In search for avenues to put CRPS into remission or reduce the impact of symptoms in daily life, many individuals may explore whether dietary adjustments can have a role in CRPS mitigation and management. To be clear, diet will not “cure” CRPS, but it can have a significant influence on the quality and intensity of pain and dysfunction due to the way that the food we ingest ends up becoming the building blocks we utilize to function.

This is particularly true for the focus of today’s article: the amino acids tyrosine and tryptophan.

**What’s Going On**

Amino acids chain together to form proteins and are the base structure for foods like meat, fish, beans, and nuts. As our bodies break down amino acids, they serve many different functions. Tyrosine and tryptophan specifically become our neurotransmitters that control the autonomic nervous system, which is the system that is severely dysfunctional in CRPS.

Tyrosine, a non-essential amino acid (which means our bodies are capable of making it internally and it isn’t mandatory that we get it from dietary sources), is the precursor (the step and ingredient that comes before) our catecholamine neurotransmitters that power the sympathetic nervous system: dopamine, noradrenaline, and adrenaline. Phenylalanine, an essential amino acid (meaning our bodies are not capable of making this internally and it is mandatory we get it from dietary sources), is the precursor to tyrosine. Catecholamines respond to stress and excitement or (mental or physiological) arousal, increasing heart rate, breathing, blood pressure, metabolism, muscle strength, mood regulation, and mental alertness.[1] The amino acid to adrenaline cycle looks like this: phenylalanine → tyrosine → L-dopa → dopamine → noradrenaline → adrenaline.

 

***Pathway of catecholamine biosynthesis***

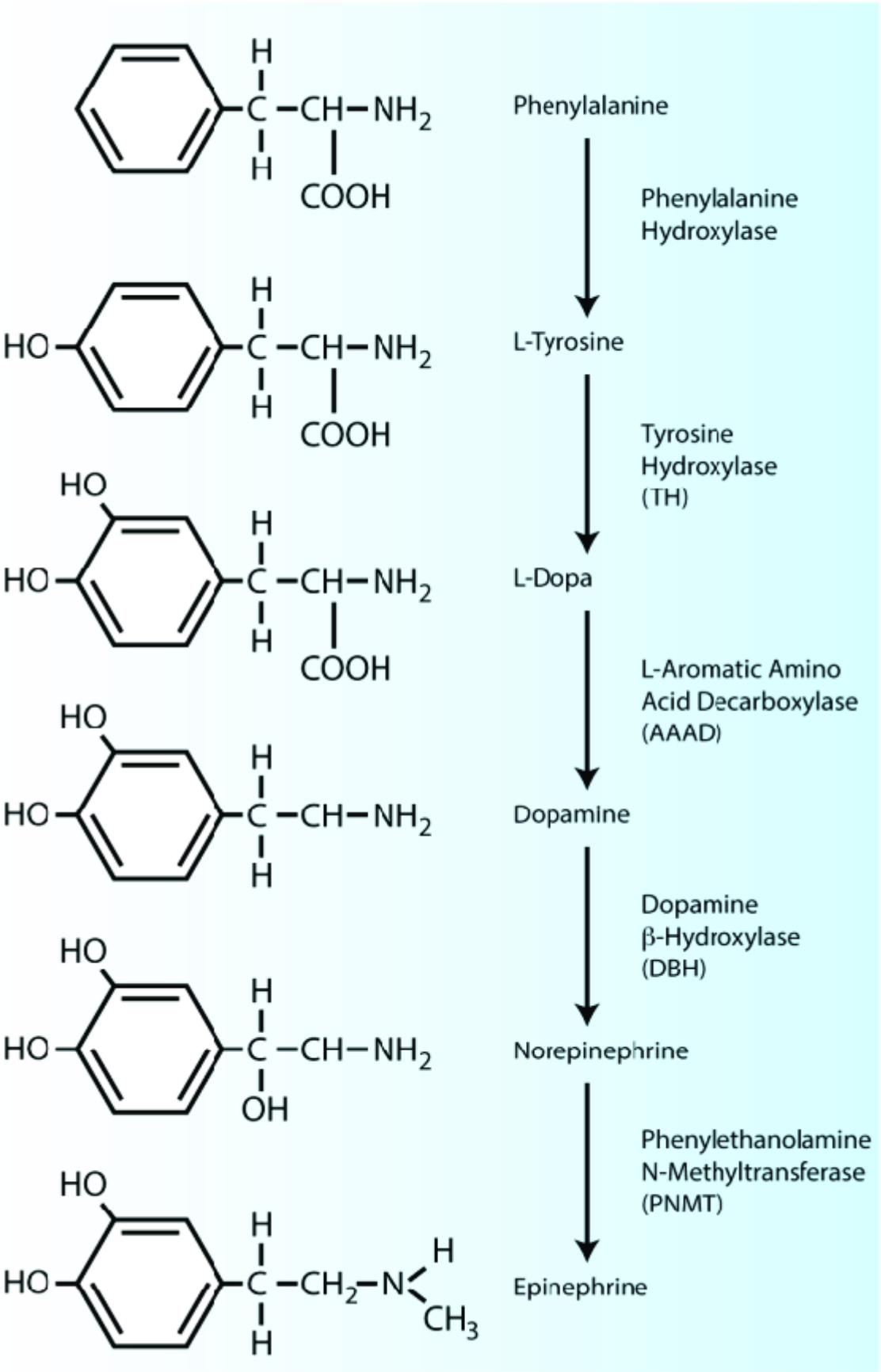


 

Image Credit: Pathway of catecholamine biosynthesis by Anna M.D. Végh et al[2]

The more phenylalanine and tyrosine we consume and have circulating in our systems, the more catecholamines we will eventually have as the amino acids get converted into neurotransmitters. The more catecholamines we have to release between neurons to convey messages, the more our sympathetic system will be able to activate with ease.[3] This same principle is true for the parasympathetic system, which is generally underactive in CRPS whereas the sympathetic system is overactive; the more parasympathetic neurotransmitters are readily available for use, the easier it is for the parasympathetic system to operate.

Tryptophan, an essential amino acid, is the precursor for serotonin, the primary parasympathetic neurotransmitter. Serotonin stabilizes mood, increases sleep quality and pain tolerance, and regulates aggression and prosocial behavior. Where oxytocin helps with the formation of social bonds, serotonin sets the tone of the interactions after those bonds are formed, regulating along an agonistic-affiliative, agreeable-quarrelsome axis.[4,5,6] The amino acid to serotonin cycle looks like this: tryptophan → 5-hydroxytryptophan → serotonin.

 

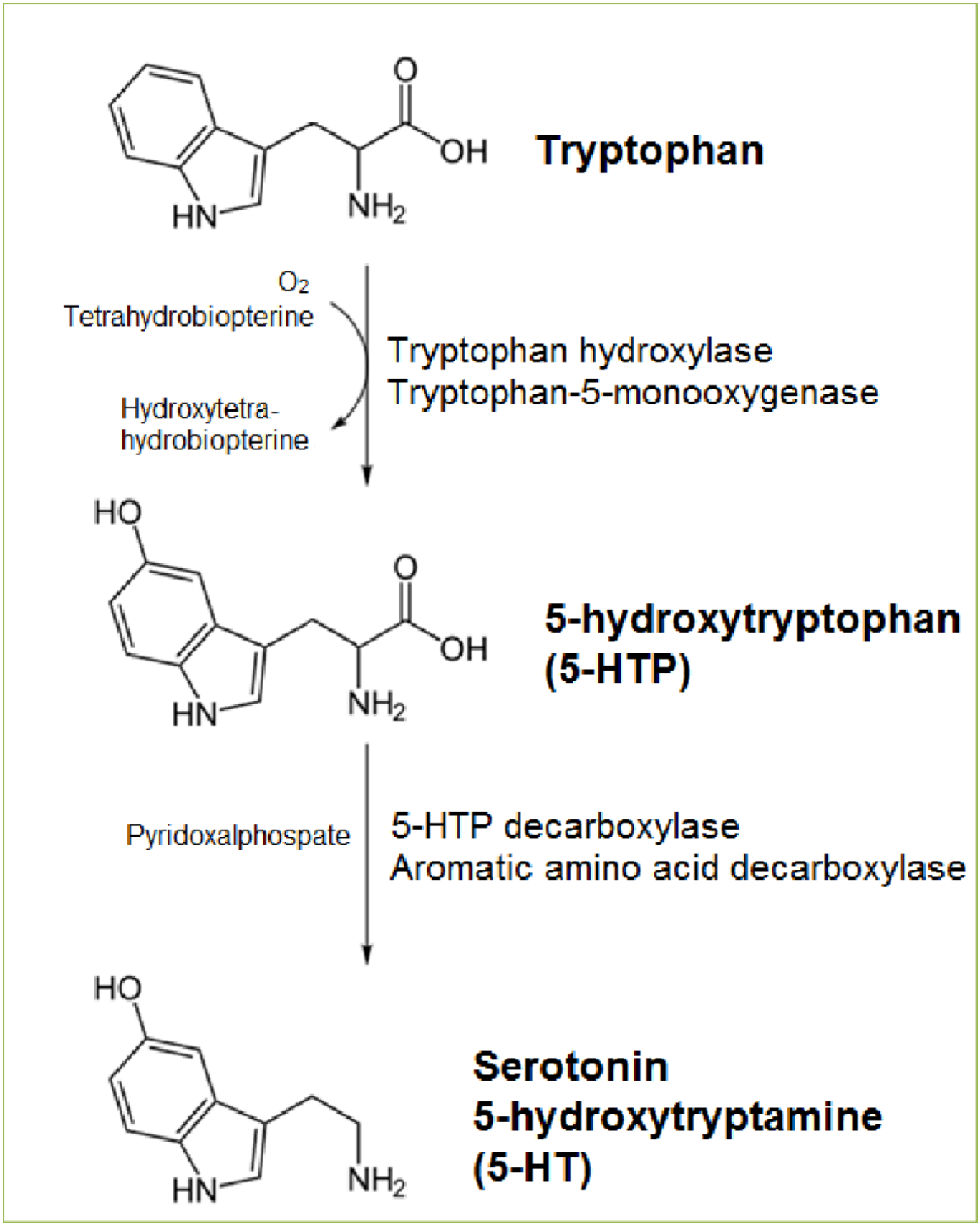


Image Credit: Biosynthesis of serotonin by Verlinden et al[7]

Tyrosine and tryptophan, along with other large neutral amino acids (LNAA), compete for

 

access across the blood brain barrier and into the brain itself. Carbohydrates block all LNAAs except for tryptophan, reducing competition and boosting serotonin levels;[8] carbohydrates cause the body to release insulin and insulin diverts all the other LNAAs except for tryptophan to muscle tissue instead of to brain tissue, thereby increasing the tryptophan:LNAA blood plasma ratio.[9]

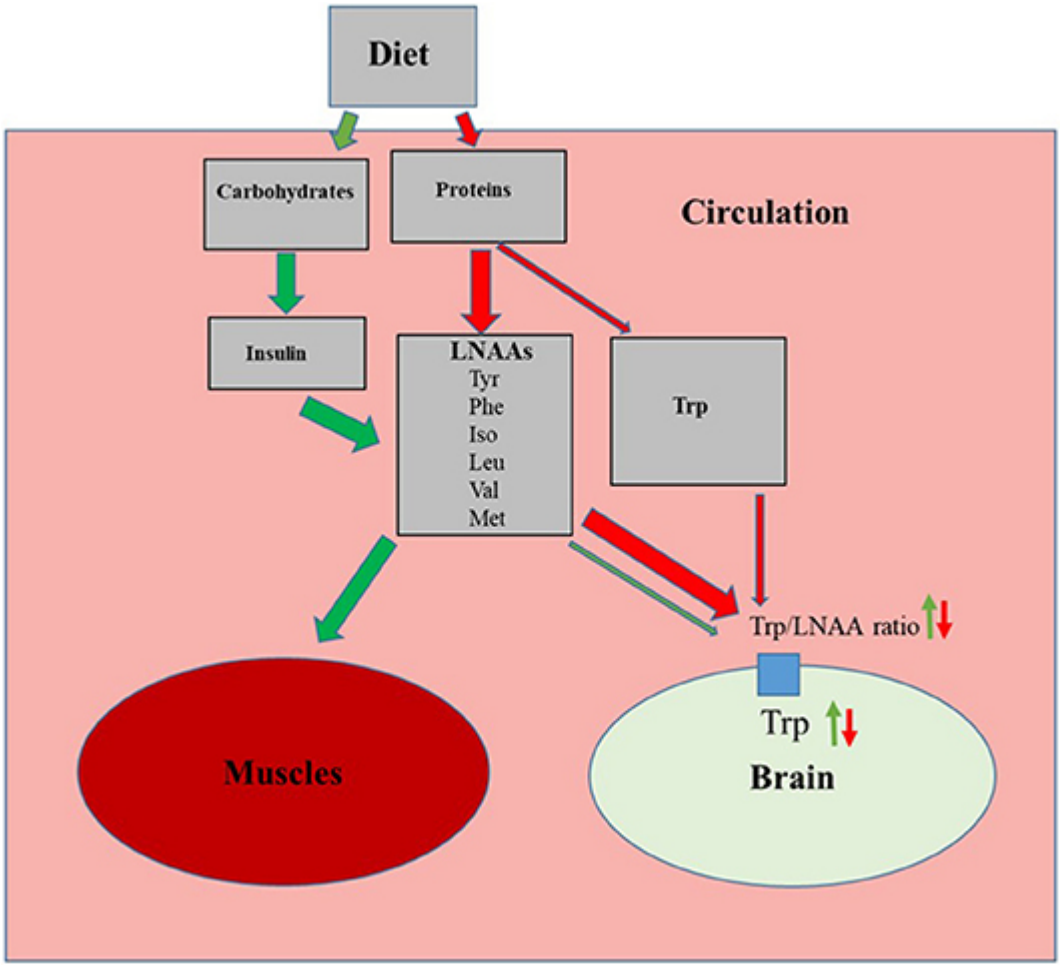


Image Credit: Tryptophan Metabolic Pathways and Brain Serotonergic Activity: A Comparative Review by Hoglund et al

When making whole-meal decisions, determining how much will be protein-based and how much will be carb-based versus other food groups can be a big decision for many people. Carb-rich foods have a considerably greater impact on serotonin amplification than on catecholamines,[10] whereas protein-rich foods impact catecholamines more than serotonin, even though the serotonin-precursor tryptophan comes from protein sources.

The ratio of carbs to protein that will neither raise nor lower the blood levels of large neutral amino acids like the ones we are discussing in this article is five-to-six servings of carbs per one serving of protein. In comparison to other amino acids also competing for access across the blood brain barrier, carb-rich meals increase tryptophan by over 10%, peaking about two hours after ingestion, while protein-rich meals decrease tryptophan's access ratio by almost

 

40%, peaking about four hours after ingestion. Over four hours, the median difference between choosing to eat a carb-rich or protein-rich meal is about 55%, ranging from 36%-88%. Individual meals can cause significant variations in the ratio of tyrosine and tryptophan in comparison to the other large neutral amino acids competing for access across the blood brain barrier, depending on the proportions of carbohydrates and proteins consumed; these differences can be greater than 50% for tryptophan and about 30% for tyrosine, which is sufficient to produce major changes in brain neurotransmitter concentrations.[11]

**Practical Application**

- Remember every meal is a choice with the goal of improving our quality of life. Food shouldn't be a punishment nor should we be so strict or rapid in adjusting to new dietary changes that we begin to despise the food that we are eating with the intention of making our lives more pleasant.
- The MIND (Mediterranean-DASH Intervention for Neurodegenerative Delay) diet lowered risk for participants who followed the dietary outlines rigorously by over 50%, but even those who followed more loosely and moderately saw a 35% reduction in health risk.[12]
- The MIND diet recommends 10 groups of food to prioritize and five groups to avoid.[13] Prioritize: green, leafy vegetables; all other vegetables; berries; nuts; olive oil; whole grains; fish; beans; poultry; wine (though this specific recommendation likely would aggravate CRPS for many individuals). Avoid/Limit: butter and margarine; cheese; red meat; fried foods; sweets and pastries. The MIND Diet: A Detailed Guide for Beginners
- For a dietary outline designed with CRPS patients specifically in mind, Dr. Hooshmand's 4Fs and 5Cs are worth examining,[14] though they are very similar to the MIND diet. 4Fs to prioritize: fish, fowl, fruit, and fresh vegetables. 5Cs to avoid: cake, cookies, chocolate, cocktails, and candy. He also recommends avoiding processed meats like bologna, salami, and hot dogs, as well as meats high in saturated fat like bacon. More details about specifics are offered in the excerpt from his book on Reflex Sympathetic Dystrophy, the previous name for CRPS.
- Note which foods are particularly high in tyrosine/phenylalanine and which are high in tryptophan; many foods will overlap and contain both, like chicken and fish. The Recommended Daily Intake for the standard person (which may not be directly applicable for every person with CRPS, particularly if a person is aiming to increase their tryptophan ratio) is approximately 6mg of tyrosine/phenylalanine combined per every 1mg of tryptophan.
- Red meats are the most concentrated source of tyrosine at a 3.4:1 ratio; poultry is the most concentrated source of tryptophan at a 2.8:1 tyr:trp ratio. Seeds have a much lower ratio, with pumpkin seeds at 1.8, flax seeds at 1.7, and chia seeds at 1.3; walnuts come in at 2.3 and almonds at 2.1. Having a general idea of which sources are increasing intake at which rates can assist when deciding what to prioritize or deprioritize.
- The goal is not to totally cut out all phenylalanine or tyrosine; they are still necessary amino acids critical to our ability to properly function. The goal is to scale back intake so

 

our dysfunctional sympathetic nervous systems are not overactive more often than not and to promote an environment that encourages more parasympathetic activity so we can move towards a more balanced state of neurological activity.

- The carb:protein ratio that doesn't impact LNAA uptake much one way or the other is about 5-6:1. One serving of carbs is 15g, which is less than one may think. If you want to promote more tryptophan/serotonin, increase the carbohydrate ratio with your meals. If you want to promote more catecholamine activity, decrease the carbohydrate ratio / increase the protein ratio.
- Eating a meal or snack more weighted in favor of tryptophan over tyrosine in wind-down time before bed may help induce some sleepiness and calmness, whereas a tyrosine-weighted snack or meal will be much more likely to activate the nervous system, particularly in the four hours following consumption.

**Closing**

This article will be part of a larger series discussing some practical dietary choices that can be made in daily life to help mitigate CRPS symptoms and improve quality of life and independence, though they will not "cure" CRPS itself. Noshing for Neural Health will continue in future pieces with different target core components.

For now, thanks for sticking with me, I hope you learned something, and I hope to see you next time.

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