epinephrine can not function correctly and there will be inadequate vasoconstriction in response to upright posture. This causes the blood to pool in the abdomen and pelvis and the systolic pressure in the arm to drop. This same person may complain of dizziness or light-headedness, especially when arising from a seated or lying position. Or he may experience transient spells of dizziness during the day or he may be dizzy all the time. The patient may be complaining of headaches, which are due to the pooling of the blood in the abdomen and pelvis, interfering with the supply to the head. Frequently these persons have had totally normal neurological examinations or some have been diagnosed as having Meniere's disease. Some are being treated unsuccessfully with manipulation to the upper cervical vertebrae. But all therapeutic approaches are ineffective in relieving the symptoms until the hypoadrenia is treated.

Some persons who have postural blood pressure dumping are being treated for hypertension. The hypertension is from another paradoxical body response. When the person changes positions from recumbence to standing and the systolic blood pressure drops 10, 20, 30 points, the body senses this low blood pressure and reacts. The body does not want all the blood pooling in the abdomen and pelvis because it decreases the amount of blood in the head and other areas. In an effort to change this situation, the body may elevate the systolic pressure to an extremely high level. The systolic blood pressure may go as high as 180 mm Hg. or more. Then, when the person changes positions from lying to standing, the systolic blood pressure will drop to only, say, 150 mm. Hg.

If the blood pressure is taken only in the seated position, the person will show a very high systolic pressure. But, when you change the person's positions, he will show the dumping blood pressure on arising from recumbence to standing. These persons are often treated with diuretics when the real problem is with the adrenal glands. Combine this with the fact that many hypoadrenic persons are also dehydrated, as previously discussed, and you can see the senselessness of a diuretic approach in these cases.

Anatomy

The adrenals are orange-colored glands that sit on top of the kidneys near the spine, just underneath the last rib and extending down about an inch. The right adrenal is shaped something like a pyramid, whereas the left is shaped more like a half moon. Each gland is highly vascularized and is only about 1” high by 1¼” to 2” wide by ¼” thick, and weighs just 4 to 6 grams (about one-eighth to one-quarter ounce). They are usually heavier in females than in males.

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Although in contact with the kidney, there is no direct connection from the adrenals to the kidney—the arterial blood supply to the adrenal glands is separate from the kidneys. Both adrenal glands are only a very short distance from the aorta, the major artery of the body, and the vena cava, the major vein. This strategic placement allows for a very rapid adrenal response to hormonal messages transported via the blood. For example, *Adrenal Corticotropic Hormone* (ACTH) is a hormone messenger from the pituitary gland that tells the adrenal glands how much cortisol to secrete. Within a few seconds of receiving this message the correct level of cortisol is on its way from the adrenals to the rest of the body. The adrenals are also placed in close proximity to the liver, pancreas, major fat storage areas and the kidneys, as these are the organs that need rapid communication with the adrenals in situations requiring their immediate response to adrenal hormones.

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Regions of the Adrenal Glands

Each adrenal gland is composed of two endocrine components—a *medulla* (inner part) that constitutes 20% of the gland and a *cortex* (outer part) that constitutes the remaining 80% of the gland. The cortex consists of four zones. The medulla and each of the zones in the cortex each produce different hormones that serve a variety of functions in your body. The adrenal *cortex* and *medulla*, like the anterior and posterior lobes of the pituitary, are obtained from separate cells in the developing embryo. The medulla is derived from *ectodermal* neural crest cells, and the cortex is derived from *mesodermal* cells.

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The Adrenal Medulla

The functional unit of the adrenal medulla is the *chromaffin* cell, which functions as a *neuroendocrine* cell. In response to stimulation, chromaffin cells secrete the hormones *epinephrine* (adrenaline) and *norepinephrine* (noradrenalin) directly into the blood. Epinephrine and norepinephrine are important mainly in crisis situations. During a crisis, they work together to dilate bronchi (air passages of the lungs) and blood vessels to the muscles, increases heart beats and strength of contraction, and cause other physiological changes to help the body respond to the stressful situation via “fight or flight.” These adrenal hormones are responsible for the superhuman abilities that occasionally occur during a crisis. The medulla is involved in extreme stress and, within this context, epinephrine and norepinephrine both work with cortisol from the adrenal cortex.

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The Adrenal Cortex

Most of the ongoing daily regulation and modification of bodily processes arises from the adrenal cortex. The adrenal cortex is divided into four zones which each secrete different hormones that carry out specific functions throughout your body. 1) The outermost zone is the *zona glomerulosa* from which the hormone *aldosterone* is secreted, and consists of cells arranged in 'whorls' (*glomeruli*)**.** Cells of the zona glomerulosa produce hormones called *mineralocorticoids*. Aldosterone is the major hormone controlling the sodium and potassium levels, and thus fluid balance, within your bloodstream, cells and *interstitial fluids* (the area between the cells).

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1) The outermost zone is the zona glomerulosa from which the hormone aldosterone is secreted. Aldosterone is the major hormone controlling the sodium and potassium levels, and thus fluid balance, within your bloodstream, cells and interstitial fluids (the area between the cells).

2) The next zone is the *zona fasciculata* in which cortisol is produced. Cells of this zone are arranged into *fascicles* separated by venous sinuses. Cells of the zona fasciculata produce *glucocorticoid* hormones**.** Cortisol controls or greatly influences the metabolism of fats, proteins and carbohydrates to maintain blood glucose within a narrow optimal range and

keep it there even under stressful conditions. Cortisol also has many other important functions.

3) The innermost zone is the zona reticularis where progesterone, DHEA and its relatively inactive precursor, DHEA-S are produced. Although the sex hormones are made primarily by the gonads (ovaries and testes), the adrenal zona reticularis manufactures an ancillary portion of sex hormones for each sex and also produces male hormones in women and female hormones in men to keep the effects of the dominant sex hormones in balance.

In humans and other primates, between the zona fasiculata and the zona reticularis, there is a narrow space called the interface zone. Although the zona reticularis has traditionally been thought to produce the sex hormones such as the estrogens and testosterones, it is now believed that this interface zone is the actual site of production of most of the sex hormones. Because most adrenal research uses rodents and other non-primate mammals, little attention has been paid to this interface zone until recently.

These zones of your adrenal cortex collectively produce over fifty hormones. Most of these are intermediary hormones that only act as bridges to form other adrenal hormones. However, about a dozen hormones end up in your circulation and actively affect the rest of your body.

Physiology

The Regulation of Cortisol

The hypothalamus of the brain influences both portions of the adrenal gland but by different mechanisms. The Secretion of glucocorticoids from the adrenal cortex is regulated by negative feedback involving the *corticotrophin-releasing hormone* (CRH) secretion by the hypothalamus. CRH then acts on the anterior pituitary to stimulate *adrenocorticotropic hormone* (ACTH) secretion, which then stimulates the adrenal cortex into cortisol secretion. Although cortisol is secreted by the zona fasiculata in the adrenal glands, it is regulated primarily from the brain.

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Normally about 80% of blood cortisol is bound to a carrier protein called *cortico-steroid-binding globulin*. Another 15% is bound to albumin, and the remaining 15% exists free in solution. Cortisol secretion has numerous physiological effects, its main target tissues being the liver, skeletal muscle and adipose tissue. Cortisol is responsible for many of the life sustaining functions attributed to the adrenal glands. Many of the symptoms of adrenal fatigue arise from decreased cortisol levels in the blood or inadequate levels of cortisol during times of stress when more cortisol is needed.

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Excess cortisol secretion results in *Cushing's Syndrome*. This can either occur as a primary abnormality in steroid hormone production by the adrenal cortex, or as a result of overproduction of ACTH by the pituitary resulting in excessive stimulation of the adrenal cortex. Cushing's patients have thin arms and legs, due in part to the loss of muscle mass as a result of the protein-catabolic effects of excess cortisol, and also as fat is redistributed from the extremities to the trunk. There is an increase in fat in the face, the trunk, across the shoulder blades, and at the base of the neck. Connective tissue is lost from the skin, causing it to become thinner. As a result, blood vessels are located closer to the surface making the skin have a slight red appearance.

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The HPA Axis

The amount of cortisol circulating at any particular moment is regulated by a complex interaction between the hypothalamus (a regulatory part of the brain), the pituitary gland at the base of the brain, and the adrenal glands. This regulatory trio operates through a negative feedback system and is referred to as the Hypothalamus/Pituitary/Adrenal (HPA) Axis or HPA System. In your body, your hypothalamus is analogous to a thermostat, your pituitary to a relay switch, your adrenals to a furnace, and your body to a room. The amount of cortisol released is comparable to the heat released from the furnace. To a large extent you control the thermostat through the demands you place on your body. These demands arise from the physical situations your body has to deal with (diet, exercise, work, climate, etc.) and your reactions (emotional and physiological) to them.

The HPA Axis is one of the most important elements of the whole body process known as homeostasis, the process that maintains a steady internal bio-chemical and physiological balance in your body. The HPA Axis adjusts cortisol levels according to the needs of the body, under normal and stressed conditions, via a hormone called the Adrenal Corticotrophic Hormone (ACTH). ACTH is secreted from the pituitary gland in response to orders from the hypothalamus and travels in the bloodstream to the adrenal cortex. There it activates cells in all four zones to produce their various hormones.

Each zone generates different hormones as end products, but the process of making all hormones in all zones begins with ACTH biding to the walls of the adrenal cells. This initiates a chain reaction of intracellular enzymes that release cholesterol within the cell. The cholesterol is then used inside the adrenal cells to manufacture pregnenolone, the first hormone in the adrenal cascade. No matter which adrenal hormone is being produced, pregnenolone is the first hormone formed in the series. In the zona fasciculata, pregnenolone is processed to form cortisone and then cortisol. Cortisol, once manufactured, is released into circulation. It takes less than a minute after the initial stimulation by ACTH for newly synthesized cortisol to be circulating through your blood to every part of your body, including to your hypothalamus where the concentration of cortisol is being constantly measured.

Your hypothalamus, in its regulatory function, analyzes and integrates input from many different external and internal sources. This input includes information from brain centers about overall excitability, energy requirements of you body, and sensory data from your brain centers for hearing, seeing, smelling, touch and taste. Based on this information, your hypothalamus determines how much cortisol your body requires and subsequently releases its own hormones as messengers. The primary hormone messenger from the hypothalamus is Corticotrophin Releasing Factor (CRF) which signals the pituitary gland to secrete a specific amount of ACTH. Thus ACTH is sent from the pituitary to your adrenal glands to begin the process described above all over again. Alterations in ACTH levels, and hence cortisol levels, are made minute by minute using this negative feedback loop, modulated by other information received by the hypothalamus.

Cortisol, ACTH and aldosterone are not secreted uniformly throughout the day, but rather follow a diurnal pattern with the highest levels secreted at approximately 8:00 AM and the lowest between midnight and 4:00 AM. As a matter of fact, it is the rising cortisol level that helps us wake up in the morning. After its peak at approximately 8:00 AM, it downtrends through the rest of the day, often with a small dip in the afternoon between 3:00 and 5:00 PM. This curve of cortisol secretion however, is not a nice smooth curve, but is filled with episodic spikes that generally fit into an increasing and a decreasing pattern throughout the day and evening. Eating something, even a little snack, causes a small burst in cortisol levels. People who have regular snacks and meals keep their cortisol at higher levels for more of the day compared to people who do not snack. This is another reason to have regular healthy snacks in addition to regular meals if you have adrenal fatigue. Exercise also elevates cortisol levels similarly to food, so the combination of regular means, small snacks and exercise can do a lot to enhance depressed cortisol levels.

Some people with hypoadrenia have an overall low pattern of cortisol secretion with circulating cortisol levels lower than normal between 3:00 and 5:00 PM. Still others fluctuate throughout the day and can even vary from day to day so that their cortisol levels are unpredictable. They may go through part of their day with elevated cortisol levels, part of the day with low levels and part with normal levels. Although cortisol has its diurnal pattern of variations each day, it remains at an amazingly consistent level throughout your lifetime, under normal conditions. In later life, some people actually experience a small rise in cortisol. If this rise is excessive it may be related to some disorder. However, a rise in cortisol in response to stress is a natural reaction that actually protects the body in several ways.

Actions of Cortisol

Blood Sugar

Cortisol is essential for maintaining blood sugar (glucose) levels in the proper balance. A drop in blood sugar triggers the adrenals to make more cortisol. The cortisol increases blood sugar levels by converting fats and proteins into energy in a process called gluconeogenesis. In this energy production process first fats are broken down into fatty acids and proteins into peptides and then these are converted into the needed blood glucose. This process is vital to keeping the blood glucose levels relatively constant throughout the day. Your body depends upon glucose as its most consistent form of energy. Cortisol works in tandem with insulin from the pancreas to provide adequate glucose to the cells where it is burned for energy. Cortisol ensures adequate levels of glucose in the blood while insulin unlocks the cell membranes to let glucose into the cells. When your body is under stress from any source, there are more demands placed upon its various tissues and organs, requiring more available glucose to fuel more energy production in the cell.

Inflammation

Cortisol is a powerful anti-inflammatory, even when secreted at normal levels. It acts quickly to remove and prevent redness and swelling of nearly all tissues. These anti-inflammatory actions keep mosquito bites from flaring into giant wheals, bronchial tubes and eyes from swelling shut from allergens, and mild scratches from looking like lacerations. For any physical body to remain in homeostatic equilibrium every inflammatory reaction must have an opposite and equal anti-inflammatory reaction. Although there are other anti-inflammatory responses occurring at local sites, cortisol is the main anti-inflammatory agent circulating naturally in your body. You can assume that almost any time you have an inappropriate amount of redness and/or swelling, there is too little cortisol in circulation. Cortisol has similar anti-inflammatory control over auto-immune reactions. In auto-immune reactions white blood cells attack parts of your body as if they were foreign. These reactions can range from mild to life threatening. In most auto-immune reactions cortisol levels are inadequate for the degree of reaction taking place in particular tissues or locations in the body. This is one of the reasons why strong corticosteroids (prednisone, prednisolone, etc.) are used with all diseases involving inflammatory processes, including auto-immune diseases. They imitate the anti-inflammatory effects of cortisol, although unfortunately with some very serious undesirable side effects. Cortisol not only affects the redness and swelling but also the actions of the white blood cells.

Immune System

Cortisol influences most cells that participate in immune reactions and/or inflammatory reactions, especially white blood cells. It specifically regulates lymphocytes, the commanders of the white blood cells. Cortisol and corticoids (cortisol-like substances) also affect the actions of other white blood cells such as natural killer (NK) cells, monocytes, macrophages, eosinophils, neutrophils, mast cells and basophils. These white blood cells gather in defense of the body at places of injury or perceived invasion and some flood the area with very powerful chemicals to attack the invaders. Although they are a great defense, these chemicals irritate the surrounding tissues, causing redness and swelling. Cortisol rushes to the site to put out the fire made by the lymphocytes and other white blood cells. It keeps the local white blood cells from sticking to the site and releasing their chemicals and also controls the number of circulating lymphocytes and other white blood cells, so there are fewer white blood cells available. This prevents an overreaction by the immune system and controls the irritation and tissue destruction that takes place at the site of congregating white blood cells.

Cortisol also reduces the rate at which lymphocytes multiply and accelerates their programmed cell death to further protect the body from this overreaction. In fact, when cortisol is elevated during the alarm reaction, there is almost a complete disappearance of lymphocytes form the blood. That is why your immune system is suppressed when you are under stress or taking corticosteroids. On the other hand, when circulating cortisol is low, its moderating effect on immune reactions is lost and lymphocytes circulate in excess. In this situation, inflammation is greater with more redness and swelling, and it takes a longer time for the inflamed tissue to return to normal. So, directly and indirectly cortisol dramatically influences most aspects of immune function.

Cardiovascular System

Cortisol has complex and sometimes opposing effects on the cardiovascular system. The most significant of these effects is probably the control of the contraction of the walls of the arteries in regulating blood pressure. The more circulating cortisol, the more contracted the mid-sized arteries. Thus, people who are deficient in cortisol usually have pervasive low blood pressure (hypotension) and reduced reactivity to other body agents that constrict blood vessels.

Cortisol also directly affects the heart. It helps regulate sodium and potassium in the heart cells and increases the strength of contraction of the heart muscle. Sodium and potassium levels are critical for normal heart function. Cortisol also tends to increase blood pressure, but this hypertensive effect is moderated by calcium and magnesium. These minerals are required to prevent the heart muscles from cramping when they contract, thus keeping the heart beating smoothly. They also help relax the walls of the arteries, counteracting and balancing the increase in smooth muscle contraction produced by cortisol.

Central Nervous System

Cortisol influences behavior, mood, excitability and even the electrical activity of neurons in the brain. Behavior changes frequently occur in cases of excess and deficient cortisol levels, for example, sleep disorders are common with both high and low cortisol. Many of the signs and symptoms of adrenal fatigue involve moodiness, decreased tolerance, decreased clarity of thought, and decreased memory. These occur because the brain is affected by both too little and too much cortisol. The right amount is needed for proper function during stress.

Stress

An intimate association between stress and cortisol is manifested in several ways. No matter what the source of stress, most challenges to homeostasis stimulate the HPA axis, resulting in increased secretion of cortisol. In animal experiments, the animals with weakened adrenals died in response to even mild stress. However, when animals with weakened adrenals were given cortisol or similar agents, they survived those same kinds of stress. People with adrenal fatigue can often tolerate mild stress, but succumb to severe stress. As stress increases, progressively higher levels of cortisol are required. When these higher levels of cortisol cannot be produced, as in adrenal fatigue, the person cannot fully or appropriately respond to stress.

Even at normal levels, cortisol serves the very important function of priming the different mechanisms of your body so they can respond when called into action. During stress cortisol must simultaneously provide more blood glucose, mobilize fats and proteins for a back-up supply of glucose, and modify immune reactions, heartbeat, blood pressure, brain alertness and nervous system responsiveness. Without cortisol, these mechanisms cannot react adequately to a significant stress challenge. When cortisol levels cannot rise in response to these needs, maintaining your body under stress is nearly impossible. The more extreme the difference between the level of stress, and the lack of cortisol, the more significant the consequences.

Cortisol can be viewed as sustaining life through two opposite but related kinds of regulatory actions: releasing and activating existing defense mechanisms of the body and shutting down and modifying the same mechanisms to prevent them from overshooting and causing damage or cell death. If this regulation is defective during stress, as it is when cortisol levels are low, an animal can be endangered or even die because its defense mechanisms cannot react or because they overreact. When your body is stressed cortisol is also needed to restrain various physiological mechanisms, to prevent them from damaging your body. For example, the elevation of blood sugar by the adrenals during stress helps control the insulin induced hypoglycemia that would occur if more blood glucose was not available. But cortisol also protects the cells against the detrimental effects of excessive amounts of glucose by helping create insulin resistance at the cell membrane to keep too much glucose from flooding into the cell.

This damping down action of cortisol can also be seen in the way cortisol modifies the immune response to control the amount of inflammation in the involved tissues and suppress potentially toxic chemicals secreted by white blood cells, thus protecting the body from auto-immune processes and uncontrolled inflammation. Cortisol is so important that when the HPA axis cannot increase cortisol activity in response to stress, these unrestrained mechanisms overshoot and can damage your body.

These actions of cortisol have evolved to both enhance the body's response to stress, yet protect it from excessive responses to stress. These mechanisms were probably needed only occasionally in our distant ancestors' lives. However in modern life, with the myriad of physical, emotional and environmental stresses we face daily, our adrenals' capacity to rise to the occasion is challenged day after day. It is possible that we experience more stressful events in a year than our ancestors experienced in a lifetime. Yet your adrenal glands require some recovery time each time they are challenged. The constant "pedal to the metal" lifestyle leaves little room for an adequate adrenal response when the adrenal glands never get the chance to recoup and are already responding at their maximum capacity.

The more we understand about the physiology of stress, the more obvious it is that, unless we quickly evolve to have adrenal glands the size of footballs, we must learn to give our adrenals the opportunity they need to recover on a regular basis. This means modifying the effects that stress is having on the body. Otherwise we will rapidly devolve into a society of the chronically sick and tired that even coffee, colas and other stimulants cannot rally.

Low Cortisol, Adrenal Fatigue and Hypoglycemia

It's been known for almost a century that people who suffer from low blood sugar frequently suffer from adrenal fatigue. It's also been known that people who suffer from adrenal fatigue almost always have some form of irregular blood sugar pattern, of which hypoglycemia is the most common. With hypoglycemia there are usually cravings for sugar. There are real physiological reasons why these cravings exist.

When your adrenals are fatigued, their cortisol output is diminished and you have lower levels of circulating blood cortisol. With lowered blood cortisol, your liver has a more difficult time converting glycogen into glucose. Fats, proteins and carbohydrates, which normally can be converted into glucose, also cannot be as readily converted into glucose. These reserve energy pools controlled by cortisol are critical to achieving and maintaining normal blood sugar levels, especially during stress. Further complicating this matter is that during stress, insulin levels are increased because the demand for energy in the cells is greater. Insulin opens the cell wall membranes to take in more glucose in order to provide more energy to the cells. Without adequate cortisol levels to facilitate the conversion of glycogen, fats and proteins to new glucose supplies, this increased demand is difficult or impossible to meet. All this combines to produce low blood sugar.

People with adrenal fatigue are in a real bind because when they are under stress, demand for blood glucose increases, but their fatigued adrenals cannot produce enough cortisol to generate higher glucose levels from reserves. In the presence of increased insulin and decreased cortisol, blood sugar drops rapidly. When this happens at the same time as an increasing demand for glucose, the stage is set for tragedy. In a physical survival situation this might lead to death because response times slow down, thinking easily becomes confused, muscular strength is weakened, and other problems occur which render the individual too helpless to effectively defend themselves or escape.

Typically in our society in which physical survival is not usually a daily source of stress, people handle their low-adrenal related hypoglycemia symptoms with a double-edged sword; they eat something sweet with a cup of coffee or cola. This is a short acting emergency remedy that temporarily increases blood sugar with nearly immediate impact. They can almost feel it hit the back of their brain as their blood sugar moves out of the basement and shoots for the stars, relieving their hypoglycemic symptoms for about 45-90 minutes. However, this is inevitably followed by a precipitous plunge back to even lower blood sugar levels than they started with. Many individuals do this day in and day out, not realizing that hypoglycemia itself is a significant stress on the entire body, and especially on the adrenals.

To the body, hypoglycemia is a strong stressor, an emergency call to action that further drains already fatigued adrenals. People who treat their own hypoglycemia like the common example given above are on a constant roller-coaster ride throughout the day with their blood sugar erratically rising and then falling after each "sugar fix." This throws not only cortisol and insulin levels into turmoil, but also the nervous system and the entire homeostasis of the body. Therefore, by the end of the day, the person may feel nearly exhausted without having done anything. It might take an entire evening or weekend to recover from this daily/weekly roller coaster ride. It has sometimes been characterized as driving with both the brakes and the accelerator pushed to the floor at the same time.

Low blood sugar times are most likely to occur at around 10:00 AM, 2:00 PM, and between 3-4:00 PM. The old Dr. Pepper commercials had this pattern of hypoglycemia pegged when they created the slogan encouraging people to have a Dr. Pepper (high in sugar and caffeine) at "10, 2 & 4" each day. It is not by accident that work breaks are scheduled at about these times or that people typically have something sweet and/or caffeine during these breaks. We have a nation of hypoglycemics. 60% of people suffering from hypoglycemia go on to become diabetics. So is it any wonder that we have a nation suffering from diabetes in epidemic proportions?

Your brain also requires increased energy during times of stress and is especially affected by a lack of glucose. Although your brain uses several different fuels, when it is low on glucose, it often does not do well. In fact, most of the mechanisms involved in regulating blood sugar are designed to ensure that your brain always has adequate glucose with which to function. Many of the symptoms of adrenal fatigue and most of the symptoms of hypoglycemia are the result of insufficient glucose available to brain tissues.

Hypoglycemia, without proper snack and meal placement, also encourages overeating when food is available. The overeating causes rapid weight gain because the increased insulin is circulating in your blood, ready to usher that excess energy (glucose) from the extra food into your fat cells where it can be stored as fat. Even though you may not like its effects, this is an elegant compensatory mechanism that has helped us survive.

Much of human history is a story of feast or famine; excess calories are a luxury in evolutionary terms. Therefore, after coming out of a situation of temporary famine (hypoglycemia) into a situation of excess calories (fat and sugary junk food), our evolutionary history urges us unconsciously to overeat and our bodies are designed to store that energy while it is available. In this way hypoglycemia creates a tendency to put on weight.

If you do not want to gain weight you should avoid those low blood sugar dips that not only make you so hungry you overeat, but, also create a tendency in your body to store energy as fat. This means regular exercise and eating the kinds of meals and foods that control hypoglycemia. It also means not eating those sugary foods and caffeine that send your blood glucose levels on a roller coaster ride and worsen your adrenal fatigue and hypoglycemia.

Fasting

Many persons and many doctors are great advocates of fasting. Yet many of these same people have considerable difficulty when on a prolonged fast. They will always rationalize the problems encountered on a fast as being due to the body detoxifying. However, many of these people are really showing symptoms of hypoadrenia during their fasts, and actually may be doing themselves more harm than good.

During a fast, the body will call on the adrenals to produce glucocorticoids to maintain a level of blood glucose which is adequate for a normal level of activity. The glucocorticoids can elevate blood glucose by breaking down protein into carbohydrates through the process of gluconeogenesis. A person on a fast puts a great strain on his adrenals and if he is already hypoadrenic, or borderline hypoadrenic, he may suffer from many problems during the fast. Severely hypoadrenic persons should almost never be put on a total fast. If they must be fasted, it should be a raw fruit and vegetable juice diet, with the juice taken at frequent intervals. It is also best that they fast for only a day or two at a time.

Regulation of Adrenal Sex Hormones

The manufacture of adrenal sex hormones in the zona reticularis of the adrenal cortex is primarily triggered by the same signal that initiates the production of aldosterone and cortisol in the other adrenal zones—the stimulation of the cell membrane by increased ACTH. This releases cholesterol to start the complicated cascade by which cholesterol is converted to pregnenolone and pregnenolone to various sex hormones. In the zona reticularis, unlike in the other adrenal zones, the cascade can follow a number of routes to produce various end product hormones. For example, pregnenolone can be converted to progesterone, which can then be converted to androstenedione, or pregnenolone can be converted to DHEA, which can then be converted to androstenedione in turn can be converted to estrone or testosterone, either of which can then also be converted to estradiol. The sex hormone precursors such as DHEA are only somewhat diurnal, having small fluctuations throughout the day.

Actions of Adrenal Sex Hormones and Their Precursors

Both male and female hormones are made in the adrenals of each person, regardless of gender. Any masculinizing in the female or feminizing in the male can be due to adrenal stress-related states. In males, the adrenals provide a secondary source of testosterone and are the exclusive source of the female hormone estrogen. In females, the adrenals provide a secondary source of estrogen and progesterone, and are the nearly exclusive supplier of testosterone. Although science may not yet understand the exact role the adrenals play as a supplier of ancillary sex hormones, it is known that many women suffering from premenstrual syndrome (PMS) and difficult menopause have low adrenal function, and vice versa. It is also known that when these women are given adrenal extracts, they often report their PMS or menopausal symptoms vanish or greatly improve. In boys entering puberty, low adrenal function is often associated with a lighter beard or less drive to achieve, with sparser hair on their arms and legs. Libido in both sexes is usually diminished by low adrenal function.

In addition to its effects on secondary sexual characteristics, estrogen has very important metabolic functions at the cellular level in both the male and the female. It is a factor in certain transhydrogenase reactions which are essential in energy metabolism. Some investigators implicate estrogen in the increased rate of coronary heart disease (CHD) in men over women, since CHD incidence in postmenopausal women approaches that of men. The only source of estrogen in the male is his adrenal glands while the premenopausal woman has a usually abundant estrogen supply from her ovaries.

Females are more likely to show secondary sexual characteristics of men than vice versa, although both are encountered. Women with excessive body hair, particularly on the face, or men with gynecomastia, seem to be the persons who seek help for their problems most readily. These symptoms result from excessive production of the sex hormones by an overactive adrenal cortex. The common medical approach to the woman with facial hair is to prescribe prednisone or some other cortisone derivative in an effort to suppress the pituitary drive of the adrenal, thereby hopefully decreasing the output of testosterone. Although this is sometimes valuable, the person must put up with the side effects, both seen and unseen, of the cortisone derivative. If you look at the person from a holistic, long-range perspective, you can see the likely imprudence of such therapy.

When one recognizes that they are dealing with a hyperadrenia in these persons and examine them from the perspective of the GAS, it will be evident that it is a stress-related illness. These persons usually fall into the category of the resistance stage of the GAS. What is really seen is a person whose system is reacting to stress by increasing adrenal function. To suppress the pituitary drive of the adrenal is to interfere with the body’s attempt to adapt to stress, and the person may well be sacrificing long-term health for short-term symptomatic relief. A far better approach is to aid the person in his ability to adapt to stress by identifying and eliminating (as much as possible) the sources of stress, and by treating the adrenal glands (and the entire endocrine system) with the nutritional and other natural therapies available.

During menopause, as the estrogen levels begin to decrease, the adrenals are supposed to increase their production of estrogen to help make up for part of the estrogen deficit. In many persons, menopause hits “like a ton of bricks.” Menopause frequently takes place very rapidly, not allowing the adrenals adequate time to increase their capacity to meet the increased estrogen requirement. This is further complicated by the fact that many of these persons are already on the verge of adrenal exhaustion.

The menopausal hypoadrenia woman will have a variety of symptoms—from just feeling poorly to severe psychosis. This is because the adrenals are not able to take the extra load that has been dumped on them without any warning by the ovaries. Any woman who has a rapid menopause with accompanying symptoms must be checked for hypoadrenia. She may complain of low back pain that started at about the time of menopause, or a knee problem, or eyes which began to become sensitive to light, and so on. These are diagnostic clues which you can obtain from her history. And she will show kinesiological muscle testing evidence of adrenal involvement.

Pregnancy is quite a stressor for many women. A common occurrence, however, is the woman who, upon reaching her third trimester of pregnancy, says that she all of a sudden "feels better than I have felt in years." This is often the case when the first two trimesters were particularly difficult. The fetus's adrenal glands mature to the point of being able to produce hormones at about the beginning of the third trimester. If the mother is in the exhaustion stage of the GAS, it is not uncommon for the baby's adrenals to try to make enough adrenal hormones for both the baby and the mother. The mother feels great. The baby's adrenals are really supporting the mother's adrenals. But the baby's adrenal glands are being stressed before it is even born! The results are doubly negative. The baby is born in a state of adrenal depletion and often exhibits symptoms of hypoadrenia. These symptoms may be varied, but two of the more common symptoms are allergies and recurrent infections. During chronic stress states, the thymus and other lymphatic structures atrophy, lowering the capabilities of the body's immune mechanisms.

Likewise, with the support of the baby's adrenals pulled out from under her, the mother is dropped back into a state of adrenal exhaustion. This accounts for the common occurrence of "post partum blues" or even psychosis. Quite frequently, both mother and child must be treated for hypoadrenia.

Protective Effect of Adrenal Sex Hormones and Their Precursors

The adrenal sex hormones and their immediate precursors such as DHEA, pregnenolone and androstenedione do more than add to or balance other sex hormones. They also help balance the effects of cortisol and act as cellular anti-oxidants. DHEA is itself a weak androgen, however it can be converted in peripheral tissues to *testosterone*, a much more powerful *androgen*. Thus, the sex hormones and DHEA both limit cortisol's possible detrimental effects on cells and at the same time facilitate its actions by functioning as hormonal anti-oxidants. These precursors have their own actions as well as serving as raw material from which the sex hormones are made. For example, DHEA is exported to most cells and once inside the cells, it often becomes the resource material from which small amounts of local hormones can be created to carry out various specific tasks.

Physiological Effects of Stress and Aging on Adrenal Sex Hormones

The more the adrenals are stimulated by stress and internal demands, the less responsive the zona reticularis becomes. Consequently, the adrenal output of sex hormones and their precursors decrease with chronic stress and adrenal fatigue. When less DHEA-S is manufactured in the zona reticularis, less DHEA-S and DHEA is available for export and use by other cells. This diminishes your ability to respond adequately to the demands placed on the body for increased DHEA-S and DHEA, thus, in turn, increasing the negative effects of chronic stress.

Loss of libido is commonly associated with adrenal fatigue, probably due in large part (in both men and women) to a drop in testosterone production by the adrenals. From your body's point of view, when you are under a lot of stress, it is not a good time to feel amorous because your energy must be used for survival.

Output of adrenal sex hormones and their precursors also decreases with age. A decline in DHEA and testosterone levels accounts for many of the degenerative processes of aging. In fact, the levels of these two hormones in males track the progression of biological aging more closely than do any other markers. As we lose the available DHEA and testosterone, we become less able to counter the intense effects of cortisol in the cells. With age, cortisol levels remain relatively steady, while DHEA and testosterone decline and the other hormones range somewhere in between. In general, as the levels of sex hormones and their precursors such s DHEA and testosterone decrease because of age, stress and adrenal fatigue, their many and varied beneficial effects decrease as well.

Regulation and Actions of Aldosterone

Adrenal Fatigue and Craving for Salt

As mentioned in the "Anatomy" section, aldosterone is manufactured in the zona glomerulosa of the adrenal cortex. Like cortisol, aldosterone follows a diurnal pattern of secretion with its major peak at around 8:00 AM and major low between midnight and 4:00 AM. Also like cortisol, its production and secretion increases and decreases in response to stimulation of the adrenal cortex by ACTH. This means that aldosterone levels generally rise in stressful situations. However, aldosterone is not part of the negative feedback loop controlling its release. Instead, it depends on the negative feedback loop in which cortisol levels trigger ACTH activity. This means that cortisol determines the amount of ACTH which controls production of both cortisol and aldosterone with aldosterone having no say in the matter.

The only thing the cells that produce aldosterone can do to regulate production is to alter their sensitivity to ACTH. Therefore, after about 24 hours, the adrenal cells of the zona glomerulosa become less sensitive to the demands of ACTH and stop manufacturing more aldosterone. The amount of circulating aldosterone then begins to decrease, even though the ACTH levels are high and the need for increased amounts of aldosterone may continue. This decreased production continues until the cells of the zona glomerulosa recover their sensitivity to ACTH, but in the meantime the decreased aldosterone leads to many of the symptoms of adrenal fatigue.

Aldosterone is the most important mineralocorticoid, but corticosterone and desoxycorticosterone are also included in this category. The effects of aldosterone depletion can be observed in a large number of hypoadrenic persons. Aldosterone depletion may create one or more different symptoms which are specifically related to the diminished mineralocorticoid levels.

In the chronically stressed person, the levels of sodium and chlorides in the urine should be measured as well as the specific gravity in the urine. Chlorides in the urine are measured by Koenisburg's test. This test also provides information of the sodium levels being excreted in the urine. Excessive sodium in the urine is one of the first clues that a person has a hypoadrenic problem.

Aldosterone is responsible for the maintenance of fluid (water) and the concentration of certain minerals (sodium, potassium, magnesium and chloride) in the blood, the interstitial fluid (area between the cells) and inside the cells. Working with other hormones such as anti-diuretic hormone from the pituitary and rennin and angiotensin I and II from the kidneys, aldosterone keeps the fluid balance and salt concentration intact, in roughly the same concentration as sea water. In the blood and interstitial fluid, sodium is the most dominant of the four minerals. Inside the cells, potassium has the highest concentration. These four minerals are called electrolytes because they carry minute electrical charges. These electrolytes are very important for proper cell function and fluid properties and they must remain in a relatively constant ratio to each other and to the body fluids. Small deviations in their ratios to each other, or to their concentration in the body fluids, means alterations in the properties of the fluid, the cell membrane and the biochemical reactions within the cell. In fact, most of the physiological reactions in the body depend in some way on the flow or concentration of electrolytes.

Aldosterone, in times of stress is the major director of these relationships by its influence on sodium and water concentrations. Although this interaction is somewhat complex, the overall process is easy to understand if you just keep an eye on the sodium in relation to aldosterone. As the concentration of aldosterone rises, the concentration of sodium rises in the blood and interstitial fluid. Wherever sodium goes, so follows water.

In adrenal fatigue, the craving for salt is a direct result of the lack of adequate aldosterone. As mentioned above, aldosterone controls sodium, potassium and fluid volumes in your body. When aldosterone secretions are normal, potassium, sodium and fluid levels are also normal. When aldosterone is high, sodium is kept high in the fluids circulating in your body.

However, as circulating aldosterone levels fall, sodium is removed from your bloodstream as it passes through the kidneys and is excreted in the urine. When sodium is excreted it takes water with it. Initially, there is some loss of volume of your body fluids but it does not become severe unless the condition worsens. Once your circulating sodium level drops to about 50% of its original concentration in body fluids, even a small loss of sodium or sodium restriction in your diet begins to have severe consequences. Tiny fluctuations in blood sodium concentration have a significant effect o blood volume when sodium is depleted to this level.

When the sodium supply of the blood is not replenished by eating salt-containing foods or liquids, sodium and water is pulled from your interstitial fluids into the blood to keep your blood sodium levels and water volume from getting too low. If too much salt or fluid is pulled from the interstitial fluids, the small amount of sodium in the cells begins to migrate out of the cells into the interstitial fluid.

The cell does not have a great reserve of sodium because it needs to maintain its 15:1 ratio of potassium to sodium. As the sodium is pulled from the cell, water follows the sodium out.

This leaves the cell dehydrated as well as sodium deficient. In addition, in order to keep the sodium/potassium ratio inside the cell constant, potassium then begins to migrate out in small quantities. However, each cell has minimum requirements for the absolute amounts of sodium, potassium and water necessary for its proper function. When these requirements are not met, cell function suffers, even if the proper ratio is maintained.

If you are suffering from moderately severe adrenal fatigue, you must be careful how you re-hydrate yourself. Drinking much water or liquid without adequate sodium replacement will make you feel worse because it will dilute the amount of sodium in your blood even further. Also, your cells need salt to absorb fluids because sufficient sodium must be inside the cell before water can be pulled back across the membrane into the cell.

When you are already low on body fluids and electrolytes, as you are in this situation, you should always add salt to your water. Do not drink soft drinks or electrolyte-rich sports drinks, like Gatorade, because they are high in potassium and low in sodium, the opposite of what someone with low cortisol levels who is dehydrated needs. Commercial electrolyte replacement drinks are designed for people who produce an excess of cortisol when exercising, not people who are low on cortisol and aldosterone. Instead, yo are much better off having a glass of water with ¼ - 1 teaspoon salt in it, or eating something salty with water to help replenish both sodium and fluid volume.

In a nation of people suffering from adrenal fatigue, the fast food restaurants come to the rescue. Such restaurants use an excessive amount of salt in their foods; a custom left-over from the old road houses where lots of salt was used in the food to stimulate appetites and whet the thirst (for alcohol, the biggest profit item). Although not a good solution, it supplies “emergency” rations daily to people living in marginal health. It averts the crisis and replenishes their supplies for another few hours.

When your aldosterone levels are low and you are dehydrated and sodium deficient, you may also crave potassium because your body is sending you the message that your cells are low on potassium as well as sodium and water. However, after consuming only a small amount of potassium containing foods or beverages (fruit, fruit juice, sodas and commercial electrolyte replacement drinks), you will probably feel worse because the potassium/sodium ration will be further disrupted.

What you really need in this situation is a combination of all three, water, salt and potassium in the right proportions. One of the easiest ways to accomplish this is to drink small repeated doses of water accompanied by a little food sprinkled with kelp powder. Kelp powder contains both potassium and sodium in an easily assimilated form. Depending upon taste and symptoms, extra salt can be added. Sea salt is a better choice than regular refined table salt, because it contains trace amounts of other minerals in addition to the sodium. Another choice is to drink a vegetable juice blend containing some celery and chard and diluted with purified water.

Usually, within 24-48 hours, your hydration and electrolyte balance will have stabilized enough that you can proceed to an adrenal-supporting diet. You must continue to be careful to drink salted water or vegetable juices 2-4 times during the day, varying the amount of salt according to your taste, and you should avoid potassium-containing foods in the morning when your cortisol and aldosterone levels are low. Never eat or drink electrolyte-depleting or diuretic foods and beverages such as alcohol and coffee, especially if you have been out in the sun or are otherwise dehydrated. One of the problems people with adrenal fatigue constantly deal with is a mild dehydration and sodium depletion.

When there is inadequate aldosterone, the kidney allows sodium, chlorides and water to spill into the urine, and maintains ionic balance by retaining, rather than excreting, potassium. Some of these low aldosterone persons present with symptoms of dehydration. The appearance of the tongue is one of the easily monitored indicators of dehydration. Normally, one should feel considerable slickness when running a finger down the protruded tongue of a person. It should slide easily across the tongue like a cube of ice across a wet piece of waxed paper. If the tongue is rough like sandpaper, or if you feel friction, with your finger catching or sticking to the tongue's surface, it is an indication of inadequate tissue hydration. The person needs more water intake.

The person may report excessive urination, up to 15 or 20 times daily. Likewise, due to the effect of aldosterone on the sweat glands, the person may report excessive perspiration or perspiration with little or no physical activity. The common factor in all of these persons is a weakness of sartorius, gracilis, posterior tibialis, gastrocnemius, or soleus, and a background of some type of stress.

A person with lowered aldosterone may also demonstrate other symptoms. For a nervous system action potential to take place there must be an adequate supply of sodium on the outside of the cell membrane and an adequate supply of potassium inside the cell. They must be balanced. If this balance is undermined by a loss of sodium and retention of potassium, the nervous system will find it difficult to propagate normal action potentials and maintain itself at a good functional level. This may result in a wide variety of symptoms, including muscle twitches and even cardiac arrhythmias (heart palpitations).

With a chronic sodium-potassium imbalance, the person will show the sign of a paradoxical pupillary reflex. Normally, shining a light into a person's eye will cause the pupil to constrict. This papillary constriction to light should be able to maintain itself for at least 30 seconds. In the hypoadrenic person (especially in the exhaustion stage of the GAS) you will find one of three things:

1. The pupil will fluctuate opened and closed in response to light.

2. The pupil will fluctuate opened and closed in response to light. (This is a deliberate opening and closing, not the minor flutter or twitch of the normally encountered hippus activity.)

3. The pupil will initially constrict to light, but it will dilate paradoxically with continued light stimulation of less than 30 seconds. This patient will frequently complain of eyes that are sensitive to light (such as when going from indoors to outside on a sunny day) or will be seen wearing sunglasses whenever outdoors or even indoors under bright light.

Another problem related to lowered mineralocorticoid levels in hypoadrenia is a paradoxical, non-pitting edema of the extremities. When the patient with hypoadrenia spills sodium and water into the urine and perspiration, and has a tendency to be dehydrated, we would hardly expect him to show signs of holding water, such as edema. But that is exactly what we do see in some hypoadrenic patients.

With the body spilling large amounts of extracellular sodium and likewise retaining intercellular potassium, we can see how an osmotic differential could develop in the patient's tissues. If the osmotic difference (created by the increased potassium seeking its intercellular position and the lowered extracellular sodium levels) is severe enough, the body will most often attempt to correct this osmotic imbalance by allowing extracellular fluid to enter the cells. (It is also possible that the body could kick the potassium out of the cell and into the extracellular fluids, and although this occasionally occurs, we rarely see signs of this in the blood potassium levels.) The body is trying to dilute the potassium in the cell with water, to bring the system into osmotic equilibrium. The cells take on water, and the patient has swelling.

Often, these patients are placed on a diuretic by an unenlightened physician whose only basis for this prescription is the patient's symptoms. The diuretic in these patients rarely helps the condition and often aggravates the tendency toward dehydration. Further, many diuretics act as adrenal (aldosterone) inhibitors, adding even more stress to the adrenals and tending to make the patient worse in the long run.

Even in adrenal fatigue, the body is still wonderful, beautiful and incredibly wise. It is our society, our maladaptation to the stresses of modern life, and our poor judgment that need to change. We may not be able to change society but we can learn to use better judgment when it comes to taking care of ourselves and to respond to stress in healthier ways.