The Biochemistry of Cannabis: THC, CBD, and the Endocannabinoid System

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The use of marijuana for medicinal purposes has long been a controversial issue. As of the writing of this article, marijuana is currently legal for medical use in 29 states and the District of Columbia, and can be used recreationally in eight states.¹ Regardless of the legal and social issues surrounding marijuana use, it has been shown to have medical relevance for a wide range of health conditions.

The Endocannabinoid System

For any pharmaceutical or nutraceutical to be effective, there must be a receptor for the molecule of interest. The body naturally has receptors for cannabinoids and manufactures cannabinoid-like molecules called endocannabinoids. Together, they make up the endocannabinoid system (eCS).

The eCS is a complex collection of receptors, ligands, and enzymes that work together to regulate many fundamental processes within the central nervous system (CNS) and peripheral nervous system (PNS).² As a primary homeostatic regulator, the function of the eCS in both health and disease is a flourishing area of research. As the name suggests, the eCS is an active target for both pharmaceuticals and phytochemicals present in the cannabis plant. Due to its diverse modulatory mechanisms, the eCS has a role in the regulation of appetite, cancer development, cardiovascular disease, fertility, immunity, memory, and pain regulation.² Disruption of the eCS leads to a number of disease states.²

The two primary classes of cannabinoid receptors—CB1 and CB2—have many physiological effects, particularly in regards to memory and learning.³ CB1 and CB2 receptors bind to the two primary bioactive compounds in cannabis—tetrahydrocannabinol (THC) and cannabidiol (CBD), respectively. However, emerging research is showing that the eCS is more complex and has further reaching effects than previously thought.

Cannabinoid Receptors

CB1 receptors are located throughout the body but primarily in the CNS. In fact, they are one of the most abundantly expressed types of receptors in CNS neurons. CB1 receptors...
CB1 activation occurs via a G-protein–coupled receptor (GPCR) mechanism. GPCRs are a class of transmembrane receptors important to signal transduction. The CB1 receptor is one of the most prevalent GPCRs in the CNS, with high levels in the neocortex, hippocampus, basal ganglia, cerebellum, and brainstem. Outside the CNS, CB1 receptors are present in the testes, eye, vascular endothelium, and spleen. CB1 receptors bind THC as well as synthetic derivatives. However, THC has a higher affinity for CB1 than synthetic counterparts. CB1 receptors have been shown to function via lipid rafts. Therefore, the cholesterol content in the cell membrane affects the functioning of this pathway, with lower cholesterol enrichment reducing the signal transduction capability.

CB2 receptors are found primarily in the immune system. CB2 activation is associated with the inflammatory pathway, particularly with microglial cells—immune cells of the brain. This is of particular interest as microglial cells have a significant role in the development of Alzheimer’s and other similar diseases.

While CB1 and CB2 receptors are both considered part of the eCS, CB2 receptors function independently of CB1 receptors. It is likely that further roles of CB2 in neuronal regulation are yet to be discovered. As CB2 receptors are mainly associated with the immune system, they are present in B lymphocytes, macrophages, neutrophils, T cells, and microglial cells in the CNS. Further, CB2 receptors are thought to affect neuronal function and may be involved in some psychiatric disorders.

Polymorphisms in CB2 receptor genes have been shown to be related to schizophrenia, depression, and bipolar disorders. In animal experiments, CB2 receptor activation reduces impulsivity, locomotor activity, and vomiting.

While CB1 receptors primarily reside in the CNS and CB2 are found in the PNS and immune cells, this separation has begun to break down in light of recent studies, locating CB1 receptors in non-neural tissues and CB2 in some neurons. For instance, it was found that endocannabinoids can bind to other receptors beyond just CB1 and CB2. The two primary endogenous endocannabinoids, anandamide and 2-arachidonylglycerol (2-AG), have activity with other GPCRs as well as peroxisome proliferator-activated receptor gamma (PPARy), a regulator of the inflammatory pathway.

**Endocannabinoids**

Endocannabinoids are typically produced as a result of increased intracellular calcium at postsynaptic sites due to continuous synaptic activity. They are not typically stored, but rather synthesized on demand. In general, endocannabinoids are classified as arachidonic acid derivatives.

Anandamide, also known as N-arachidonylethanolamine or AEA, is one of the primary endocannabinoids in the body. The name is derived from the Sanskrit word ananda, meaning joy, bliss, or delight. The enzyme fatty acid amide hydrolase (FAAH) converts anandamide back into arachidonic acid, thus inactivating it. One of the therapeutic effects of CBD may involve reducing the activity of FAAH, increasing anandamide concentrations.

Anandamide can bind to both CB1 and CB2, deriving both psychological and immunological effects. Anandamide binds CB1 with high affinity and has similar effects to THC in animal models.

The endocannabinoid 2-AG, a derivative of diacylglycerol, is not as well understood as anandamide. Basal levels of 2-AG are estimated to be two orders of magnitude greater than anandamide. However, studies to induce 2-AG release have been inconclusive at best. 2-AG primarily exerts its influence through the CB2 receptor and has several immunomodulatory effects.

**Tetrahydrocannabinol**

Tetrahydrocannabinol, or THC, is perhaps the most famous component of cannabis. It is the molecule responsible for the classic psychoactive properties of the plant. Like most pharmacologically active plant compounds, THC is a secondary metabolite thought to protect the plant from being eaten. It may also protect it from ultraviolet radiation.

The main metabolic pathway of THC within the human body is hydroxylation. This process generates the psychoactive form, which is then oxidized to an inactive acid. The inactivated acid-derived metabolites are stored in adipose tissue and slowly released. In fact, due to this metabolite, THC can be detected in urine for several weeks following use.

THC primarily binds to the CB1 receptor and therefore has diverse psychological effects due to the CB1 receptor’s presence in the CNS. THC has wide-ranging, sometimes contradictory effects on the body, including relaxation and unease, tolerance and dependence, as well as analgesic properties.

**Cannabidiol**

The eCS is of great interest as a target for psychological conditions. While long-term use of cannabis may increase the risk of schizophrenia due to its THC content, CBD—the second most prevalent cannabinoid in the plant—does not appear to
induce the same risk, making it a safer and milder compound. Additionally, CBD does not have the often stigmatized psychotropic effects for which THC is known.

The mechanism behind the effects of CBD is not yet fully understood. However, there are several hypotheses. Studies have shown that CBD blocks the degradation pathway of anandamide as well as anandamide transporters. CBD also binds to PPARγ which is involved in regulating the gene expression related to glucose homeostasis and inflammatory response. CBD has also illustrated binding capacity to several other GPCRs, however, the physiological effects of this capacity are not yet fully understood. Currently, CBD is of particular interest as a low–side-effect antipsychotic due to its ability to increase anandamide levels, in addition to potential roles as a mood enhancer for less severe conditions such as anxiety and stress.

**Conclusion**

The eCS is comprised of much more than CB1, CB2, anandamide, and 2-AG. Similarly, there are other biologically active components present in cannabis beyond CBD and THC. The *Cannabis sativa* plant has over 400 chemical compounds, 60 of which are cannabinoids. However, CBD and THC are the most well-studied and well-understood aspects of the complex relationship between the cannabis plant and the human body. The elaborate interplay between plant and human has been present for thousands of years and is unlikely to disappear any time soon. Our present-day society follows a long tradition of recreational, industrial, and medicinal cannabis use. While the societal effects and recreational use of cannabis is complicated at best, the medicinal potential for this famous herb is far-reaching and likely to be an active area of research for quite some time. Cannabis has been used medically for centuries due to its wide-ranging physiological effects that scientists are just now beginning to understand.
The Biochemistry of Cannabis: THC, CBD, and the Endocannabinoid System References

Influence of the Microbiome on Reproductive and Metabolic Health in Women

Felice L Gersh, MD

Dr Felice L Gersh, a board-certified OB/GYN and medical director of the Integrative Medical Group of Irvine, California, is one of a small number of fellowship-trained, integrative gynecologists. Dr Gersh is an award-winning physician and renowned international speaker on ovarian health, menopause, cardiometabolic health, environmental toxins, and other important issues affecting women of all ages. Assisting her patients in regaining their health, happiness, and vitality is the overriding mission that guides Dr Gersh in the care she provides. She utilizes the most cutting-edge and high-tech diagnostic testing, while incorporating a unique blend of all science-based therapies, from the herbal to the surgical, to assist in the healing process. Adept in all areas of women’s health, Dr Gersh has exceptional expertise in women’s hormones and addressing the negative impact of pharmaceuticals, environmental toxins, stress, and aging. Contact Dr Gersh at fgersh@integrativemgi.com, through polly.dowson@90degrees.co.uk, or her website http://www.integrativemgi.com/

The microbiome has increasingly become a focus of scientific research, clinical practice, and a common topic of conversation among health care practitioners and consumers alike. Given much of the early research focused on the bacterial population residing in the gut, it comes as no surprise that many of the benefits surrounding a healthy microbiome focus on digestive health. Yet the gut microbiome impacts nearly every aspect of our biology, including neurological health, immune function, metabolism, and reproductive health. Metabolites originating from this symbiotic population of bacteria in the gut, as well as environments previously thought to be sterile, interact with receptors throughout the entire body, making the broader microbiome the most important and modifiable underlying factor of overall wellness.*

*These statements have not been evaluated by the Food and Drug Administration. These products are not intended to diagnose, treat, cure, or prevent any disease.

Just as the microbiome is not an isolated ecosystem, the reproductive system is also not an entity operating in and of itself. All systems, including those involved in reproduction, are interrelated. One such interaction involves the clear associations between hormonal fluctuations and gut function. Estrogen can significantly alter various clinical manifestations of gut health, including slowed gastric motility, visceral hypersensitivity and bowel discomfort during premenstrual, the menstrual cycle, and perimenopause. This demonstrates the interconnectedness between the microbiome and reproductive system. As such, actions to improve gut health can be leveraged to benefit reproductive health.

The various systems of our bodies, linked via bidirectional communication, can benefit from physical activity, a healthy circadian rhythm, and modifications to the diet. The application of this integrative approach can promote a healthy microbiome and influence barrier integrity and healthy motility. As a result, it can improve metabolic, reproductive, cognitive, and immune health.

Physical activity is known to be a moderator of the microbiome on its own, as well as in relationship with estrogen. Proper exercise can lead to bacterial diversity, including proper ratios of key bacterial species (eg, the Bacteroides to Firmicutes ratio). It can also lead to improved barrier function through mucosal immunity and promotion of the production of short chain fatty acids, the main source of energy for the cells lining the colon.2

Like exercise, food can also serve as an information delivery system to impact the complex and symbiotic relationship between you and your microbiome.3 The Western diet, high in fat and simple carbohydrates, can contribute to intestinal barrier disruption, increased gram-negative bacteria in the colon, and insulin-disrupting protein expression. However, foods rich in pre- and probiotics can support a healthy composition of the gut microbiota.4 Through metabolite receptor interactions, pre- and probiotics can behave like hormones to physiologically influence the various interconnected systems of the body, supporting the microbiome and healthy fasting blood sugar, plasma insulin, blood lipid levels, blood pressure, and BMI. Short-term dietary intervention can make a dramatic impact on the health of the microbiome. Avoiding excess protein, particularly from animals, added sugars, wheat, and processed foods, while increasing plant-based protein, healthy fats, probiotic-rich foods, and complex carbohydrate sources of fiber and prebiotics for 21 days to six months—followed by a sustained, well-balanced diet including a rainbow of plant-rich foods—can feed the microbiota and modulate balance within the various systems throughout the body.5–7

However, it’s not just what we eat, but when we eat that can impact the complex ecosystem living among our own cells. The time we eat indicates time of day to the body and influences the circadian rhythm (24-hour oscillations that affect every part of our body). The circadian rhythm is modulated by a master clock, the suprachiasmatic nucleus located atop the optic nerve. It perceives light and dark via input from specialized receptors in the eye and is controlled by estrogen. As women get older and are exposed to endocrine disrupters or to bright light all hours of the day, their master clock can drift, and with it, the circadian rhythm of organ and bodily function. The microbiome also helps to regulate the body’s natural rhythm. Eating smaller meals throughout the day can deprogram the microbiome, whereas eating breakfast and dinner at least 12 hours apart, limiting snacking, and eating at approximately the same time each day can indicate time of day to the gut microbiota.8

Furthermore, beyond the therapeutic interaction between host and microbiome, and its impact on health, emerging evidence now suggests that the microbiome can affect the most fundamental of host physiological phenotypes: the rate of aging itself.9 With this knowledge, further study on the influence of microbiome is sure to be rife with scientific and clinical opportunity for years to come.
Influence of the Microbiome on Reproductive and Metabolic Health in Women

References


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or corn and increasing consumption of probiotics. Supplementing with methylated B-vitamins, particularly methylfolate, was the most common suggestion in a thread discussing dietary treatment of a MTHFR mutation. Other discussion topics included increasing magnesium with vitamin supplements, probiotics for ulcerative colitis, treating HPV, and A2 milk. In our commitment to being fair and unbiased, discussions regarding individuals or organizations, as well as certificate programs, testing, and nutrient analysis programs, can be found on the electronic mailing list under: https://groups.yahoo.com/neo/groups/DIFM_listserv/info.

What’s New - Journal Reviews and Resources

Perceptions on Vegetarian Diets and Shaping Future Health Promotion Toward Plant-based Diets

An extensive review was conducted to assess the public’s attitudes and perceptions toward vegetarian diets, based on existing research and literature, to determine how this data may be used for shifting future health initiatives. Researchers out of the University of Guelph reviewed over 1800 database records and 24 different articles on peoples’ perceptions of vegetarian diets, published between the years of 2000 and 2015. For the purpose of this study, vegetarians were defined as those who follow any type of vegetarian diet (such as plant-based, pescatarian, flexitarian, lacto-ovo-, lacto-, and ovo-vegetarians), with the exclusion of vegan diets. The review found many mixed perceptions; however, overall, vegetarian diets are generally viewed in a positive light, and the prevalence of vegetarian diets continues to grow. Common positive characteristics associated with vegetarians include “healthy,” “thoughtful,” and “animal lovers.” However, “unhealthy,” “weak,” and “freaks” were negative attributes found to be associated with individuals following vegetarian diets. Further, veganism had a greater negative perception than vegetarianism. The review also found one study that showed 69% of vegans considered those following vegetarian diets to be “hypocritical” (Povey et al, 2001). They also revealed a strong correlation between increased knowledge of nutrition and positive associations with vegetarian diets. The review reiterated the correlation between vegetarianism and increased health benefits, environmental factors, and animal welfare. However, they found that the pleasure of consuming meat was the largest barrier to adopting a vegetarian lifestyle. Other significant barriers included the idea that people are “meant to eat meat,” that vegetarian diets are low in protein or nutritionally imbalanced, that foods are more expensive, and that finding and preparing vegetarian meals is more challenging. The reviewers concluded that people may be more willing to decrease their intake of meat as opposed to completely removing it from their diet. Lastly, they believe using the Health Belief Model and addressing barriers to adopting a vegetarian diet should be the focus of future health promotion initiatives.

The review concluded that there is a stronger chance of people decreasing their intake of meat, rather than completely removing it from their diets and that there is promise to increasing future health promotions towards vegetarian diets. They believe future health initiatives should weigh more on addressing the barriers to adopting a vegetarian diet, rather than focusing on the potential benefits.


The Anti-inflammatory Response to Bovine Colostrum

In a recent study, three different experiments tested bovine colostrum's antibacterial and anti-inflammatory effects on intestinal

Electronic Mailing List (EML)
Recent Topics Review:

In recent threads on the DIFM Listserv, members discussed various treatments for patients with SIBO. Several common recommendations amongst users included a low-FODMAP diet, a formal elemental diet, and antibiotic therapy. In a discussion on dietary approaches for cystic acne treatment, several users suggested eliminating or decreasing intake of dairy, wheat, gluten, and/or...
cells. Due to positive outcomes from previous studies on bovine colostrum and inflammatory intestinal diseases, the researchers proposed that bovine colostrum may be a possible non-pharmaceutical therapy for Crohn’s disease, similar to that of enteral nutrition. Caco-2 and HT29 cell lines from human adenocarcinomas were cultured with colostrum from Friesian and Holstein cows in vitro. A strain of adherent invasive *Escherichia coli* (AIEC) and an uncharacterized isolate of *Salmonella typhimurium* were grown with the addition of colostrum. Additional wells with colostrum and the absence of bacteria were used as absorbance controls, and wells without colostrum and with bacteria were used as the positive control. The Caco-2 and HT29 cell lines were exposed to the proinflammatory cytokine TNF-α to increase IL-8 expression and cell-associated bacteria in the epithelial cells. Caco-2 and HT29 cells exposed to TNF-α showed a significant decrease with higher concentrations of colostrum in IL-8 expression as well as in the cells incubated with AIEC. This study found that bovine colostrum may have anti-inflammatory or antibacterial effects and block TNF-α disruption to epithelial cells, which could be a possible therapeutic target for Crohn’s disease.


**Effects of Probiotic Supplementation on Despair Behavior**

Researchers from the University of Virginia recently published a preclinical study on despair behavior of laboratory mice on alterations to the gut microbiome from chronic stress and consuming the natural probiotics found in yogurt. Taking into consideration the genetic links between certain mental illnesses, such as depression, as well as the genetic component to microbiota compositions, the researchers wanted to test if altering the gut microbiota in mice would have an effect on depressive behavior based on what they consumed. The mice were assigned to a control or experimental group (one receiving probiotic supplementation and one without, both under chronic stress). Mice in the experimental groups were under an unpredictable chronic mild stress (UCMS) protocol for three weeks. Analyses of fecal sample cultures found that the prolonged stress decreased the levels of *Lactobacillus* in the mouse’s gut microbiomes while levels of kynurenine (a metabolite associated with depression and psychiatric diseases) increased. The experimental group was then supplemented with an active strain of *Lactobacillus*, *L reuteri*, and the stress protocol was continued for an additional four weeks. After treatment with *L reuteri*, they found that the probiotic supplementation improved the depressive symptoms and that the composition of the gut microbiome altered with periods of chronic or acute stress. This study suggests the microbiome may affect manifestation and characteristics of depression. Further research is needed to determine if alterations in gut microbiome composition can alleviate depression and despair behavior.


**Nutritional Genomics Research Publications – April 1, 2017**


**The impact of vitamin D pathway genetic variation and circulating 25-hydroxyvitamin D on cancer outcome: systemic review and meta-analysis. Br J Cancer.** 2017. doi: 10.1038/bjc.2017.44. [Epub ahead of print] (PubMed ID: 28301870) A number of interesting studies are reviewed which report on how genotype may affect the importance of dietary zinc for various groups, including examples of potential excess as well as deficiency. Additional research is recommended to better determine what is optimal for patients, which can better equip health care professionals who have knowledge of both genetics and nutrition.


Several genera were found to be associated with breast cancer risk. Related gene variants rs1048943 and rs10175338 were identified as possible risk factors regarding intakes of grilled or smoked meats.


As the public becomes more aware of genomic-related discoveries and innovations, there is a growing need for improving genetics literacy among a variety of audiences. This includes concepts pertaining to gene-environment interactions, lifestyle, and behavioral risk factors. The authors address several related challenges, and propose that community health workers can be particularly helpful in this arena, as listed in Table 1: Ways forward.

**Epigenetics and cardiovascular risk in childhood. J Cardiovasc Med (Hagerstown).**
A variety of environmental and lifestyle factors, both prenatally and during childhood, can be managed to help reduce risk of developing cardiovascular diseases later in life. Discussion includes the role of various microRNAs (MIR21, MIR200, MIR33, MIR155, etc). Emerging information about epigenetics will become increasingly helpful for identifying interventional opportunities.


The rs34621387 variant of the CACNA1C was found to be associated with an increased risk of Parkinson's disease among those who were deficient in vitamin D but not among those who were not deficient.

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Confronting Cancer with Diet

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Billions of dollars are spent each year on cancer research, and billions more are spent on cancer treatment. Pharmaceutical companies are developing drugs that can cost $100,000 or more for a course of treatment and yet may have only limited effectiveness. Despite these efforts, cancer is still the second leading cause of death, with about 40% of the US population being diagnosed with cancer during their lifetimes. Cancer survival rates have improved, although this is largely due to decreased smoking rates and improved diagnosis, rather than advances in treatment. In addition, improved survival rates mask some concerning trends, such as a sharp increase in colorectal cancer among ages 20 to 53.

Is there another way to improve outcomes for this devastating disease? Current research suggests that there is. At the 2017 Arizona Center for Integrative Medicine’s Nutrition and Health Conference, two researchers spoke about their work in this field. Stephen Hursting, PhD, MPH, spoke about cancer and calorie restriction, and Adrienne Scheck, PhD, spoke about cancer and ketogenic diets. They each approach cancer from a different angle, but both approaches are united by a focus on cancer’s metabolic features. Along with the broader body of research into the metabolic nature of cancer, their work affirms that combining metabolic therapy with other treatments has the potential to transform cancer care.

Metabolic Features of Cancer

What is our current understanding of the causes and mechanisms of cancer? As Dr Scheck described it, cancer results from a “perfect storm” of genetic, lifestyle, and environmental factors. Diet, smoking, chemical exposures, and random cellular changes all play a role. But what is the number one factor in cancer? It is not our genes, nor smoking, but rather diet and subsequent metabolic dysfunction. Thus, the focus of research is gradually shifting away from a genetic view of cancer and towards a metabolic, epigenetic view.

Cancer is strongly linked to metabolic syndrome, which is a condition of metabolic dysfunction arising from insulin resistance. Symptoms include high blood pressure, high blood sugar, excess body fat, and abnormal triglyceride and cholesterol levels. Some hallmark biomarkers of both metabolic syndrome and cancer include elevated insulin, elevated insulin-like growth factor-1 (IGF-1), elevated leptin, decreased adiponectin, and elevated inflammatory cytokines. As described by Dr Hursting, these hormonal and inflammatory metabolic factors contribute to cancer risk and progression by causing epigenetic changes; in other words, they change gene expression. As seen in Figure 1 on page 12, the changes in gene expression lead to inflammation, vascular perturbations, and growth factor signaling, all of which support tumor growth.

Another important metabolic feature of cancer is the Warburg Effect, which is a metabolic pattern that is required for tumor growth. In this pattern, tumor cells take up much higher levels of glucose from the blood. Then, once the glucose is taken up, it is not fully oxidized in the mitochondria as would normally occur. Instead, the glucose is fermented to lactate—a process which in most cells only occurs when there is no oxygen available. The function of this phenomenon in cancer is still not clear, but it provides clues to the mechanism of cancer progression and how it might be inhibited.

Two possible ways to modify this metabolic dysfunction were presented during the conference: calorie restriction and ketogenic diet therapy

Calorie Restriction

Calorie restriction (CR) has received a lot of attention, particularly in regard to its anti-aging effects. It typically entails a 30% reduction in daily energy intake. The work of Dr Hursting has helped establish strong evidence that CR is an effective way to suppress cancer. Although much of the evidence so far is from animal models, CR stands out as a broadly effective treatment, which works across genetic backgrounds and with different types of cancer. It reduces cancer progression in two primary ways: by inhibiting tumor growth and reducing inflammation.

CR improves metabolic regulation by decreasing insulin, IGF-1, and leptin. This occurs through a variety of mechanisms, such as mTOR signaling. mTOR is a cellular signaling complex that reacts to the energy status of the body, leading to epigenetic gene expression changes. For example, when the body is in a state of positive energy balance, with an abundance of glucose, mTOR is activated. This activation stimulates cell growth, cell proliferation, cell survival, protein synthesis, nucleotide production, and angiogenesis—all of which increase cancer risk.

CR also impacts inflammation, partially through its inhibition of adipocyte (fat cell) growth. When adipocytes multiply or increase in size due to excessive lipid storage, they secrete inflammatory signals and attract immune cells. Adipocyte expansion also leads to hypoxia, a state of low oxygen. Eventually the adipocytes die, leading to further inflammation. These processes result in a chronically inflamed, hypoxic microenvironment that supports tumor growth.

Although research shows CR to be a powerful therapy, in practice, compliance with CR diets is very low, even in controlled clinical trials. However, a fasting-mimicking diet may be just as effective as true CR. These diets do not necessarily require reducing calories, but instead involve methods such as eating only within a set time frame each day or fasting only on certain days. In fact, research into a variety of fasting-mimicking diets shows that they also improve metabolic biomarkers, perhaps even...
more effectively than simple CR. One example of a fasting-mimicking diet is a ketogenic diet, which was the topic of Dr Adrienne Scheck’s talk.

**Ketogenic Diet Therapy**

The ketogenic diet (KD) mimics fasting because of its extremely low carbohydrate content. Without carbohydrates, the body’s metabolism shifts away from burning glucose and uses fats and ketones for energy. Compared to CR and intermittent fasting, this has a similar impact on metabolic biomarkers such as insulin. The ketogenic diet used in cancer research, however, is a more extreme version that includes 90% fat, 5% protein, and 5% carbohydrate.

In her research, Dr Scheck used a mouse model with brain cancer to study the effects of the KD diet. Her lab has helped establish that it can significantly improve outcomes, and greater results are achieved when the KD is used in combination with either chemotherapy or radiation treatments. As described by Dr Scheck, the KD impacts cancer progression in a variety of ways:

- Reduces reactive oxidative species (ROS)
  - ROS are elevated in cancer and act as cancer-promoting agents. Paradoxically, ROS can also have cancer-suppressing effects and are generated during radiation treatments. The KD was found to increase the effectiveness of radiation treatments, and therefore regulates the opposing actions of ROS.

- Lowers expression of COX-2
  - COX-2 is an enzyme that increases inflammation. Thus, the KD can decrease overall inflammation in the body and may help reduce inflammatory damage from radiation treatments.

- Reduces edema and swelling (especially dangerous in brain cancer)
  - The KD reduces the leakiness of blood vessels by increasing expression of tight junction proteins and decreasing expression of vessel pores.

- Reduces hypoxia
  - Tumor cells that are in a low oxygen environment have activated genes that increase their resistance to radiation and chemotherapy. The KD was found to reduce expression of these genes.

The abilities of the immune system to attack the tumor

- The ability of tumors to evade the immune system is an area of current research. The KD was found to strengthen the immune response against tumors.

How does the KD have such broad effects? As discussed previously, metabolic shifts lead to a wide range of epigenetic changes. There is also evidence that the ketones themselves play a role. For example, Dr Scheck’s lab conducted a cell culture study in which adding ketones alone increased the effectiveness of radiation. The ketone beta-hydroxybutyrate has been shown to inhibit enzymes involved in DNA histone methylation. MicroRNA is affected by the KD as well. Thus, there are a variety of mechanisms at play, and although they are not yet fully understood, there is strong evidence for the use of metabolic therapy as an adjuvant treatment.

**Clinical Use**

At this point, these potential therapies are supported by a base of animal research, several clinical trials, published case reports, and anecdotal evidence. There are also some clinical trials in progress. Used with more frequency abroad, metabolic adjuvant therapies have not yet gained broad acceptance in the US. Yet many patients and practitioners are taking matters into their own hands and pursuing metabolically based treatment.

What are the considerations of clinical use of KD or CR? It is important that the physician, patient, and family all be committed to the treatment. The therapy requires a high level of support and compliance. As Dr Scheck emphasized, the KD should be treated as a therapy, not as “just food.” Thus, the patient needs to understand and carefully follow the diet, just as with any other treatment.

Physician misconceptions can be a barrier to pursing the KD. For example, contrary to fears, the diet can be used at the same time as steroids without worsening side effects. Another concern addressed by both speakers was cachexia. This is a metabolic disorder that involves extreme weight and muscle loss affecting about 80% of patients with advanced cancer. However, as Dr Scheck emphasized, weight loss that occurs in ketogenic diets is loss of adipose tissue, not muscle, and is not comparable to cachexia. Additionally, concern about excessive weight loss is one reason why ketogenic or intermittent fasting diets may be preferable to actual calorie restriction.

As Dr Scheck pointed out, the ketogenic diet is tolerable, does not have serious adverse effects, and some patients achieve remarkable results; thus, it may be worth investigating as a complement to other treatments. As with any therapeutic diet, it should be implemented with the support and guidance of a health care practitioner such as an RDN—ideally one who is experienced in both oncology and ketogenic diets. To learn more about clinical use of KD and metabolic therapies, refer to Table 1 on the next page for a list of resources.

In addition to the use of metabolic therapies as part of treatment, it would be remiss not to mention the implications of this research for prevention. As Dr Hursting pointed out, cancer often takes decades to develop. Cancer-promoting metabolic dysfunction can be altered long before cancer appears, without resorting to extreme dietary changes.

**Conclusion**

Both speakers emphasized the importance of further research. As Dr Scheck explained, a major barrier to metabolic therapy gaining acceptance in the US is that doctors want to see large controlled trials first, which cost millions, if not billions, of dollars. However, it is essentially impossible to get that amount of funding for a dietary therapy, with no promise of a lucrative drug being developed. This mirrors a broader problem in cancer research, whereby promising but unprofitable treatments are not studied, thus limiting potential new therapies.

As previously mentioned, cancer research is gradually shifting from a genetic to an epigenetic approach.
This is encouraging news, because to some extent our epigenetics can be changed, unlike our genes. This may empower individuals to make dietary changes, both before and after a cancer diagnosis. As we gain a deeper understanding of the underlying mechanisms, cancer treatments will improve, patients will pursue new options, and advances will hopefully lead to a decline in this ubiquitous disease.

**Figure 1**: Relationships between metabolic factors and cancer.

**Table 1.** Resources for more information about KD and metabolic therapy for cancer.

<table>
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<th>Further Resources</th>
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| **KetoDietCalculator** | - HIPAA compliant app that assists with meal planning, diet calculations, etc  
- Available free for RDNs or other licensed health care providers to use with clients  
- [https://www.ketodietcalculator.org/ketoweb/KetoStart](https://www.ketodietcalculator.org/ketoweb/KetoStart) |
| **Charlie’s Foundation** | - Provides information and resources about therapeutic ketogenic diets  
- List of RDNs that specialize in ketogenic diets for a variety of disorders  
- [https://www.charliefoundation.org/](https://www.charliefoundation.org/) |
| **Matthew’s Friends** | - Nonprofit based in the UK  
- Provides information, research, and grants in support of ketogenic dietary therapies  
- [http://www.matthewsfriends.org/](http://www.matthewsfriends.org/) |
| **Tripping Over the Truth** book by Travis Christofferson | - Explores the metabolic nature of cancer, history of cancer science, and new therapies  
- Author is also founder of the Single Cause Single Cure Foundation  
- [http://www.singlecausesinglecure.org/](http://www.singlecausesinglecure.org/) |

**Key Terms**

**Warburg Effect**: A metabolic process that is required for tumor growth. Glucose uptake into tumor cells is greatly increased, and instead of being fully oxidized in the mitochondria, the glucose is fermented to lactate.

**Epigenetics**: Refers to processes that activate or deactivate genes, thereby changing gene expression without actually changing the DNA sequence itself.

**mTOR**: Cellular signaling pathway that regulates cell growth, metabolism, and proliferation via epigenetic pathways. Activation of mTOR is associated with tumor formation, angiogenesis, etc.

**IGF-1**: Hormone produced in liver in response to factors such as insulin. Stimulates cell growth and proliferation throughout the body.

**Leptin**: Hormone produced by adipocytes. Increases with increased adipose stores. It signals energy status to the brain, thus decreasing appetite. In obesity, leptin is elevated, and the brain stops responding to the signal. Involved in angiogenesis, carcinogenesis, immune function, etc.

**Adiponectin**: Hormone produced from visceral adipose tissue. It is decreased with increased adipose stores. Increases fatty acid oxidation, increases insulin sensitivity, and decreases inflammatory cytokines.
Confronting Cancer with Diet References


Dietitians in Integrative and Functional Medicine DPG Symposium
Saturday, October 21, 2017
11 am – 3:30 pm
McCormick Place West (Convention Center)
Room W187 ABC

The Dietitians in Integrative and Functional Medicine (DIFM) DPG will host a half-day symposium at the McCormick Convention Center. Please join us in Chicago for this cutting-edge session.

Symposium Schedule
• 10 am – 10:50 am – Registration and Vendor Time
• 10:50 – 11 am – Welcome
• 11 am – 12:30 pm – Nutritional Genomics, Nathan Morris, MD
• 12:30 – 1:30 pm – Light Spa Cuisine and Vendor Time
• 1:30 – 3:00 pm – Nutrition and Cognition, James Greenblatt, MD
• 3 – 3:30 pm – Vendor Time

CDR approval pending for 3 CPEUs

Registration Fees through October 7:
- DIFM DPG Members: $39
- DIFM DPG Students: $25
- Non-DIFM members: $79
- Non-DIFM student members: $69

October 8 - 18, registration in each category increases by $20.

Additional information about sessions, speakers and registration for the event will be available on the DIFM website in early August.

Sponsored by: Gaia • Pure Encapsulations • Integrative Therapeutics • Emerson Ecologics

2017 FNCE® DIFM Activities

DIFM’s Member Appreciation Event at FNCE®
Monday, October 23, 2017
Hyatt Regency Chicago, Room Plaza AB
6:30 – 8:30 pm

After a bustling day of sessions and exhibits, you deserve some down time. Join the DIFM DPG Executive Committee and your fellow DIFM members for food and drinks while you network and participate in some "make and take home" activities/gifts. Stay tuned for more details! As always, as a DIFM member, you will receive a gift to thank you for your membership! This is a free member only event, yet registration is required and will be coming soon.

Thank you to Pure Encapsulations, sponsor of DIFM’s Member Appreciation Event!

Sponsored by:

Student Panel
8:30 – 9:00 pm

Immediately following the Member Reception, DIFM-invited panelists will discuss how they entered the field of Integrative and Functional Nutrition and answer questions. While this will be student-focused, all members are welcome to attend. This is a don’t miss event for DIFM student members.

DPG SHOWCASE
Monday, October 23, 2017
Exhibit Hall
9 am – 12:30 pm
McCormick Place West (Convention Center) – The Academy Pavilion
(Located in the Registration C area outside of Exhibit Hall F2)

Visit us at the DPG Showcase for a small membership gift of appreciation.

Looking for FNCE® Volunteers: Can You Spare Some Time?

If you are interested in volunteering during the DPG Showcase and/or Member Reception, both on Monday, October 23, please contact Mary Alice Gettings at difmma@gmail.com.
Translating Research into Recipes: Daily Detox at Dinner

Denise Pickett-Bernard, PhD, RDN, LDN, IFNCP

Denise has worked as chef, culinary arts instructor, University of Miami wellness center nutritionist and adjunct faculty at Florida International University and Nova Southeastern University. She has participated as student and faculty for the Integrative and Functional Nutrition Academy (IFNA) and earned Integrative and Functional Nutrition Certified Practitioner (IFNCP). Denise holds a degree from the Culinary Institute of America, a BS in Food Service Management from Johnson & Wales University, an MS in Food Science and Human Nutrition, graduate certificates in dietetics from the University of Rhode Island and Brown University's teaching hospitals, and a PhD from Barry University studying spiritual factors affecting weight maintenance. Denise merged talents and passions when creating the Culinary Nutrition Bachelor of Science curriculum for Life University in Marietta, GA and serves as Assistant Dean of Nutrition. The Culinary Nutrition program she developed merges functional nutrition with culinary arts to translate scientific principles into recipes for consumers. Denise currently provides functional nutrition therapy in private practice in Roswell, GA. Contact Denise at denise.pickett-Bernard@life.edu.

Knowledge brokers mediate between researchers and user communities and must understand both the research process and the users’ decision-making process.1 Glasgow and Emmons discuss some of the issues related to translating evidence into practice. They ask the pertinent question, “What constitutes evidence and when do we have enough evidence to translate?” They evaluate the strengths and weaknesses of different types of data and analysis and make the points that robustness and representativeness of the data should influence the decision to include it in program creation.2 Baumbusch et al describe a collaborative relationship between researchers and practitioners which underpins the knowledge translation cycle and occurs simultaneously with data collection/analysis/synthesis.3 RDNs as practitioners are positioned to act as researchers in the clinical setting by writing and/or sharing unique results from case studies as well as by testing out strategies for implementation in individualized patient plans. This dual engagement in knowledge translation illustrates Baumbusch’s description of a dialogical process which allows practitioners to use findings in a rapidly evolving health care setting as well as encapsulates the ideal knowledge broker.

An asset of the DIFM membership is the listserv which allows members to benefit from the clinical “n=1.” While it should be strongly encouraged that RDN practitioners attempt to publish case studies for the benefit of establishing evidence, exchanging information for the benefit of patient care is more often what happens. RDNs sit uniquely poised to effect change in treatment protocols as well as to implement those changes with their patients on a personalized basis. This back-and-forth flow of information can be overwhelming, and practitioners tend to stick to what works and what is evidence-based. The ability to quickly translate knowledge into practice is a skill that can be learned and honed and allow for a more personalized approach to implementing evidence into practice. Titler describes the process of implementing evidence-based practice (EBP) as a communication process between users of EBP and the system—where fit influences adoption.4 This dynamic plays out in practice when RDNs attempt to implement functional practices in traditional versus progressive settings.

Practitioner time can be well-spent scouring food trends as well as PubMed for a few reasons. When it comes to translating research into recipes, the process can be simplified as the burden of evidence for specific ingredient inclusion in a meal plan or recipe is far less rigorous for broad health recommendations than for specific nutrition protocols. For example, multiple phytonutrient-rich foods can be considered antioxidants or act as chelators whereas specific foods need to be avoided on a low-FODMAP diet. For recipe creation acceptability of taste and flavor, one must consider seasonality, freshness, color, and texture, as well as healthful qualities of food. Clients will prepare recipes that appeal to them, are within their skill level, and contain ingredients that are either familiar or easy to acquire. For example, a robust list of food chelators allows the practitioner to recommend a variety of recipes and preparations that will support health outcomes of detoxification as will be illustrated below.

Today’s media offers information on a variety of toxins of which to be wary and a variety of methods to detoxify. Physical, chemical, and biological agents may be responsible for inflammation which occurs in response to cellular damage as a defense mechanism. Heavy metals such as mercury, cadmium, lead, arsenic, aluminum, and iron can be found in the soil, water supply, dental amalgams, and various industry exposure. Additionally, and controversially, mercury and/or aluminum may be used as adjuvants in vaccines. More ubiquitously, toxic metals may be found in household products or packaging. While trace metals are required by the body, heavy metals may accumulate in the body and become toxic. As well, individual tolerance and ability to remove metals varies. All of the above listed metals can be found on the Environmental Protection Agency Priority Pollutant List.5 Regarding all sources, heavy metals can enter the body via drinking, eating, inhaling, epithelial, or membrane contact. At the cellular level, they can initiate oxidative stress which leads to inflammation and subsequent disease. Inflammation is a defensive response that appears after cell damage and is implicated in almost all human and animal diseases.6 The unifying factor in determining toxicity and carcinogenicity for all the above listed metals is the generation of reactive oxygen and nitrogen species.7

Abnormal accumulation of metals can result in a variety of negative effects. For example, copper is associated with neurodegenerative disorders, diabetes, and some cancers.8 Copper also plays an integral role in promoting tumor growth and angiogenesis.9 Lead
poisoning is a potentiator of brain damage, mental impairment, severe behavioral problems, neuromuscular weakness, and potentially coma. It is well documented that low level exposure to lead can lead to intellectual deficit. Lead increases reactive oxygen species (ROS) levels with elevated intracellular calcium which decreases mitochondrial function and leads to apoptosis via the release of cytochrome. Arsenic, while not officially classified as a carcinogen, does enhance the carcinogenic action of other carcinogens. It causes alterations in neurotransmitter levels and has been studied extensively regarding its ability to generate ROS. Cadmium toxicity usually occurs through lung exposure in proximity to smelting facilities. Soluble cadmium salts accumulate and cause toxicity to the kidney, liver, lungs, brain, testes, heart, and central nervous system. Recent data indicate that relatively low dose exposure to cadmium may give rise to osteoporosis and fractures. This is significant as the level of exposure to all contaminants in a lifetime has increased thus making low level cadmium exposure a risk factor for decreased bone health. According to Flora et al, mercury can be found in nature in varying physical and chemical forms (liquid, solid, and vapor). It is found environmentally, is ubiquitous—practically impossible for humans to avoid exposure to some form of mercury, and its presence in the water system leads to mercury-contaminated land and sea animals. Mercury exposure at low, chronic levels has been found to be a causative agent of various disorders including neurological, immunological, cardiac, motor, reproductive, and genetic. As well, heavy metal toxicity has been linked to Alzheimer’s, Parkinson’s, autism, lupus, amyotrophic lateral sclerosis, etc. Food contains nutrients such as antioxidants and anti-inflammatory phytochemicals which can neutralize the toxic effects of heavy metals. Foods also contain chelators or compounds that act as chelators. The word origin of the term “chelate” literally means “to have pincer-like claws” — somewhat illustrating how the metals are clawed or grabbed and dragged out of the body. Toxic effects of metals can be mitigated by chelating agents or more palatably by foods with chelating properties. 

Food ultimately plays a biochemical role in all of detoxification. At Life University, vitalistic nutrition is conceptualized as a whole-foods–based approach to reducing toxins, detoxifying, and nourishing the body in order to optimize the expression of health and performance for a lifetime of flourishing. The average consumer thinks of detoxification in general as the elimination of toxins by fasting or eating restrictively, however reducing toxins refers to avoidance of all exposure. Reducing the exposure or combined exposure from all sources of toxins, is slowly becoming part of the conversation and is an obvious step toward optimization. The second clause of the vitalistic nutrition definition is detoxifying which requires nutrients to support the liver, biotransformation, and elimination. For optimization of health and flourishing, nourishment must be able to provide for both normal health and ultimately organ reserves. 

Detoxification is a buzz word, and an internet search leads consumers to many sites that are not credible. As knowledge brokers, RDNs need to source their information credibly and then offer specific dietary recommendations for foods to include and recipes containing these foods. Totelin discusses the continuum between cooking and medicine, that ancient cooking and medicine share the same processes and understanding of substances’ effects on the body. It is really time for RDNs to fully integrate their cooking/food knowledge with their medical nutrition therapy expertise. Food-based nutrients are involved in the modulation of metabolic pathways for detoxification. Detoxifying nutrients found in foods play a role in the biotransformation and elimination of toxicants. Fasting might take toxins out of the diet, and rapid weight loss liberates toxins from cells; but neither are ideal solutions as those toxins will recirculate and then have access to the brain, liver, and kidneys causing something akin to a traffic jam unless there are adequate nutrients to aid in their elimination. To qualify, an elimination diet removes specific foods. One study found increased mercury and arsenic excretion on a modified elimination diet with a supplemental medical food. Being well-nourished through diet and selectively choosing foods for detoxification abilities will improve overall health status. Matés and Sánchez-Jiménez discuss the notion that the imbalance between antioxidants and oxidants results in harmful physiological responses, which may lead to cell damage. They outline links to cancer, aging, atherosclerosis, ischemic injury, and inflammation. Antioxidants may directly react with and quench free oxygen radicals and form chelating complexes with transition metals offering a negation of the negative effects from metal exposure. Detoxification of heavy metals through the diet will include a robust selection of foods which chelate heavy metals or biotransform them into molecules that can exit the body. Cline stresses the importance of a detoxification “lifestyle” and emphasizes the food-as-medicine approach to supplying the myriad of nutrients required to keep the highly complex detoxification processes functioning in a balanced fashion. Regarding biochemical individuality, Waring et al discuss that variation in individual response to diet is due to differences in DNA sequences modulated by physiological states, particularly those which involve chronic inflammation which suggests that dietary input must be both relevant to a condition and targeted towards an individual. 

First things first. Naturally occurring polyphenols have metal ion–chelating properties. Therefore, it is essential to consume a varied diet, particularly a wide variety of various colored vegetables and fruits in order to ingest an abundance of polyphenols. It is important to decrease potential sources of heavy metals in the diet and environment. Committing to cleaner sources of food with richer nutrient profiles (organic and locally grown) will also ensure adequate nutrition to support healthy detoxification. Additionally, mobilized chelated minerals must be removed via the stool and/or urine or they may be translocated to other tissue. Therefore, optimizing bowel transit time becomes an essential step in any detoxification protocol. Multiple bowel movements per day will decrease the likelihood for mercury reabsorption during the detoxification process. Increasing
water intake as well as soluble and insoluble fiber can help to decrease transit time naturally.

After those obvious general recommendations are the very specific recommendations for foods that will directly chelate out specific metals. Cilantro, coriander, and Chinese parsley all refer to the leafy herb that is common in both Latin American and Asian cuisines and, according to Omura, especially useful for removing mercury from the brain.27,28 One animal study found coriander extracts to protect the liver and lower lead concentration.29 Mercola suggests that the active substance is the volatile fat-soluble portion of the plant indicating the use of the fresh herb 3-5 times per week.26 Essential oil may also be a useful adjunct therapy. Also, making sure to have a quality fat source with cilantro can aid in ensuring that the fat-soluble compounds are able to be absorbed. Quality fat can be extra virgin olive oil with a high phenolic content or a richly flavored sesame or coconut oil which will complement the unique flavor of cilantro in a recipe.

Vitamins E and C act protectively and synergistically in preventing lead-induced cytotoxicity in rat studies.30 N-acetylcysteine (NAC) and alpha-lipoic acid are thiol antioxidants which act as scavengers of free radicals and have been shown to show prophylactic activity against arsenic-mediated injuries. Additionally, alpha-lipoic acid has powerful potential to chelate metals such as iron, copper, mercury, and cadmium.31 Garlic extract was found to alleviate lead-induced neural toxicity and prevent cadmium-induced mitochondrial injury.32 Ginger and onion similarly were found to prevent lead-induced renal and developmental toxicity and well as cadmium gonadotoxic effects in rats.33 Pires found grapes effective against cadmium toxicity.34

Curcumin is well-known for its anti-inflammatory and anti-tumor activity.35 It inhibits cell proliferation, invasion, metastasis, and angiogenesis of cancers.36-38 Zhang et al demonstrated that curcumin chelates with Cu2+ in vitro, suppresses tumor growth in vivo, is an effective copper chelator in vivo, and also suppresses angiogenesis by copper chelation.39 Curcumin is found in turmeric, the spice that gives the yellow color to curry powder and curry dishes.

Detoxification is a buzz word, indeed. Knowing the science behind detoxification and foods that can support a specific vehicle for detoxification can be translated into foods and recipe suggestions for clients. This article supports the notion that a varied diet with targeted inclusion of foods with chelation abilities may help to remove toxic heavy metals from the body and support overall detoxification. Those foods are phytochemical-rich vegetables and fruits, particularly the cruciferous family, cilantro, curcumin, garlic, onion, and ginger.

The following table lists some foods which contain a variety of chelating factors. As most of these foods are fruits and vegetables, they also contain varied phytochemicals.

<table>
<thead>
<tr>
<th>FOOD</th>
<th>Vit E</th>
<th>Vit C</th>
<th>NAC</th>
<th>Alpha-lipoic Acid</th>
<th>Fiber</th>
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<tbody>
<tr>
<td>Dark leafy greens</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Nuts</td>
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<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Sunflower seeds</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Avocado</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant oils</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cruciferous</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Butternut squash</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>Kiwi</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Mangoes</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Apricots</td>
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<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Peppers</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Guava</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Berries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Citrus</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Tomatoes</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Peas</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Translating Research into Recipes: Daily Detox at Dinner References

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curing light (used to solidify synthetic dental filling material) & effective treatment: a clinical case report, along with organ representation areas for each tooth. *Acupunct Electrother Res.* 1996;21(2):133-160. doi:10.3727/036012996816356915


Chinese Pancake Egg Wedges

By Denise Pickett-Bernard PhD, RDN, LDN, IFNCP
Life University & IFNA Culinary Collaborative

For the following diet(s): FODMAP, SCD/SIBO
Serves: 4

INGREDIENTS

2 tablespoons olive oil
8 eggs, beaten
Cilantro, fresh, chopped
1 bunch Bok Choy, chiffonade
4 scallions (green parts only), sliced

PROCEDURE

1. Sauté Bok Choy very lightly on medium heat in olive oil.
2. Add eggs and scramble eggs in the pan, when starting to set, sprinkle with cilantro and onions.
3. Let cook through. You can attempt to flip the whole omelet or you can finish under a broiler.
4. Cut into 4 wedges.
5. Serve with a splash of hot sauce for 6 FED and FODMAP.
Indian Spiced Fish

By Denise Pickett-Bernard PhD, RDN, LDN, IFNCP, Life University & IFNA Culinary Collaborative

For the following diet(s): FODMAP, SCD/SIBO

Serves: 4

INGREDIENTS

1 tablespoon fennel seeds
1 teaspoon cumin seeds
2 tablespoons yogurt, lactose free
2 tablespoons lemon juice
2 tablespoons olive oil
1 tablespoon curry powder
1 tablespoon ginger, grated

Sea salt
¼ cup fresh parsley, chopped
1 red chili pepper, finely diced
Black pepper, freshly ground
4 pieces haddock

PROCEDURE

1. Preheat oven to 350°F.
2. Toast fennel and cumin in a dry pan.
3. Place all ingredients except for the fish into a small tabletop food processor.
4. Process until combined yet still chunky.
5. Coat fish with mixture and marinate for at least 30 minutes.
6. Bake fish until cooked through (12-15 min per inch of thickness).
Mineral-Rich Seaweed Salad

By Denise Pickett-Bernard PhD, RDN, LDN, IFNCP, Life University & IFNA Culinary Collaborative

For the following diet(s): 6FED Serves: 6

INGREDIENTS

½ cup pre-cut wakame ½ cup carrot, cut into matchstick
2 tablespoons coconut liquid aminos ¼ cup diced red pepper
1 teaspoon toasted sesame oil 1 scallion, thinly sliced
2 tablespoons brown rice vinegar 2 tablespoons toasted sesame seeds
½ teaspoon honey 2 cups watercress
¼ cup grated daikon

PROCEDURE

1. Rehydrate wakame in room temperature water for 10 minutes (if the wakame does not say “ready to use,” you may need to soak the seaweed longer in warm water). Drain well and set aside in a bowl. If the wakame is not already cut, chop it into bite-size pieces.
2. Mix the coconut liquid aminos, toasted sesame oil, vinegar, and honey together until well combined and pour over the wakame.
3. Add the daikon, carrots, peppers, and scallions and mix well.
4. Garnish with seeds and serve over watercress.
**Purple Cabbage & Brussels Sprouts Slaw**

*By Denise Pickett-Bernard PhD, RDN, LDN, IFNCP, Life University & IFNA Culinary Collaborative*

**For the following diet(s): FODMAP**

**INGREDIENTS**

- 2 cups purple cabbage shredded
- 8 each Brussels sprouts, shredded
- 2 tablespoons fresh cilantro, finely chopped
- 2 tablespoons rice wine vinegar or coconut vinegar from specialty store
- 1 tablespoon coconut amino acids
- 1 tablespoon sesame oil
- Sea salt and pepper to taste

**Serves: 4 - 6**

**PROCEDURE**

1. Mix all ingredients in a medium-size bowl.
2. Let sit for about 30 minutes, periodically stirring to re-coat salad with dressing.
Middle Eastern Quinoa Salad

By Denise Pickett-Bernard PhD, RDN, LDN, IFNCP, Life University & IFNA Culinary Collaborative

For the following diet(s): FODMAP

Serves: 4 - 6

INGREDIENTS

- 2 cups quinoa
- 4 cups water
- 1 bunch scallions chopped, green parts only
- ½ bunch coriander chopped
- ½ bunch parsley chopped
- ½ cups pine nuts
- 2 teaspoons cumin
- 1 teaspoon turmeric
- 1 tablespoons ground fresh ginger
- ¼ cup extra virgin olive oil
- ¼ cup white vinegar
- Salt and pepper to taste

PROCEDURE

1. Cook quinoa as directed on package. Cool
2. When quinoa is cool, mix with the chopped herbs, scallions and pine nuts.
3. Whisk together the oil, vinegar, cumin, turmeric, and ground fresh ginger. Add salt and pepper to taste.
4. Pour the dressing over the quinoa mixture. Combine well.
Lisa is a registered dietitian in Vermont specializing in wellness. She is the director of nutrition for a preventive care practice which focuses on all four pillars of health and wellness: nutrition, exercise, behavior modification, and stress management. Lisa got her start in nutrition at the University of Vermont where she studied dietetics while participating on the school’s track and field team. After college, Lisa spent time as an athletic performance coach before returning to dietetics through her internship. Lisa spent her dietetic internship in Indianapolis through the Indiana University–Purdue University Indianapolis (IUPUI) program. Upon graduation, Lisa spent time learning about the effects of malnutrition and sustainability in Western Africa before landing herself in her current role. Lisa is also an adjunct instructor at Champlain College teaching the Biology of Nutrition and Fitness. Lisa’s favorite part of dietetics is the fact that it applies to everyone’s life—rich, poor, young, or old. When she isn’t working, Lisa can be found doing various outdoor “Vermont-y” things like hiking, biking, skiing, or chasing around her goofy yellow lab. Lisa can be reached at LBunn51@gmail.com.

Whenever I’m in an airport I tend to let my mind wander. Where is that person going? What are they going to do there? What did they have for breakfast? While I was waiting for my flight to Washington, DC, I knew exactly where the people in the waiting area were going and what they were doing. They, like me, were on their way to the Academy of Nutrition and Dietetics Public Policy Workshop (PPW). In the Academy’s words, PPW is an “annual food and nutrition advocacy summit, where you get up to date on current issues and learn how to become the voice of nutrition that Congress trusts.” In thanks to DIFM and the stipend I was awarded by them, I was able to spend two days in our nation’s capital learning how to advocate for our profession. This is my story of being there for the first time.

If anyone had told me a year ago I would be sitting in Sen Bernie Sanders’ office discussing preventive nutrition policy and nutrition education in the Farm Bill with his staffers, I would have said they were crazy. I became interested in policy about six months ago when I first entered the field of nutrition. I was a brand new dietitian and the director of nutrition for a group wellness program. The biggest deterrent for our program is cost. In Massachusetts and New Hampshire, the program is covered in full by insurance providers. In Vermont, however, it is not. After our argument fell on deaf ears with private insurance companies, I remembered and was inspired by Martha Rardin, RD, MSM, CD, a dietitian from my internship, speaking to us about making real changes in our profession and legislation through advocacy. After volunteering for the State Policy Representative position with the Vermont affiliate of the Academy of Nutrition and Dietetics (VAND), I found myself in an advocacy role. That role with VAND led me to PPW.

During the 48 hours I spent in Washington, DC, I was not alone. I was with over 300 dietitians and nutrition professionals, and the Academy armed me with everything I needed. Prior to the workshop, we spent five weeks on webinars, focusing on specific issues, and learning advocacy skills. We learned about the Farm Bill and how the Supplemental Nutrition Assistance Program Education (SNAP-Ed) and Expanded Food and Nutrition Education Program (EFNEP) affected our lives, and we learned about how the preventive care industry could be improved to enhance our practices. These issues were not only the focal point of the Academy, but important to me personally. As I said, while in DC, I was not alone. In my thoughts, I was also with Michael*, a gentleman who lost 50 pounds with the help of our preventive care practice and dropped both his total cholesterol and fasting blood glucose out of the risk ranges for chronic illness. Kathy*, a new grandmother, who after taking our 13-week class now had the energy to play with her grandbaby, was also with me. And I was with Kara*, a single mom who prioritized her own self-care by asking for our help. She now exercises on a regular basis and feeds her family fresh fruits and vegetables. These stories, along with the other Vermonters who have walked through our doors, were the reason why I decided to speak up for my profession. After all, if dietitians don’t do it, then who will?

I arrived in Washington, DC, on Sunday morning, but the workshop didn’t start until the afternoon. I went to the hotel and my room wasn’t ready. No problem. The Smithsonian American Art Museum was only a few blocks away and had a courtyard where I could grab some lunch and read my book while I waited. When I walked into the museum, I realized that admission was free, so I thought I might as well look around. I wandered through and found myself looking at an exhibit about some of the big change-makers in the United States during the civil rights movement—like Martin Luther King, Jr and Rosa Parks. I kept hearing, as an echo in my head, words from the book I was reading on the plane, “When the civil rights leaders began to force a reckoning with otherness in the 1960s, they did so in the name of love.” Those that enacted arguably the greatest changes in our country didn’t do it from a place of data, numbers, violence, or outrage. They did it from a place of love. In his book, Across
That Bridge, John Lewis claims that “the Civil Rights Movement, above all, was a work of love. Yet even 50 years later, it is rare to find anyone who would use the word love to describe what we did.”

I’m not equating the advocacy of 300+ dietitians over one weekend to the enormity of the Civil Rights Movement; but I felt so incredibly energized knowing the small steps I was taking, and the motivation behind them, were pushing me in the right direction.

With that energy, the guidance from the Academy, and the view of the sun setting over the national monuments, I was ready to charge the hill on Monday! Vermont is lucky for a couple of reasons. First, we’re a tiny state. We have two senators and one congressman, so we only had three meetings to attend. While some would look at this as a negative—we only got to speak to three members of Congress—we chose to look at it as a positive. For some on our Vermont team, this was their third or fourth time attending; so over the years, they had developed relationships with representatives we were meeting. And while we only got to speak to three members of Congress, they have large voices in the House and the Senate. So for us, what we were asking from our representatives reached further than that which was provided by the Academy. We also urged them to speak up to their fellow Congress members about our issues. Second, we ended up “preaching to the choir” to some extent. In Sen Patrick Leahy’s office, after we landed our ask (to urge the senator to continue to fund the Prevention and Public Health Fund), his staff member looked us in the eyes and said, “He is.” It was nice knowing we wouldn’t run up against a wall while we were talking!

You may get the impression that I’m into politics and policy, but I’m not. Other than overhearing my roommates talk about current events in the news and reading my Facebook feed from time to time, I’m not super invested in politics. I do, however, feel a responsibility to advocate for my profession—not only because it is my livelihood, but also because I care about the people we serve. I didn’t start off by committing to go to Washington, DC, for a weekend; I started small with just a few action alerts when the emails came. Then I started paying more attention and soon found myself in front of the staffs of Sen Patrick Leahy, Sen Bernie Sanders, and Rep Peter Welch talking about nutrition in legislation and why it matters!

*Names have been changed for privacy

References

DIFM/DPBRN Research Project

In a follow-up to the 2015 publication, "Integrative Medicine: Education, Perceived Knowledge, Attitudes, and Practice Among Academy of Nutrition and Dietetics Members," DIFM and the Dietetics Practice Based Research Network (DPBRN) have teamed up again to study the critical thinking skills and processes that proficient and experienced Integrative Medicine (IM) RDNs use in providing patient care. Additionally, this collaborative project seeks to understand the practice roles, service delivery models, reimbursement, practice facilitators, and challenges unique to IM RDNs. To assist in the completion of this project, DIFM has selected a one-year research fellow, Emily Goodman, MS, RD, LD, to work with DIFM workgroup members and the DPBRN Director. The study, "Role Delineation and Decision Making Frameworks for Integrative and Functional Medicine RDNs," will help support the future practice of integrative and functional nutrition. Potential survey participants have already been contacted via email. If you received an email from Emily, we hope you consider participating.

The purpose of this project is to assess and describe the critical thinking skills and nutrition care processes integrative and functional RDNs use in various practice settings. Enrolled subjects will be experienced integrative and functional RDNs who have been practicing for at least 4 years, have the equivalent of at least 9 months full-time practice (approximately 1500 hours) in integrative and functional nutrition, and who have either a master’s degree or have published or presented on integrative and functional nutrition. The FAQ list below aims to increase understanding of various aspects of this research study.

1. What is the overall goal of this study?
   a. The goal of this study is to support DIFM members and provide them with tools to help guide their practice. The project will result in a decision-making framework that could guide integrative and functional RDNs to help weigh evidence and provide the best patient care through shared decision-making, safety, and risk management.

2. What will you do with the data collected in this study?
   a. The practice setting data will be used collectively to describe the various practice settings and responsibilities of integrative and functional RDNs. The critical thinking data will be used to identify necessary skills employed in the practice of integrative and functional nutrition. The data we collect from participants will NOT be used to evaluate practice or RDNs on an individual basis.

3. Who created this study?
   a. This study was proposed by DIFM members and was developed into its current form through collaboration between the DIFM advisory workgroup, a member research expert, Academy staff member and the research fellow Emily Goodman, MS, RD, RDN.

4. Who approved this study?
   a. This study was approved by DIFM and the Academy’s research team. It received Institutional Review Board (IRB) approval from the American Academy of Family Physicians.

5. Who funded this study?
   a. This study is funded by DIFM. Results of the study will be published when available, later this year.

If you have further questions, please feel free to contact any of the members of the DIFM advisory workgroup listed below. If you have further questions, please feel free to contact them at DelegateDIFM@gmail.com

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About Our Research Fellow

Emily’s passion for natural sciences brought her from her hometown of New Hartford, NY, to Emory University in Atlanta, GA, where in 2012 she earned her bachelor of science degree in Neuroscience and Behavioral Biology. While engaging in rare-disease research at Emory, Emily was astonished by the complete absence of nutrition as an element in any course of disease treatment, inspiring her to pursue a career in dietetics. In 2016, Emily graduated with honors from the master’s degree Coordinated Program at Georgia State University. At Georgia State, she was a research assistant for Dr Dan Benardot and worked with the Atlanta Falcons NFL team and Georgia State University athletes. She developed a keen interest in functional foods and nutrients and their ability to improve athletic performance and overall well-being. Exploring this further, Emily completed her master’s thesis, “The Relationship between Sun Exposure, Diet, and Muscle Soreness in Collegiate Football Players.” Emily currently lives in Austin, TX, where she enjoys tacos, Longhorn football games, and the company of her cats, Fig and Olive.
App Review

Probiotic Guide US

This app is designed to help translate scientific evidence for probiotic products into practical, clinically relevant information. It is designed with the clinician in mind but can be downloaded by anyone. The app can help clinicians select the appropriate probiotic strain and dose for specific conditions. Products can be filtered by brand name, indication, and age/gender. Data or studies with defined clinical outcomes for probiotic strain(s) are searched using the inclusion criteria listed in the app. References are also included. As of now, the database is fairly limited, but if it continues to be consistently and reliably updated it will be a convenient and practical way for clinicians to choose the most appropriate probiotic for each patient.

Price: Free
Platform: Apple and Android

Environmental Working Group's Food Scores

EWG's food score app is a database of over 80,000 food products in a searchable format designed to guide consumers to healthy, affordable food that is beneficial for people and the planet. The food product scores are based on algorithms for nutrition, ingredients of concern, and processing. Foods are scored from 1-10, with 1 being the best and 10 being the worst. The score breakdown is then given based on the area of concern: nutrition, ingredients, and processing. Nutrition is given the most weight, followed by ingredients, and then processing. Although the database may not have many familiar brands, it enables the consumer to look beyond the nutrition label for information about the quality of ingredients and level of processing.

Price: Free
Platform: Apple and Android
DIFM Professional Development Stipends
We Encourage YOU to apply!

Application Deadline:
September 15, 2017

One $250 Stipend for a DIFM RDN Member

One $250 Stipend for a DIFM Student Member

The Executive Committee of the DIFM DPG believes it is important for DIFM DPG members to attend and/or participate in professional meetings related to integrative, functional and holistic medicine, nutritional genomics, whole foods, dietary supplements, and natural healing modalities in order to enhance our members’ knowledge and increase the visibility of the DIFM DPG. The purpose of these professional development stipends is to provide financial assistance to one RDN member and one Student member to attend a suitable educational event. Recipients of these stipends are responsible for a newsletter article featuring coverage of the topic of the event. Further information on this stipend and the application form and procedure is available on the DIFM website: www.integrativerd.org.

Thank You to DIFM Volunteers

Thank you to the many volunteers whose contributions make this newsletter possible, as well as those volunteering for FNCE® activities and other national, state, and local events. We have made every effort to identify those of you who have assisted us during the 2016-2017 program year. If your name is not listed here and you would like to be acknowledged, please do not hesitate to contact me at peaknut70@gmail.com.

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When I joined Dietitians in Integrative and Functional Medicine (DIFM) 11 years ago as a graduate student, then called Nutrition and Complementary Care, I never dreamed I'd be writing an article as the chair. The DIFM Leadership Team seemed like cutting-edge nutrition superheroes, and I was just “little ole me.” Turns out that superheroes are just little ole us’s—with perhaps just a little bit more time behind us. Persistence, passion, and the drive to make a difference in the field keep us climbing up what can often feel like a rocky and steep mountain with or without our capes and bulletproof bracelets.

If you know me, you may know that I love stories, so I will offer one here. Earlier this May, I had minor surgery to repair a torn ligament in the index finger on my right dominant hand. What I thought would be a simple procedure turned out to be a long-haul–healing process that made even the most basic tasks a challenge. (Who knew opening a jar, cutting an onion, or washing dishes one-handed could be so difficult?) I muddled through it, learning many uses for the crook of my elbow, and coming to understand the unlikely fortitude of my right pinky. But it was not without periodically throwing up my hands (or hand) in frustration when I couldn’t open a can of beans or when my computer dictation program wrote “many puzzles” instead of “menopausal.”

A month prior I had been brainstorming about themes to consider for my year as DIFM Chair and had settled upon “Simplify, Strengthen, Strategize.” DIFM members are thought leaders whose fervor for the field and integrity around science know no limits. The Leadership Team is no exception. It seemed to me that if we could be strategic about our strong but simple initiatives, we may have more ability to both execute and follow through.

Little did I know that these themes would also apply to my own personal situation. Without the use of my dominant hand, I was forced to simplify. I stuck with succinct emails and slip-on outfits that were belt-, shoelace-, and button-free. Strengthening became a requirement for daily duties as my sluggish left hand learned how to navigate doorknobs, keyboards, and the almond butter jar. And I became strategic when forced to focus on what could be done most effectively and efficiently with reduced speed and abilities. Creativity thrives in the face of adversity.

As nutrition professionals working in a field met with skepticism, there is great value in being strategic with how we engage with our community. Over the past few years, DIFM has expanded exponentially with new initiatives, projects, and a clearer-than-ever vision for how we are helping to shape the dietetics profession. We now have collaborated with the Academy of Nutrition and Dietetics to create their certificate of professional training in integrative nutrition, a robust website, numerous scientifically rigorous archived and upcoming webinars and newsletter articles, a yearly symposium, a research fellow, a strong relationship with the Academy, and an ever-increasing membership already 1,000 members larger than we were a year ago.

I know we will all continue to dream big as we move forward promoting and implementing integrative and functional concepts and solidifying our place at the table of established nutrition professionals. At times, the task can feel overwhelming. How can we simplify? We can start with baby steps, paring down to the most essential, allowing us to reach more people and do less better. How can we strengthen? We can build upon and solidify what is already in place. We can expand and diversify our membership, and we can actively engage in public policy. (These feel all the more important in our current political climate.) How will we strategize? Taking a lesson from my torn ligament—we will look towards our partners, think ahead, and determine how efforts will give us the most bang for our buck. Lastly, we rely on you, our members, who keep hold of those capes as we hike up that steep hill. I encourage you all to join us in the quest for simplicity, strength, and strategy as we move into a new program year together working for change. You may just find yourself opening up a metaphorical almond butter jar with your metaphorical elbow.

Best Wishes!
Welcome to DIFM and the summer issue of The Integrative RDN. For those of you who are new to DIFM and for those of you returning, welcome, we are glad that you have joined us for another year. This promises to be another year of continued growth for integrative and functional medicine and nutrition. Evidence-based nutrition information is becoming more and more available, and research on atherosclerosis to the microbiome and beyond is demonstrating that some practices that were once thought of as “snake oil” are now mainstream or becoming more accepted.

With the summer and the fall issues of The Integrative RDN, we are departing somewhat from tradition by melding the topics of cancer and cannabis across both issues. Summer will focus on the role of the ketogenic diet in cancer therapy and the difference between tetrahydrocannabinol (THC) and cannabidiol (CBD), the active compounds of marijuana. The fall CPE article is slated to be on the use of medical marijuana for cancer with complementary articles on mind-body therapies for cancer. Within this issue is information on this year’s DIFM events including the symposium on the Saturday prior to FNCE® and our annual Mind Body Happy Hour at FNCE® (MBHH) where a good time will be had by all! Information about the research project that DIFM is participating in with DPBRN is presented with a spotlight on our research associate.

I would like to take this time to thank the numerous authors, reviewers, and volunteers who make the newsletter the success it is. A complete list of volunteers will be printed in the electronic version of the newsletter, available in the newsletter archives at https://integrativerdn.org. I would like to begin with the newsletter team who tirelessly works to get this publication to you, including the past copy editor, Emily Davis Moore, RDN, MS, LD/N, who provided expert editing for the past eleven years; Jena Savadsky Griffith, BA, BS, Associate Newsletter Editor; Shari B Pollack, MPH, RDN, LDN, CPE Editor; Malorie Blake, MS, RDN, LDN, CNSC, Communications Chair; Danica Cowan, MS, RD, Biochemistry/Nutritional Genomics Editor; Raquel Praino, Dietetic Intern, News You Can Use/Resource Reviews/Spotlight Editor; Dina Ranade, RDN, LD, Botanicals/Functional Foods/Supplements Editor; Doris Piccinin, MS, RD, CDE, LDN, CDE, Mind-Body Editor; Kathleen Schofield, Student Member Services Chair; and Editors Linda Lockett Brown, ABDM, MA, RDN, LDN, CLC, and Christian Calagaus, RD. Without this exceptional team, the newsletter would not be what it is.

I would like to welcome Holly Van Poots, RDN, CSP, FAND, as the incoming Copy Editor and Ruth Goldstein, MS, RD, as the incoming Assistant CPE Editor. They both bring invaluable experience to DIFM and the newsletter. As the Biochemistry/Nutritional Genomics Editor position has been vacated as of May 31st, we are looking to fill this position. Please contact me at peaknut70@gmail.com if you are interested in the position, or as always, if you have ideas or articles for the newsletter.

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The views expressed in this newsletter are those of the authors and do not necessarily reflect the policies and/or official positions of the Academy of Nutrition & Dietetics. We invite you to submit articles, news and comments. Contact us for author guidelines.

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ISSN 1524-5209

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Upcoming Issues
- Winter 2018, Editor’s Deadline November 1, 2017
- Spring 2018, Editor’s Deadline February 1, 2018
- CPE Deadline January 15
- Summer 2018, Editor’s Deadline April 1, 2018
- Fall 2018, Editor’s Deadline July 1
- CPE Deadline June 15

Editor's Notes
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