Webinar 3 Handout:

FOOD & IMPACT ON NEUROTRANSMITTERS

You know about carbs, fiber, fats and protein. You understand why you need these nutrients in your diet. Now we're going even deeper, with a look at what happens to foods as they're turned into particles that enter our blood and make wild science happen. Amazing technology has allowed us to watch invisible to the naked eye nerve endings work their magic. We can actually tag things like adrenaline and watch physiological responses as they travel through the blood. While there is a lot left for us to learn and understand, we have an amazing foundation to look at the role of how foods affect our nervous system. We focus on the brain, as it is the control center for all of these incredible reactions.

Inside the Brain

The brain is made up of nerve cells called **neurons**. They're the basic building blocks of the nervous system and they store **neurotransmitters,** which are the chemicals that run the brain and therefore the whole body. Neurotransmitters send messages from one neuron to another communicating information all throughout the body. The brain uses neurotransmitters to tell the body to do just about everything - they keep the heart beating, the lungs breathing, the body moving and the brain thinking. They're also responsible for regulating things like mood, appetite, pain, concentration, alertness and even weight gain and hunger. These messages are sent extremely fast and efficiently - just think how quickly you can type or speak without even thinking about it. Sometimes we talk about **hormones,** chemical messengers made in the endocrine glands that also signal for different functions to occur. The major difference between hormones and neurotransmitters is that hormones are released into the bloodstream for signaling. Neurotransmitters signal between neurons in the brain, usually by physical contact at a synapse (a junction between two nerve cells).

There are lots of different neurotransmitters in the brain and each one plays a different role in the body. Some neurotransmitters are excitatory, meaning that they stimulate the brain, some are inhibitory, meaning that they calm the brain, and some can act in either way. Neurotransmitters are also very sensitive -- to stress, sleep, exercise and diet. Maintaining a healthy balance of different neurotransmitters is essential for keeping the brain working properly so that each part of the body can do its job right. One of the easiest ways to maintain this balance is to eat a healthy diet, because nutrients (specifically, amino acids) in food directly affect these neurotransmitters.

Inside Food

Food is made up of various nutrients that act as the building blocks of neurotransmitters. Because you need specific nutrients to make specific neurotransmitters, it is super important to eat a high quality diet that is varied and full of nutrient dense foods. Eating junk and popping a multivitamin is not the same thing as eating a high quality diet. For example, some of the most important neurotransmitter precursors are amino acids, which are the building blocks of proteins. Take tyrosine (an amino acid found in many foods, such as eggs, cheese, seaweed, etc). Tyrosine is converted to norepinephrine with the help of folic acid, niacin, iron, and vitamins C and B6.You absorb all of these nutrients better in a food form than a supplement form, so go for the real deal as often as possible.

Important Neurotransmitters: What They Do and Where They Come From

Acetylcholine

- *What does it do?* Acetylcholine causes muscle contractions, stimulates release of certain hormones, enhances memory and is involved in mood and attentiveness.
- *What nutrient makes it?* Acetylcholine is made from choline, an amino acid found in eggs, dairy products, peanuts and peanut butter, beef, broccoli, Brussels sprouts, salmon, shrimp and cod.

Dopamine

- *What does it do?* Dopamine carries signals that control movement, emotions, concentration and the ability to experience pain or pleasure. It also has a tie to Parkinson's disease, a condition in which the cells that make dopamine are destroyed leading to impaired movement control, shakiness, difficulty swallowing and stiff muscles.
- *What nutrient makes it?* Dopamine is made from tyrosine, an amino acid found in chicken, turkey, soy, fish, dairy products, peanuts, almonds, avocados, bananas, lima beans, pumpkin seeds and sesame seeds. You can also make tyrosine from phenylalanine, an amino acid in beef, poultry, pork, fish, dairy, eggs and soy.

Norepinephrine

- *What does it do?* Norepinephrine is both a hormone and a neurotransmitter and can be excitatory or inhibitory depending on what it needs to do. When it's excitatory it controls the "fight or flight" response by constricting blood vessels and increasing blood pressure, heart rate and blood sugar levels. It's sometimes referred to as noradrenaline. As an inhibitory neurotransmitter, it has been linked to mood disorders and depression at low levels, likely because it is so important for cognition, motivation, and intellect.
- *What nutrient makes it?* Norepinephrine is made from dopamine. To make dopamine, you need tyrosine, an amino acid found in chicken, turkey, soy, fish, dairy products, peanuts, almonds, avocados, bananas, lima beans, pumpkin seeds and sesame seeds. You can also make tyrosine from phenylalanine, another amino acid in beef, poultry, pork, fish, dairy, eggs and soy.

Epinephrine

- *What does it do?* Epinephrine is more commonly known as adrenaline and acts as a hormone and a neurotransmitter. It's also involved in the "fight or flight" response by increasing blood pressure, raising heart rate, and helping blood flow to essential organs.
- *What nutrient makes it?* Epinephrine is made from norepinephrine, so you can't make it without dopamine, and you can't make that without tyrosine.

Glutamate

- *What does it do?* Glutamate is key to the central nervous system. It plays a role in brain development, memory, learning and overall brain function. It may also be related to Alzheimer's disease.
- *What nutrient makes it?* Glutamate (aka glutamic acid) is the most abundant amino acid in the diet. It's a nonessential amino acid, meaning the body can make its own from glucose and other precursors (aka building blocks). It's in a wide variety of foods like meat, fish, poultry, dairy, mushrooms, asparagus and tomatoes, but is most talked about as a part of the food additive MSG, which stands for monosodium glutamate. While natural glutamate found in foods is safe, the additive MSG is not for everyone. It is linked to neurological damage, headaches, obesity and more.

Aspartate

- *What does it do?* Aspartate plays a role in the central nervous system and in memory function.
- *What nutrient makes it?* Aspartate is also a nonessential amino acid. It's found in the diet in meat, poultry, dairy and eggs but it's also made in the body from glucose.

Serotonin

- *What does it do?* Serotonin regulates appetite, mood, memory and learning. Serotonin release has been linked to improvement in mood. Low levels of serotonin can lead to depression, aggression or low self-esteem.
- *What nutrient makes it?* Serotonin is made from tryptophan, an amino acid found in poultry, eggs, soy, peanut butter, pumpkin seeds, fish and dairy products.

Glycine

- *What does it do?* Glycine is part of the central nervous system and essential for movement, sight, and hearing.
- *What nutrient makes it?* Glycine is an amino acid found in beef, pork, fish, eggs, soy and seaweed. It can also be made in the body from serine, an amino acid found in eggs, soy, fish, milk, cheese, and peanut butter.

GABA (Gamma-Aminobutyric Acid)

- *What does it do?* GABA plays a role in vision, motor control, cognitive function, and anxiety.
- *What nutrient makes it?* To make GABA you need the amino acid glutamate, which can either be made from glucose or obtained in the diet from foods like meat, fish, poultry, dairy, mushrooms, asparagus and tomatoes.

To feel well and be healthy, we need the right balance of these neurotransmitters. Food impacts not only our body size and shape, but also how we feel. Tiny chemical signals play a role in influencing our feelings of calm, fatigue, and even clarity of thought. A poor diet can cause a desensitization and depletion of neurotransmitters. You may not be able to see the imbalance, like you can see brittle hair or a poor complexion, but without the proper nutritional building blocks to build the brain's neurology the nervous system and neurotransmissions become less effective and certainly less efficient. Eating well benefits the brain as much as the body! We often spend time eating for physical wellness, immunity, beauty and athletic performance. Understanding what a good diet does to the science in your brain is just as important.