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In this issue: Is Acupuncture Another Way to Awaken Neural Plasticity; SNiPPets: Stress Interacts with Variants of a Biological Aging-Related Gene; Gender-Imbalanced 'Afterburn'

Is Acupuncture Another Way to Awaken Neural Plasticity?

Acupuncture has long been used in Asia to manage serious conditions like stroke, and is now also applied in dementias and Parkinson’s disease. As of September 2019, clinicaltrials.gov listed 1200 human studies employing acupuncture for conditions like sports injury, pregnancy, stroke recovery, lung disease, brain or spinal cord injury, seasonal allergies, and many others, as well as emergency ward usage for pain and other difficult issues.

A recent review concluded that acupuncture may influence neural plasticity through effects on nerve growth factors and neurotransmitters, with potential applications in a wide variety of neurological conditions. The creation and programming of new stem cells is central to the notion of brain and nerve cell plasticity, and in animals, electroacupuncture was seen to mobilize stem cells into circulation, and acupuncture has been seen to help stem cells develop into mature cells. Though many acupuncture studies are unavailable in English, a recent review of Korean literature on acupuncture suggests that numerous acupuncture meridians and points are areas of potential stem cell generation, and that this may underlie the Traditional Chinese Medicine concept of Qi flowing through these pathways.

In this interview, acupuncturist Helen Langevin, MD, now Director of the National Center for Complementary and Integrative Health, relates to Dr. Bland how particular techniques can encourage cellular remodeling and stimulate broader healing. Though it covers much additional ground, this IFM presentation on the systems approach to pain mentions how acupuncture recruits stem cells and helps ‘reprogram’ muscles, ligaments, and other soft connective tissues—and the importance of twirling the needle.
SNiPpets

How significant to health are particular single nucleotide polymorphisms, also known as SNPs? SNiPpets is an ongoing exploration of this topic.

Stress Interacts with Variants of a Biological Aging-Related Gene

The KL gene codes for Klotho, a membrane protein whose expression relates to insulin sensitivity, may be a biomarker for vascular events, and influences the receptor binding of fibroblast growth factors (a family of liver proteins involved in cell survival and tissue repair). A July 2019 study found that serum levels of alpha-Klotho may be a reliable biomarker for psychological stress. Reduced production or genetic expression of Klotho has been associated with accelerated biological aging processes. One 2017 study showed that, at least in some oral cancers, reduced expression of Klotho may be epigenetically linked to DNA hypermethylation—effectively softening the message of this protective protein.

Assessing “epigenetic age” with greater accuracy is a growing area in gerontology (aging research), as it can help clarify the effects of stress, health, disease, lifestyle, environment, and genetic variations on an organism’s true biological age. In a study focusing on gene-environment interactions in military veterans, several single-nucleotide polymorphisms (SNPs) within the KL gene region have been associated with epigenetic age under stress-related circumstances, especially in older persons:

- A variant at locus rs9527025 (a G-to-C substitution) was associated with slower epigenetic aging.
- In combination with pain, an A-to-C SNP at the rs398655 locus correlated with lower epigenetic age.
- Combined with post-traumatic stress disorder (PTSD) with sleep disturbance, SNPs at the rs9315202 or rs9563121 loci (both of which are C-to-T switches) predicted greater epigenetic age.
- The rs9315202 variant (above) combined with PTSD also predicted levels of the inflammation biomarker C-reactive protein (CRP), and was positively associated with metabolic syndrome.

While these gene variants were studied in a military population, they are relatively common among the broader population, and it is reasonable to consider that these findings may be generally applicable to stress-related illness. This letter to the editors of the British Journal of Sports Medicine suggests that just one instance of vigorous physical activity may activate Klotho, and a 2018 study in animals found that upregulation of Klotho may be part of how exercise increases lifespan and healthspan. Vitamin D helps regulate Klotho, and vitamin D nutritional status may therefore impact its genetic expression. In an animal model of diabetes, supplementation with the flavonoid hesperidin was seen to increase alpha-Klotho levels in the blood, kidneys, and liver, and an August 2019 study of stress in animals noted that Korean red ginseng upregulates the expression of Klotho, which may partially explain its adaptogenic effects, though these results need to be confirmed in humans.

Those experiencing uncomfortable levels of stress may wish to consult with a Functional Medicine practitioner to identify comprehensive individualized lifestyle strategies for addressing it.
Many plant nutrients are useful or essential to body metabolism, but some plant families have evolved a clever mechanism for surviving environmental challenges: synthesizing noxious substances that protect them from overconsumption by insects. Nicotine, produced by the nightshade family member tobacco, is one example of this. While nicotine has some of the same toxic effects in humans that it has in insects, they are much less immediate, though death and illness from eating or even just handling tobacco leaf is not unknown. In the last decade, over 30% of men and about 6% of women globally consumed tobacco on a daily basis. During this time period, tobacco smoking was the #1 worldwide risk factor for disease burden among men, and was #4 in women.

As smoking vaporizes nicotine for rapid absorption by lung surfaces, it also releases carbon monoxide, heavy metals, tars, and additives from tobacco. Whether delivered in smoke, vapor, or patch, nicotine powerfully excites the nervous system, heart, blood vessels, and lungs, and while it can take the body numerous days to recover from these immediate effects, healing the genomic and oxidative damage left behind can take much longer—or never even happen at all. Even without adding in effects of secondhand smoke, tobacco use in recent years has caused the loss almost 7% of life-years globally.

Why So Popular?

In the past, plants were, on limited occasions, burned as medicine or incense for inducing specific moods and perceptions. Tobacco was accorded respect as one such agent, but because of its strong effects, was used in small amounts in combination with beneficial herbs like bearberry, sweetgrass, sage, and willow.

Modern life presents a bewildering variety of mental, physical, social, and emotional challenges that can at times leave one feeling overwhelmed, and using nicotine can temporarily help filter out some of this ‘noise’ and provide a sensation of control. However, the dosage of nicotine required for achieving these effects increases over time and accelerates biological aging processes—a bit like ‘fast-forwarding’ through life, skipping opportunities for resolving issues. Tobacco does this chiefly through altering how the brain and digestive tract (our “first and second brains”) produce and respond to neurotransmitters like:

- Serotonin, crucial to mood, cognition, pain perception, and stress response
- Dopamine, active in motivation, attention, learning, and mood
- Acetylcholine, central in attention, memory, movement, and learning
- GABA, important for mental and physical calming, relaxation, and sleep
- Glutamate, which modulates learning and memory

It’s been over 50 years since the US surgeon general first reported on the health impacts of tobacco, which we now know include alterations in cognitive (especially attention and memory), cardiovascular, metabolic, respiratory, inflammatory, reproductive, neurological, and immune-related functions as well as in the flora of the mouth, lungs, and gut. From 1980 to 2012, the number of smokers in the United States went down by almost 14 million, yet China showed an increase of almost 100 million during this same period. Habitual nicotine ingestion relates to all four major quadrants of body-mind function:

- Physical, through direct effects on neurotransmitter receptors throughout the body, especially in the brain, heart, blood vessels, and lungs
- Metabolic, through immediate and long-term changes to communications in virtually every cell of the body, especially the brain, cells’ protection/detoxification systems, and immune system
- Cognitive, through delayed as well as direct effects on perception, attention, memory, and learning
- Behavioral, through its use as a chemical ‘crutch’ for easing social interactions and blunting feelings of stress

A Few Ways of Cultivating Body-Brain Equilibrium
Build regular, enjoyable, sweat-inducing physical activity into your daily life, and spend time in quiet and/or natural settings.

Ask a Functional Medicine practitioner about nutritional, behavioral, and lifestyle therapies for supporting nicotine withdrawal, and consider being evaluated for mood, social, and cognitive issues that ‘feed’ nicotine use and make it difficult to quit.

Ask yourself what nicotine is substituting (fun, excitement, connection, etc.) or compensating for (loss, anxiety, frustration, etc.) in your life, and what lifestyle actions would better address those issues.

Consider activities that provide healthy stimulation, soothe the nervous system, and help re-set your stress response, like competitive sports, meditation, dancing, aromatic baths, gardening, massage, martial arts training, intense exercise, making music, yoga, work that complements personal interests, etc.

Increase the overall nutrient density of your diet: total essential nutrient, fiber, and phytonutrient contents versus total calories, and get at least around 1.5 grams of omega-3 fatty acids each day.

Increasing the number of plant species you consume can help re-establish healthy diversity among microbial species in your gut microbiome, and enjoying more beans, seeds, nuts, leafy greens, berries, and Brassica family vegetables can aid stress and immune responses.

Keep a sleeping environment conducive to rest and dreams: uniformly dark, quiet, cool, and far from electromagnetic fields, and try apps for optimizing sleep habits, like Sleep Cycle, Pzizz, or Sleep Time.

Learn about how medically-supervised metabolic detoxification and/or sauna therapy can reduce your body’s toxic burden, and discuss with a Functional Medicine practitioner whether you might benefit from periodically following a Fasting-Mimicking Diet.

Use apps that help you understand nicotine usage patterns and facilitate quitting, like Kwit, Smoke Free, Cessation Nation, MyQuit Coach, QuitNow!, or Craving to Quit!

Try apps that help keep you relaxed, grounded, and breathing deeply, like Calm or Breathing Zone, and consider ones that give your gray matter a fun challenge, like Peak, Elevate, Lumosity, or Active Memory.

To help guide lifestyle strategies, consider genomic testing for gene variants that impact neurotransmitter metabolism, nicotine dependence, or altered nicotine detoxification.

Ingesting nicotine or tobacco every day impairs normal regulation of brain function and vital cellular healing processes yet is addictive; a kind of metabolic trap. Dr. Christopher Murray, director of the Institute for Health Metrics and Evaluation in Seattle, has stated that “Where we see stagnation [in control of tobacco use], we need to find out what’s going wrong.” In this informative discussion, Dr. Jeffrey Bland talks with Professor Richard Wurtman about nicotine’s relationship to carbohydrate cravings, mood, and the neurotransmitter serotonin, as well as ways in which diet and lifestyle influence brain chemistry.
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