November 2018 - Mid-Month Bonus Newsletter

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**In this issue:** Phytonutrient of the Month: Glucosinolates; How Medicine Became Functional; How Genetics Got Its Groove

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**Phytonutrient of the Month: Glucosinolates**

Many people don’t eat much in the way of Brassica (cabbage family) vegetables despite knowing that they extend a generous variety of health benefits. However, eating too much of them can affect thyroid function. We also know that they taste a little different when eaten raw or fermented versus cooked. How can we take advantage of the good yet avoid the not-so-good?

While Brassica vegetables provide a broad spectrum of carotenoids, flavonoids, vitamins, minerals, and dietary fibers, they also supply a rather unique phytonutrient: glucosinolates. Glucosinolates are synthesized in these plants from amino acids, and thus they contain nitrogen and sulfur in organic forms. These compounds are master examples of hormetic phytonutrients, as they help protect plants from environmental extremes and from being overeaten by insects and animals, and in humans, they provide strong support for antioxidant systems. But before the body can use glucosinolates, it must convert them into more bioavailable metabolites like sulforaphane, diindolylmethane, and isothiocyanates. It is quite handy, then, that in fresh form, these foods also provide the very enzyme (called myrosinase) needed to help metabolize the glucosinolates they offer: simply chew and receive the benefits.

It is fortunate that the Brassica family is large and offers variety in textures and tastes. Members include watercress, nasturtiums, alyssum, radish, horseradish, arugula/rocket, turnips, maca, rutabagas, kohlrabi, bok choy, seed mustard, and mustard greens in addition to the better-known broccoli, cauliflower, cabbage, kale, and Brussels sprouts. Different members of this family provide a different profile of glucosinolates, though they are generally present in most parts of these plants: sprouts, seeds, leaves, stems/stalks, roots, and flowers. It is interesting to note that the seeds are often particularly good sources of myrosinase. Glucosinolates are also known to occur in
papaya, capers, and moringa, which are from different families in same phylogenetic order as Brassica vegetables. In addition, a very few have been isolated from plants in families not related to Brassica, such as the poinsettia, poke plant, and coffee/madder families, though not necessarily in their more famous members. Here are several examples of glucosinolates, followed by their metabolites in humans and their plant sources:

- Glucoraphanin/sulforaphane/radishes, Brussels sprouts, cabbage, cauliflower, broccoli, arugula
- Gluconasturtiin/phenylethylisothiocyanates/nasturtium, mustard greens, horseradish, black mustard seed, broccoli
- Sinigrin (particularly bitter, this one!/allylisothiocyanate/black mustard seed, broccoli leaves
- Glucotropaeolin/benzylisothiocyanate/horseradish, maca, nasturtium, papaya
- Glucobrassicin/indole-3-carbinol and diindolylmethane/mustard greens, turnips, rutabaga, cauliflower, broccoli, maca, radish, capers, seed mustard, arugula, Brussels sprouts, cabbage, dyer's woad
- Glucomoringin/moringin/moringa, sweet alyssum
- Sinalbin/hydroxybenzylisothiocyanate/white mustard seed
- Glucoiberin/(metabolites not fully characterized)/capers, horseradish, Brussels sprouts, cabbage, kale, cauliflower, broccoli
- Glucoiberin/(metabolites not fully characterized)/horseradish, bok choy, mustard greens, Brussels sprouts, cabbage
- Capers also contain glucocapparin, moringa and capers contain isothiocyanates, and papaya contains benzylglucosinolates; their metabolites have not yet been fully characterized

The health benefits of glucosinolates and their metabolites are many and legion; here are a few:
- Many isothiocyanates have microbe-modulating properties
- Glucosinolate metabolites protect against:
  - neuronal injury and death
  - mitochondrial degeneration
  - production of toxic amyloid protein
  - excessive inflammatory response
- Diindolylmethane is apparently a phytocannabinoid, as it is a partial agonist of the cannabinoid 2 receptor; this action may partly explain some of its anti-inflammatory influence
- Sulforaphane:
  - is perhaps the strongest known inducer of the crucial Nrf2/ARE antioxidant enzyme pathways
  - is a genetic expression regulator of several metabolic detoxification enzymes
  - helps upregulate production of the versatile antioxidant glutathione
  - encourages mitophagy and supports mitochondrial integrity and function
  - helps preserve brain acetylcholine levels

Diindolylmethane, indole-3-carbinol, and other glucosinolates have shown a wide variety of genomic and metabolic chemopreventive activities

Moringin is one of few substances shown to protect against demyelination in an animal model of multiple sclerosis, and shows anti-inflammatory and immune-balancing properties as a PPARγ agonist

A good way to receive all the good that glucosinolates have to offer without consuming too many of their goiter-producing substances is to enjoy 1-3 larger (around ½ cup cooked or fermented or 1 packed cup raw) or 3-6 smaller (around ¼ cup cooked or fermented or ½ packed cup raw) servings of these foods weekly, divided among fresh raw, fermented, and gently cooked forms.
their best judgment to identify a disorder and apply treatment. This works well when patients look and respond the same way... except that they don’t. Then came population studies, showing what works in a large population, even if it only really worked for a small minority of people in that group. We are now entering the Age of the Individual, in which each person is evaluated for present and potential wellness and illness, engaged as the focal member of the team, and treated as a genetically unique being in all ways. In the Age of the Individual, medical education is incomplete until a well population renders it obsolete.

In 1980, Dr. James Fries’ idea that lifestyle change could postpone the loss of functional capacity until shortly before a natural death and his call to study the processes of biological aging seemed to fly in the very face of conventional medicine. However, in 1998 he published compelling evidence that exercise, smoking, and body mass index predict future disability, and by 2014, even the Department of Health and Human Services (speaking through the staid Journal of the American Medical Association) acknowledged that the current health system is failing to provide effective care for those with chronic disease and that changes in the practice of medicine, its payment, and patient engagement are urgently needed.

Human genome sequencing has enabled deeper understanding of phenotypic expression in illness and wellness and optimal targeting of treatments, as laid out in Eric Topol’s groundbreaking 2014 Cell article. Albert-László Barabási has described how different conditions may be linked by networks of functionally related genes such that, in an individual, obesity could share genetic origins with asthma or with glioblastoma. A critical 21st century clinical pearl is realizing that there are NO bad genes—only gene-environment interactions at odds with the functional adaptations offered by inherited gene alleles. This point is demonstrated by a large study published in the New England Journal of Medicine in 2015 that found risk for coronary artery disease split almost equally between lifestyle habits and genetic inheritance.

Functional Medicine isn’t functional until a co-operating team consisting of a wellness seeker (and her/his social network) and Functional Medicine practitioner come together to make it so with every interaction. Function is homeodynamic, ever adapting to changing needs to the greatest extent physiologically possible, and Functional Medicine explores how biological systems interact in order to knowledgably intervene in dysfunction. In this article, Dr. Bland describes the evolution of Functional Medicine and its core harmony with the systems biology, and in this fast-paced video from the Institute for Functional Medicine, he describes how Functional Medicine evaluates core physiology in pursuit of each individual’s optimal expression of wellness. The teamwork between wellness seeker and Functional Medicine practitioner is what puts the Functional in Functional Medicine. 

How Genetics Got Its Groove

Who started the Nature versus Nurture quandary? Why did it take so long for separate concepts of heredity, adaptation, chromosomes, and evolution to combine into the study of genetics? What was “eugenics” originally intended to mean—and how do we determine what is genetically “good”? In Dr. Siddhartha Mukherjee’s book The Gene, we learn that these quintessential entities were described and named decades before their actual discovery and of a failed professor whose prescient labors guided the work of future Nobel Prize winners though they were never appreciated during his lifetime. Dr. Mukherjee examines the significance of environment and presents a fateful equation describing how genes express themselves in phenotypes like eye color and disease risk. He relates how social forces hampered research into understanding the means by which cells are instructed to form humans and why every human being is unique. In a particularly compelling passage, he discusses whether or
not genotype commands phenotype. This fascinating exploration of the high hopes and horrifying misuses of genetics is an important read for anyone interested in recognizing the forces of evolution—and our hand in them.

Read more: http://siddharthamukherjee.com/the-gene-an-intimate-history/