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MOLECULES & HEALTH

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The Brain on Broccoli



For some, hearing the word “broccoli” conjures up horrific childhood memories of a brownish colored overcooked pile of mush in an untouched corner of a school lunch tray that could only be salvaged with gallons of melted cheese and butter. Some of us might also remember sitting at the family dinner table long after everybody else had finished –

confined at the table because that dreaded broccoli was keeping you out of the “clean-plate-club.” Hopefully most of us have been able to move past those memories and have since embraced broccoli with the appreciation it deserves as a crunchy, bright green vegetable that tastes great and is extremely good for your health.

Regardless of your attraction or aversion to broccoli, it turns out that it could very well be one of the healthiest vegetables you ever put on your plate. There are a lot of reasons broccoli is good for your health including the high fiber and nutrient content. However over the past decades, researchers have begun identifying potent antioxidants that have health benefits far beyond what we originally imagined. One particular



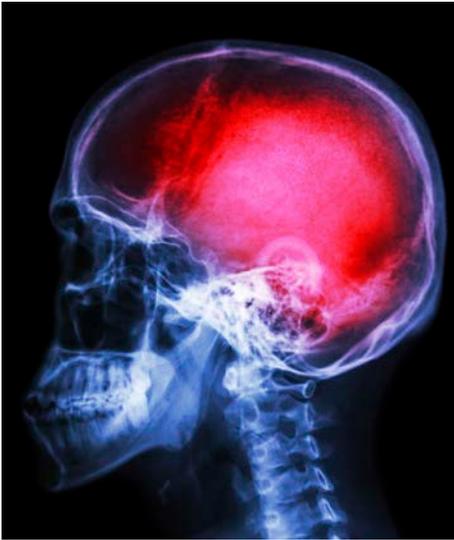
compound found in broccoli is an antioxidant called sulforaphane and it has been getting a lot of attention due to its positive health effects, especially when it comes to brain health.

Sulforaphane gets into the Brain

The brain is a unique organ because it is separated from the blood supply by something called the “blood-brain barrier.” This is an anatomical filter created by special cells that help keep unwanted and potentially harmful compounds out of the brain. A molecule has to have very specific properties in order to cross from the blood stream and into brain cells. Sulforaphane happens to possess the properties that allow it to cross the blood-brain barrier, so it is able to reach the brain cells.¹ Once it is there, scientists have discovered it ex-



erts a number of protective and beneficial effects.



Neurological benefits

- There is a neuroprotective transcription factor called Nrf2 that has been shown to play an important role in the progression of neurodegenerative disorders including Parkinson's disease, amyotrophic lateral sclerosis (ALS), Alzheimer's disease, and more. Sulforaphane has been shown to induce the expression of Nrf2-driven genes, conveying neuroprotective antioxidant and anti-inflammatory activities that protect against related neurodegenerative diseases.^{1,2} Sulforaphane's ability to interact with the Nrf2 pathways has also been shown to provide protective effects from ischemic (lack of oxygen/blood flow) brain injuries.
- Sulforaphane has been shown to reduce cerebral edema and improves cognitive function following traumatic brain injuries

(TBI).^{3,4} Researchers believe the beneficial effects come from a combination of mechanisms including decreasing the permeability of the blood-brain barrier, enhancing cell survival, and increasing the number of specialized aquaporin channels that help clear excessive fluid from the brain reducing swelling and edema. The effects on aquaporin channels also helps to clear excessive potassium from the brain, subsequently reducing the damaging effects of glutamate release that occurs with TBI. Nrf2 is also an important pathway affected by sulforaphane following TBI.¹

- Sulforaphane has been shown to protect brain cells from the damaging effects of reactive oxygen species (oxidants) including superoxide anion radicals, hydrogen peroxide, hydroxyl radicals, and peroxy nitrite. Oxidative stress is likely a key component involved in the development of many neurological disorders including ALS, Parkinson's disease, Alzheimer's disease, and multiple sclerosis (MS).^{5,6}

- Clinical trials of sulforaphane supplementation in males aged 13-27 diagnosed with autism spectrum disorders demonstrated improved sociability, reductions in abnormal behaviors, improvement in verbal communication, and overall improved behavior.⁷ The effects were reversed when sulforaphane supplementation was discontinued.

Increasing Dietary Sulforaphane

In addition to broccoli, sulforaphane is found in other cruciferous vegetables like cauliflower, kohlrabi, and Brussels sprouts, but the highest concentrations of sulforaphane are found in young broccoli sprouts.⁸ The levels of sulforaphane found in cruciferous vegetables decreases significantly when they are cooked. To get the most sulforaphane from your diet, incorporate broccoli sprouts and raw or lightly steamed preparations of broccoli and other cruciferous vegetables.

Some of the health benefits from sulforaphane were seen at relatively normal dietary intakes of cruciferous vegetables, however many of the positive





effects require higher blood levels that would be difficult and impractical to safely obtain from diet alone. Instead, you can increase your daily intake by using sulforaphane-containing supplements such as Small Molecule Technologies ImmuneBoost, Brain Health, and Joint Health. The use of these supplements is also a great option for people with food intolerances or those that just do not like the taste of those types of vegetables.

Sulforaphane and Synergy

Like most nutrients, sulforaphane does not act alone, but instead it is dependent on several other compounds to function properly. One such nutrient is N-acetyl-l-cysteine (NAC). NAC is a key nutrient required for the production of glutathione, and glutathione plays an es-

sential role in the absorption and utilization of sulforaphane within the body.¹ Inadequate intake of NAC reduces your body's ability to produce glutathione and subsequently could reduce the ability of sulforaphane to exhibit its neuroprotective effects.^{9,10}

One of the reasons that Small Molecule Technologies Nutritional Supplements stand out from other products is that they were created with an understanding of biochemical processes and the synergy between certain nutrients. The patented Olivamine 10 Max formula contains a precise balance of nutrients that was scientifically demonstrated to provide positive synergistic cellular effects. One of the key nutrients in Olivamine 10 Max happens to be NAC, so when we combine sulforaphane from broccoli extract with Olivamine 10 Max, we know that the body is also getting the NAC that is required for the optimal utilization of sulforaphane.

Small Molecule Technologies Supplements contain many other plant-based antioxidants that have been shown to protect the brain from a wide variety of disease processes related

to stress, free radical damage, aging, neurodegeneration, and cell death. Some of these ingredients include hydroxytyrosol from olives, EGCG from green tea, trans-resveratrol from grape vines, and curcumin from turmeric. There are many more vitamins, minerals and essential amino acids provided by Small Molecule Technologies supplements that have been shown to help improve brain health including B12, folic acid, magnesium, melatonin, L-taurine, and Vitamin D. All of these nutrients have been associated with neuroprotective effects and when combined can help provide biochemical and nutritional support directly to your brain cells.^{2,6,11-13}



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