Brain Chemistry

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The ability to enjoy and perceive life is totally related to brain function

The loss of ability to enjoy and perceive life is totally related to a decrease in brain function

Healthy brains and balanced brain chemistry are absolutely essential for every aspect of health: physical, mental, emotional and spiritual. The western medical model has been almost entirely focused on treating symptoms solely as they relate to individual organs and body systems. Even, the holistic medical community, while looking at the whole human body as one living system, where every part is important, has largely ignored the brain. The focus, instead, has been on our varied systems like the digestive, endocrine, immune, metabolic, cardiovascular, etc. However, in almost every ailment ranging from headaches to high blood pressure, insomnia, depression, heart disease, obesity, gastro-intestinal issues and even cancer, the brain plays a critical role.

The brain needs to be seen as the starting place for disease and health. This article will discuss several key aspects of this incredibly important topic. I have written this in the hope that people will begin to understand some of the many factors involved in healthy brain chemistry and gain a better understanding and assessment of their own brain status. Finally, I will offer some ideas on diet, nutrients and lifestyle that can be implemented to dramatically improve both brain health and overall health.

Determining Brain Chemistry Status

In our practice, we use both a thorough blood evaluation along with a comprehensive Neurotransmitter Assessment Form to ascertain Brain Chemistry status. Neurotransmitters are chemicals that are used to relay, amplify and modulate signals between a neuron and another cell. Neurons, numbering approximately one hundred billion at birth, are the smallest components of the nervous system and are core components of the brain, spinal cord and peripheral nerves. With the assistance of the brain's biochemicals, neurons transmit information throughout our body via electrical current. The four primary biochemicals are: Dopamine, Acetylcholine, GABA and Serotonin.

There are several labs in the U.S. that specialize in neurotransmitter testing. Unfortunately, it is only possible to measure neurotransmitter levels in the peripheral system, not in the brain. Neurotransmitters in the gut do not pass through the blood-brain barrier, for the most part. Further, absolute levels are only a part of the story. The brain's ability to process and utilize these essential chemicals at their receptor sites is also not measurable. So, while it is impossible to precisely measure neurotransmitter levels and utilization, with our methodology we can get a very good idea of their status as well as other underlying factors related to brain chemistry.

Brain Function

Some of you may have noticed that over the past number of years, your brain is functioning less effectively than it used to. You may have told yourself that this memory decline is a normal sign of aging, what has jokingly been called a "senior moment". But these cognitive deficits are not nor-

mal. They are a sign of brain aging and degeneration. Chronological age has nothing to do with the amount or rate of degeneration our brain has. It is not normal or necessary for our brain function to deteriorate with time.

We are all losing neurons every single second of the day. In a two hour period, most of us will lose about 6500 neurons. But some of us may lose a great deal more. Some will lose 60,000 neurons. Others may lose 600,000 neurons. It's different for every one of us. There are many factors that contribute to this increased level of destruction. These include brain injuries, nutritional deficiencies, food allergies, infections, environmental toxins and psychological traumas (to name but a few). These factors must be determined and addressed.

One of the ways we can counteract the normal loss of neurons is through Neuroplasticity. This is the process by which a healthy brain can change to better cope with the environment. If an area of the brain is damaged and dysfunctional, another area can take over some of the function. As we fire a specific pathway repeatedly over time, it becomes more and more efficient. So, while we are constantly losing neurons, our pathways can become more efficient and responsive. We can actually have a higher level of function as we get older.

But, factors can occur in life that can prevent the brain's ability to adapt. Our brains can lose plasticity and begin to degenerate. To maintain plasticity we need healthy neurotransmitter levels. When we see these levels decline, we see increasing symptoms of brain degeneration. Also, we need to exercise our brains. The more we challenge our brains to learn and grow, the greater the plasticity we will develop and the more functional our brains will become.

Symptoms of Brain Degeneration include:

- Memory decline
- Difficulty remembering names
- Focus noticeably declining
- More difficulty learning new things
- Temperament getting worse
- Lessened attention span
- Feeling more depressed than usual
- Fatigue when driving compared to the past
- Fatigue when reading compared to the past

THERE ARE TWO KEY NUTRIENTS ESSENTIAL FOR BRAIN PROTECTION AND REGENERATION:

- **Omega 3 Fatty Acids:** The brain is comprised of phospholipids and is strongly influenced by rich sources of fatty acids such as EPA and DHA. The best source of these is from a high quality fish oil supplement. Rich food sources of omega 3 include: salmon, lamb, avocadoes, flax, walnuts and pecans.
- **B12** (as methylcobalamin): Vitamin B12 is essential for many brain pathways, maintenance of neurotransmitter levels and the reduction of homocysteine levels that can cause brain inflammation.

Contributing Factors of Brain Dysfunction

There are many factors that can contribute to brain dysfunction. In this section, we will cover three key factors that must be addressed, if treatment success is to be achieved. These three factors are: **Adrenal Stress, Hypoglycemia and Insulin Resistance.** In my clinical experience, the overwhelming majority of patients with Brain Dysfunction have unaddressed adrenal and blood sugar issues.

Adrenal Stress

Stress is the most aggressive challenge to our neurological system and decreases neurotransmitter activity. We all have stress. But, if our stress levels are high and we don't have (or take) sufficient time to *rest, relax, sleep, exercise and rejuvenate* or if there are stressful life situations beyond our control, it is imperative to support our adrenal glands, if we are to successfully resolve brain chemistry dysfunctions.

While there is no replacement for an adrenal healthy lifestyle, there are certain adaptogenic herbs that can help us manage the impact of stress on our body and support our body's ability to respond to stress. The most important adaptogens for the adrenals include:

- Panax ginseng
- Siberian Ginseng
- Ashwaganda
- Rhodiola
- Holybasil Leaf
- Eleutherococcus Root

Also extremely beneficial for the adrenals is *Phosphatidylserine*. A dose of up to 800 mg a day will help modulate the neuroendocrine response to stress and lower cortisol levels.

Hypoglycemia

Regulation of blood sugar is absolutely essential to regulate and modulate brain chemistry. The brain utilizes 25% of all glucose available in the body and needs constant glucose for normal function.

Both hypoglycemia (low glucose levels) and insulin resistance (poor cell response to insulin) result in surges of insulin that disrupt the production and utilization of all key neurotransmitters.

Symptoms and signs of hypoglycemia include:

- Getting irritable, shaky and lightheaded between meals
- Feeling energized after meals
- Difficulty eating large meals in the morning
- Energy levels drop in the afternoon
- Craving sugar and sweets in the afternoon
- Reduced fasting glucose and LDL levels

Diet must be moderated to prevent big swings in blood sugar levels. Of utmost importance, is the necessity to:

- Eat protein at breakfast. Breakfast is the most important meal of the day.
- Limit high-glycemic foods.
- Eat protein with every meal.

- Eat frequent high quality snacks or meals. Every time a hypoglycemic goes too long without eating and gets symptoms of low blood sugar, their brain is actually degenerating and neurotransmitter production and pathways can be thrown off for days.

A wide range of vitamins, minerals and glandular substances can be used to improve the nutritive and biological conditions to better control blood sugar. These are best taken in a broad spectrum supplement designed for this purpose.

Beneficial nutrients for regulation of hypoglycemia include :

- Vitamin A
- Vitamin C
- Vitamin D
- Vitamin E
- Vitamin K
- Thiamin
- Riboflavin
- Niacin
- Vitamin B6
- Vitamin B12
- Folic Acid
- Pantothenic Acid
- Magnesium
- Zinc
- Copper
- Manganese
- Chromium
- Inositol
- Choline
- L-Carnitine
- Co-Enzyme Q10
- Bromelain
- Adrenal Glandular
- Liver Glandular
- Pancreas Glandular
- Pituitary Glandular

Insulin Resistance

Insulin Resistance is a metabolic disorder than usually develops over many years, as our cells become less and less responsive to insulin. Insulin surges as the body tries to get glucose into our cells. This triggers elevations in cortisol (an adrenal stress hormone) and inflammatory cytokines which promote neurodegeneration of the brain.

The key symptoms of insulin resistance include:

- Fatigue after meals
- Craving sugar and sweets after meals
- Need for a stimulant such as coffee after meals
- Elevated fasting glucose, triglycerides and cholesterol levels

The keys to controlling insulin resistance are:

- Limiting levels of starchy, carbohydrate foods (cakes, cookies, breads, pasta, potatoes etc.)
- Regular exercise

A wide range of vitamins, minerals and herbal substances can be used to improve the nutritive and biological conditions to better modulate the insulin response and support blood sugar stability. These are best taken in a broad spectrum supplement designed for this purpose.

The most key beneficial nutrients insulin resistance include:

- Chromium
- Vanadium
- Alpha-Lipoic Acid
- Vitamin E
- Magnesium
- Biotin
- Zinc
- Inositol
- Gymnema
- Banaba Leaf
- Maitake Mushroom
- Bitter Melon

NEUROTRANSMITTERS

In this section, we will focus on the four key neurotransmitters essential to our health and well-being: **Serotonin, GABA, Dopamine and Acetylcholine**. We will look briefly at specific functions, symptoms and conditions related to each and list beneficial supplements and foods necessary for their production and utilization.

You will note that some symptoms are common to multiple neurotransmitters. You may discover that you fall into one specific neurotransmitter category or may have symptoms of multiple neurotransmitters. To better differentiate your status, it is important to understand the function of each neurotransmitter and the quality of its symptoms.

Before we get into that, however, I'd like to say a few words about neuro-psychiatric drugs. If you are on one or more of these types of medications, do not simply stop taking them and switch over to these natural alternatives. This transition must be done only under medical supervision, as these medications are extremely bio-chemically habituating. Also, while the nutrients mentioned above for brain, adrenals and blood sugar health should create no problems and will likely be very beneficial, some of the nutrients and botanicals listed below can function almost like a drug. With the exception of the nutrients for acetylcholine health, which should be totally fine no matter what medications you are on, the others should only be taken with the knowledge and guidance of your physician. All of the listed food recommendations should be fine and can indeed benefit your condition.

SEROTONIN

Serotonin is produced both in the Central Nervous System (CNS) and in the Peripheral Nervous System (PNS). Serotonin produced in the CNS is associated with anger regulation, body temperature, mood, sleep, pain modulation and appetite. Serotonin produced in the PNS is associated with GI motility and pain modulation.

Serotonin provides a healing, nourishing, satisfied feeling in the body. When serotonin levels are sufficient and balanced you can sleep deeply and peacefully, enjoy family, friends, foods and activities and think rationally.

Symptoms or conditions of serotonin imbalance include:

- Obsessive-compulsive disorders
- Migraines
- Irritable Bowel Syndrome
- Tinnitus
- Fibromyalgia
- Anxiety Disorders
- Bipolar Disorders

- Loss of pleasure in interests
- Feelings of overwhelm with ideas to manage
- Feelings of inner rage
- Feelings of paranoia
- Not enjoying life
- Lack of artistic appreciation
- Depression from lack of sunlight
- Loss of enthusiasm for favorite activities
- Not enjoying favorite foods
- Not enjoying friendships and relationships
- Unable to fall into a deep, restful sleep
- Feeling of dependency on others

The following are botanicals, amino acids and co-factors required for serotonin production and utilization.

- 5-Hydroxytryptophan (5-HTP) is an amino acid precursor to serotonin that has been shown to increase serotonin levels, decrease depression and to be effective for nightmares, fibromyalgia, chronic daily headaches, migraines and mood disorders.
- St. John's Wort has the ability to increase serotonin activity.
- SAMe is a methyl donor in the brain and is a very effective anti-depressant with few side effects.
- Vitamin B6 in the form of Pyridoxal-5-Phosphate (P-5-P) is an essential co-factor in the production of Serotonin. Individuals who consume alcohol on a regular basis have increased risk for P-5-P depletion.
- Vitamin B 12 in the form of Methylcobalamin
- Folic Acid
- Magnesium
- Niacinamide

Iron is essential for the production of serotonin. Iron anemic individuals are typically found to have low serotonin symptoms. Anemia must be managed for proper serotonin production to occur. Since iron can act as a free radical toxin in the body, I don't recommend taking added iron supplementation unless iron anemia has been medically diagnosed.

Tryptophan is an amino acid precursor to serotonin. The brain does not produce tryptophan and is therefore dependent upon peripheral sources and diet to supply it. It is important to note that tryptophan is the most limited amino acid in foods consumed by humans. Supplementation of tryptophan can be helpful, but if a person has blood sugar problems, tryptophan will not be transported effectively to the brain and converted into serotonin. Blood sugar must be managed for proper serotonin production to occur.

Foods richest in Tryptophan include:

- Shrimp
- Scallops
- Mushrooms
- Snapper
- Halibut
- Turkey
- Beef
- Liver
- Lamb
- Soybeans
- Salmon
- Chicken Breast
- Raw tofu
- Spinach

DOPAMINE

Dopamine monitors our metabolism. It works like a natural amphetamine and controls our energy, excitement about new ideas and motivation. Dopamine is associated with the "pleasure system" of the brain and promotes feelings of enjoyment and reinforcement to motivate performance.
Dopamine has numerous functions in the brain related to motor coordination, cognition, mood, attention and learning. Dopamine controls bodily functions related to power, including blood pressure, metabolism and digestion.

Symptoms or conditions of dopamine imbalance include:

- Depression
- Parkinson's Disease
- Fatigue
- Social Anxiety
- Heavy Menstrual cycles
- High or Low Blood Pressure
- Depressed libido
- Learning Disorders
- Attention Deficit Disorder
- Chemical Addictions
- Schizophrenia
- Feelings of worthlessness
- Feelings of hopelessness
- Self-destructive thoughts
- Inability to handle stress
- Desire to isolate oneself
- Need to use caffeine to get alert
- Lose temper for minor reasons
- Distracted easily

As you read on, you'll notice that acetylcholine is also closely associated with learning and attention issues. But, they are quite different in their qualities. Dopamine deficiencies cause a loss of energy to learn while acetylcholine deficiencies lead to actual forgetfulness.

The following are botanicals, amino acids and co-factors required for dopamine production and utilization.

- Mucuna Pruriens is commonly known as cowhage. Its components include L-Dopa which is converted into dopamine in the brain. It has been demonstrated to have anti-Parkinson influences.
- Beta-Phenylethylamine (PEA) influences endorphins attributed to feeling pleasure, improve attention and relieve depression. Chocolate contains a rich source of PEA.
- Blueberry extract contains a rich and potent source of antioxidants proven effective in free radical quenching of dopamine rich neurons of the CNS.
- D, L-Phenylalanine (DLPA) is an essential amino acid precursor for the production of dopamine. DLPA is effective in managing depression, mood and reducing pain perception.
- N-Acetyl-Tyrosine is an amino acid that is a precursor of dopamine.
- Glutathione Cofactors including selenium, lipoic acid and n-acetyl-cysteine are essential

nutrients for the synthesis of glutathione that helps protect the neuronal tissue responsible for dopamine production.
- Vitamin B6 (as pyridoxal 5 phosphate)
- Methyl donors such as folic acid and B12 (as methylcobalamin). Deficiencies can stem from hypothyroid conditions, use of oral contraceptives and estrogen replacement, antacid use, decreased levels of hydrochloric acid and h pylori infections.

Foods rich in phenylalanine and tyrosine impact dopamine. These include:
- Beef
- Pork
- Fish
- Turkey
- Eggs
- Cheese
- Oats
- Chocolate

GABA

Gamma-aminobutyric acid (or GABA) is the brain's natural Valium. It is the chief inhibitory neurotransmitter of the nervous system and is linked with relaxation, anti-anxiety and anti-convulsive effects. Sufficient and balanced levels of GABA provide calmness to your body, mind and spirit. GABA is also involved in the production of endorphins, brain chemicals involved in the feeling of well-being.

Physical effects of GABA imbalance can include headaches, hypertension, palpitations, seizures, diminished sex drive and disorders of the heart.

Symptoms of GABA imbalance also include:
- Anxiousness or panic for no reason
- Feelings of dread
- Feelings of "knots" in the stomach
- Feeling overwhelmed for no reason
- Feelings of guilt about decisions
- Restless mind
- Difficulty turning the mind off
- Disorganized attention
- Worry about things not previously thought of
- Feelings of inner tension and excitability

Oral GABA supplements are not able to cross the blood-brain barrier and are not beneficial for increasing levels of GABA in the brain. If GABA supplements increase relaxation in an individual, this is actually evidence of a breakdown of the blood-brain barrier. The following are botanicals, amino acids and co-factors required for GABA production and utilization.

- Valerian Root Extract has been used for centuries as a botanical sedative to manage anxiety, insomnia and restlessness and appears to inhibit GABA catabolism (breakdown).
- Lithium Orotate is a naturally occurring mineral that increases GABA activity and can be

used to stabilize mood swings, mania and depression.
- Passion Flower
- L-Theanine is an amino acid found in herbal teas that appears to create relaxation. L-Theanine crosses the blood-brain barrier and raises GABA levels.
- Taurine is an amino acid that is similar in structure to GABA and has anti-anxiety properties. It may be useful in agitation, restlessness, irritability and depression.

Foods rich in glutamic acid and glutamate promote GABA. These include:
- Walnuts
- Almonds
- Peanuts
- Cheese
- Oats
- Rice
- Halibut
- Spinach
- Beans
- Liver

ACETYLCHOLINE

The neurotransmitter acetylcholine is used to promote excitatory actions for cognition, memory and arousal. It regulates your ability to process sensory input and access stored information. Acetylcholine controls your brain speed by determining the rate at which electrical signals are processed throughout your body. When your brain speed slows, the brain doesn't react as fast as it used to. This leads not only to reduced cognition, but to slowed impulses that result in organs functioning less well.

Alzheimer's disease, Dementia and Myasthenia Gravis are conditions associated with imbalances of acetylcholine.

Symptoms of decreased levels of acetylcholine include:
- Learning disabilities
- Memory lapses
- Calculation difficulties
- Diminished comprehension
- Loss of visual and verbal memory
- Difficulty recognizing objects and faces
- Attention Deficit Disorder
- Slowed mental responsiveness
- Decreased creativity

The following are botanicals, amino acids and co-factors required for Acetylcholine production and utilization.

- Galantamine is extracted from the Caucasian Snowdrop plant and has been used for decades

in Eastern Europe to increase acetylcholine levels in the brain and increase the sensitivity of acetylcholine receptor sites. Galantamine is demonstrated to improve mental and cognitive effects and is a safe and effective way to slow the progression of Alzheimer's.

- L-Alpha-Glycerylphosphoryl Choline is a form of Choline isolated from lecithin. It is well absorbed and has been shown to increase acetylcholine levels in the brain. It significantly improves cognitive functions.
- L-Huperzine A decreases the breakdown of Acetylcholine and can significantly increase levels of the neurotransmitter in the brain.
- L-Acetylcarnitine is very structurally similar to Acetylcholine and is effective in improving cognition.
- Pantothenic Acid has been shown to increase acetylcholine.

Dietary consumption of choline has a tremendous influence on the production of acetylcholine.

Foods richest in choline are:

- Eggs
- Beef
- Liver
- Tofu
- Nuts
- Fatty Cheeses
- Milk and Cream

I sincerely hope that this article has given you a greater understanding of Brain Chemistry and its importance in every aspect of your life. This is a very big and complex topic and there was much information I chose to exclude for the sake of space and level of difficulty. I hope I have given you sufficient information to gain a better understanding of your own brain chemistry status as well as some ideas that you can implement to improve your own brain function and the quality of your life.