From Mitochondria to Meditation: An Integrative Approach to Enhancing Cognitive Function

Integrative therapies which address both mind and body may offer a novel approach for preserving and enhancing cognition and executive brain function in our patients. From an holistic perspective, when we discuss cognition and executive function, we are referring to mental function, psychological function and emotional function. An integrative medicine protocol must address all of these areas.

In my practice, I employ a multi-pronged approach to improve cognition and executive function: Support circulation of blood flow to the brain, which includes reducing congestion/hyperviscosity in the blood; minimize inflammation; increase antioxidant protection and reduce oxidative stress; and support energy production in the brain, which is specifically fueled by glucose through aerobic metabolism.

In its day-to-day function, the brain thrives on glucose that provides energy through proper mitochondrial function. Mitochondria are organelles contained within eukaryotic cells that provide the cell with energy in the form of ATP by oxidative phosphorylation. Mitochondria are also central to intracellular Ca2+ homeostasis, steroid synthesis, generation of free radical species, and forms of apoptotic cell death. Mitochondrial dysfunction compromises the integrity of cells and may play a vital role in cognitive decline as well as aging, metabolic and degenerative diseases.¹

Protecting mitochondrial function is critically important for normal brain function and a healthy Krebs cycle is essential for proper mitochondrial function. The Krebs cycle (one of the first cellular processes taught in undergraduate biochemistry) is also known as the citric acid cycle or tricarboxylic acid cycle. The Krebs cycle is defined as a series of enzymatic reactions in aerobic organisms that involves oxidative metabolism of acetyl units and produces high-energy phosphate compounds, which serve as the main source of cellular energy. When the Krebs cycle is working properly, all of its different biochemical components, including succinate, malonate, and alpha ketoglutaric acid, are metabolized and, in turn, produce NADH, which is a fundamental component of cellular metabolism that aids the production of ATP through oxidative phosphorylation. But, when these biochemical components are not properly metabolized, such defects -- particularly an excess of malonate -- may contribute to neuronal death and neurodegenerative diseases.²,³

Brain Energy

From an organic point of view, an essential necessity for healthy brain function is healthy mitochondrial function which depends on a well-functioning Krebs cycle. To support the Krebs cycle, our bodies need phospholipid nutrients to support cell membranes. Cell membranes are made of phospholipids. However, phospholipids are shown to accumulate soluble toxins and heavy metals, such as mercury, that can enter the central nervous system.⁴

Phosphatidyl choline, which is necessary for cell membrane function, is very important for ensuring that mitochondria can perform their job of producing energy for brain cells. Phosphatidyl choline will exchange with toxins that accumulate in brain cell membranes. The rationale for using phosphatidyl choline in this treatment approach is that removing toxins from the cell membrane and exchanging these toxins with phosphatidyl choline supports better membrane and mitochondrial function.⁵,⁶,⁷

One problem with cognitive health can be a lack of energy. So when we are supporting mitochondrial energy, we are supporting cognitive function. That is why medicinal mushrooms like Cordyceps, Reishi
and Tremella help to do this, as they are shown to benefit mitochondrial function.\textsuperscript{8,9,10} These medicinal mushrooms also are high in natural phospholipids, which protect brain cell membranes. The leading mushroom is Cordyceps, followed by Reishi and Tremella. These mushrooms provide antioxidant, mitochondrial and circulation support, which in turn lead to greater energy production.

Of course another critical part of energy is diet. We want a diet that does not produce a lot of free radicals, or produce spikes in insulin. These effects generate inflammation and also specifically damage brain cells. So a low glycemic index diet which is high in natural antioxidants, such as carotenoids, vitamins C and E, and others, is important in reducing inflammation and oxidation,\textsuperscript{11} and in increasing energy levels.

NADH, which is one of the biochemicals that produces energy in mitochondria, can be taken as a supplement. Currently, NADH is used for improving mental clarity, alertness, concentration, and memory. Some patients take it for Alzheimer’s disease. Because of its role in energy production, NADH is also used for improving athletic endurance and treating chronic fatigue syndrome.\textsuperscript{12}

**Oxidative Stress: The Brain’s Enemy**

Antioxidants are critical for maximizing the preservation of cognitive and executive function. Especially helpful are antioxidant compounds that naturally help transfer nutrients into the mitochondria such as acetyl L-Carnitine, or L-Carnitine, and alpha lipoic acid. L-Carnitine is important for fat metabolism and for normal function of cell membranes. Alpha lipoic acid is both water soluble and fat soluble and has the potential to cross the blood brain barrier. So Acetyl L-Carnitine and alpha lipoic acid are two important antioxidants which help protect the brain, along with vitamins C and E.

There is another powerful herbal antioxidant which is shown to be 1,000 times more powerful than alpha tocopherol in inhibiting lipid peroxidation in rat heart mitochondria. It is called honokiol, an active compound extracted from Magnolia bark.\textsuperscript{13} Magnolia bark has been used for centuries in traditional Asian preparations. Research over the last two decades has shown that honokiol, the active ingredient in Magnolia bark, provides numerous health benefits. In a 2010 study, honokiol conferred a protective effective against beta-amyloid protein, which is toxic to brain cells in patients with Alzheimer’s disease.\textsuperscript{14}

Numerous other studies and literature reviews have outlined honokiol’s neurological benefits.\textsuperscript{15} For neurological protection, honokiol may be superior to other antioxidants, as research suggests that honokiol enhances the function of GAD (glutamic acid decarboxylase), thus possibly aiding in the shift from glutamic acid to GABA.\textsuperscript{15} While essential for brain function in normal amounts, excess glutamic acid is considered a neurodegenerative agent implicated in Parkinson’s disease, multiple sclerosis, Alzheimer’s disease, and dementia.\textsuperscript{16} Degenerative processes can occur when the enzymes that convert glutamine into glutamic acid become overly activated, often by toxins or by excess glutamate decarboxylase. This creates an imbalance, with low levels of glutamine adversely affecting the Krebs cycle and high levels of glutamic acid causing nerve damage. So honokiol is not only a powerful antioxidant, capable of crossing the blood-brain barrier; it also influences GABA, which is linked to a sense of relaxation and well-being.\textsuperscript{15,17,18} GABA is a neurotransmitter associated with reduced anxiety and greater mental clarity.

**Blood Flow, Brain Power**
Another approach to enhancing cognition and executive brain function is supporting circulation. Gingko biloba is a classic example used in integrative medicine, but other herbs such as the traditional Chinese herb Dan Shen (Salvia miltiorrhiza) and hawthorn berry can also be useful. There are also cardiovascular formulas that simultaneously support circulation and antioxidant activity. My top recommendation is a Tibetan herbal formula called Padma Basic which has been extensively researched in clinical studies.

Vinpocetine also helps circulation to the brain. This semi-synthetic compound derived from the periwinkle plant has been widely used in the treatment of ischemic cerebrovascular diseases and vascular-type dementias. If we look at contributing factors in dementia, much of the disease is due to oxidative stress and abnormal function, such as amyloid plaque formation found in Alzheimer’s disease; but also, dementia is a vascular disease related to poor circulation. Research suggests that vinpocetine has several different mechanisms of action that account for anti-inflammatory, antioxidant, vasodilating, antiepileptic and neuroprotective benefits in experimental conditions. In other research, vinpocetine improved the cerebrovascular reserve capacity in patients who suffered ischemic stroke and in patients diagnosed with mild dementia. It also improved the cognitive status and general condition of patients with chronic hypoperfusion. The authors of the study recommend the use of vinpocetine for the treatment of patients with mild cognitive impairment.

Meditation and Mind-Body Methods

In addition to nutrition and supplementation, it is wise to incorporate mind-body practices such as meditation and yoga, which are shown to support cognitive and emotional health. In Buddhism, mind-body relationships can be looked at as an ongoing dialogue and interaction between three basic categories, “body, speech and mind”. Speech also refers to the movement of “subtle energy” known as Prana in Sanskrit, and Qi in Traditional Chinese Medicine. This is especially important when we look at cognitive function. The mind is affected by nutrition, by exercise, and by movement. If we exercise, for example, there is greater consumption of oxygen and increased blood flow throughout the body, including the brain. The increased blood flow to the brain is one reason we feel clear-headed after we exercise. Exercise also changes different neurotransmitters and endorphins to support peak mental functioning and healthy mood. So physical health certainly helps the mind. But you can also use your mind to improve cognitive ability. One of the principles of homeopathy is “like cures like”. So if there is a problem with cognitive function, you can use “mind methods” to help, and that is why meditation can be so powerful. When we look at simple meditation like Shamatha (“Calm Abiding”) meditation, there is a concept of rhythm – through breathing and focusing. As a result, our bodies and brains slow down. One of the effects of meditation, in general, and of rhythmic breathing specifically, is that it creates space between the breath and space between the thoughts. It is during this space between the thoughts when we get our moments of clarity, and the perception of “seeing the big picture”. Seeing the big picture is an executive brain function. Seeing the space between the thoughts is clarity. Healthy executive function makes it possible to make clear, accurate decisions. In fact, good cognitive function can be viewed as a direct expression of a meditative state. That is why accomplished meditators can give solutions to different complex problems.

So how does this relate to yoga and tai chi compared to robust, gym related exercises? Yoga brings together the elements of exercise (body), breathing (speech), and meditation (mind). There are many studies that support the benefits of yoga, meditation and mind-body exercises. One study showed that
meditation increased cortical gyrification in brain tissue.\textsuperscript{24} Another study showed that yoga significantly enhanced cognitive function compared to aerobic exercise in college-aged women.\textsuperscript{25}

**Conclusion**

Based on my clinical experience, I believe a multi-layered treatment approach which addresses brain health from multiple angles, offers the best chances at preserving and enhancing cognition. Ensuring that our cells are functioning properly to produce energy, protecting our cells from damage through proper supplementation and diet, and supporting mind-body connections through exercise and meditation represents integrative medicine at its best.

References


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