



Harnessing Endogenous Mechanisms of Antiviral Immunity CPE Objectives

After completing this CPE activity, the nutrition professional will be able to:

- 1) Describe the four steps of the antiviral response
- 2) Understand the role of Nrf2 in protecting cells from pathogens
- 3) Identify at least three lifestyle interventions that may activate Nrf2

**CPE references, quiz, and certificate
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CPE Article Harnessing Endogenous Mechanisms of Antiviral Immunity

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Lecturer in the School of Human Movement and Nutrition Science at the University of Queensland. Following three decades in private Nutritional Medicine practice, Christine founded Cell-Logic, an evidence-focused company which develops nutrigenomically active formulations for clinical application. Her current interests lie in the investigation of phytochemicals which significantly impact gene expression within human cells, especially in the context of gut ecology, immune modulation and mechanisms that maintain cellular defenses. Sulforaphane, the bioactive phytochemical derived from certain cruciferous plants, has been the primary focus of her phytochemical research, with three indexed review publications and two book chapters supporting her acknowledged role as an authority in this field.

Disclosure: Dr Christine Houghton is the founding director of Cell-Logic Pty Ltd, an Australian company which researches and formulates nutraceutical and functional food supplements. Dr Houghton is also the developer of the Gut Ecology & Metabolic Modulation Clinician Education program.

Finding ourselves amidst a global pandemic resulting from a microscopic virus evokes understandable anxiety. The purpose of this article is to broadly contextualize the biochemical effects of SARS-COV-2 by outlining some of the mechanisms human cells use to defend themselves against such infectious organisms. The intricacies and capability of these mechanisms in a viable human immune system are such that they may completely prevent a virus from entering human cells. Should the virus gain entry to infect the host's cells, endogenous

mechanisms exist to minimize potential adverse effects. Such mechanisms represent a resource of largely untapped therapeutic targets. For clarity, SARS-CoV-2 is the virus which causes the infection COVID-19.

Human cells are remarkably complex entities, each with an intricate inbuilt set of defense mechanisms which are rapidly activated when under threat. Perhaps remarkably, public health advisers have failed to provide any of the evidence-based nutrition or lifestyle-related recommendations widely acknowledged as essential for optimal function of human physiology. Instead, individuals are influenced by a plethora of unsupported supplement recommendations, especially via online media. By investigating these innate defensive mechanisms against microbial infection, it may be possible to identify biochemical pathways as intervention points for targeted nutritional guidance. The relatively young science of nutrigenomics underpins the suggested practical interventions, targeting biochemical control points in the host's response to the SARS-CoV-2 virus.

There are few medical options to protect an individual against viral infections, especially those from the enveloped, single-stranded RNA viruses such as SARS-CoV-2. Community anxiety is compounded by the many uncertainties associated with the development of a safe and effective vaccine, with public health advice limited to measures to control viral spread via personal hygiene

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Editor's Notes



"Current Issues in Nutrition" is the theme for this newsletter. We don't always get to package it nicely together in support of a unifying through line, but this time it worked out. It is not a new nor revolutionary statement to say that the pandemic has revealed broken systems within our physiological, social, cultural, economic, political and planetary structures. We have seen the devastation revealed in the literal death of our friends, family and fellow humans and consequential death of livelihoods that has further resulted in hunger, suicide, delayed care, violence and more.

It also should not be a revolutionary statement to say that in order to stay relevant and continue making a difference in the lives of our patients, clients, colleagues and communities, as RDNs, we may first need to recommit to learning beyond our education, and second, insert ourselves into areas and organizations where we may not be traditionally seen. This is an editorial, and therefore my personal opinion, however, it appears now would be an excellent time to overcome what I see in this field as a crisis of confidence. Integrative and functional RDNs are some of the most knowledgeable and passionate people I know. Whether it is regarding individual or environmental health, these most important matters of our time directly intersect current issues in nutrition. Many are awaiting our help!

Basic biology tells us that if we improve our health we improve the bodily systems that organize us. Our continuing education article features an overview of the immune system against the backdrop of COVID-19. Suggestions on how RDNs can make an impact are sprinkled throughout, and in other articles on planetary health and food waste. The importance of focusing on regenerative agriculture is covered in our review of the book *Sacred Cow*. Importantly, thank you to Fatima Bahary and DIFM's Diversity, Equity & Inclusion team for contributing a thorough article on the evolution of the committee and its current focus and initiatives.

A very grateful 'thank you' to the newsletter team and all writers who volunteered their time and hard work. I'm also excited to welcome Janie Jacoby as Assistant Editor for *The Integrative RDN*. She's essentially been performing that role these last few years with her consistent support, filling article gaps and generating ideas. As DIFM members, we rely on you to inform us as to what we're missing, what you're loving, if you'd like to contribute or just an email to ask a question. Please don't hesitate to contact me at any time at jenas_mailbox@yahoo.com or find me on Instagram @jenagee.rd.

Happy and healthy holidays! *Jena*

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Upcoming Issues

- Winter, 2020, Editor's deadline, October 1st.
- Spring 2021, Editor's deadline, January 1st.
- Summer 2021, Editor's deadline, April 1st.
- Fall 2021, Editor's deadline, July 1st.

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A warm welcome to our fall newsletter! As a university instructor, I always look forward to fall as an opportunity to set new intentions that will guide me through the upcoming school year. This year, I continue to reflect on how I can practice becoming aware of my own implicit biases and use my privilege to challenge social injustices and help create necessary changes so that all people may thrive, which has allowed me to incorporate new philosophies in my teaching. Also this fall, DIFM held our annual leadership retreat in September to plan the coming year. Some of our intentions include more educational offerings for diversity, equity, and inclusion (DEI); sustainability; and how to support our members both personally and professionally with mind-body resources. (Of course, this is in addition to our usual educational offerings!)

The Academy's Strategic Plan includes the vision of "a world where all people thrive through the transformative power of food and nutrition." This vision, coupled with DIFM's intention to expand our DEI offerings, has guided the theme for our upcoming

Virtual Symposium on March 6, 2021. How can we "be the change we wish to see" in our profession? Connecting, collaborating, and creating an inclusive community is essential to achieving this. DIFM is proud to be collaborating with the Vegetarian Nutrition DPG and the International Affiliate of the Academy of Nutrition and Dietetics to bring you, our valuable members, low-cost CPE sessions with practical take-home messages that address how to incorporate DEI and sustainability—both within ourselves and within our community. DIFM will address the topic "integrative medicine for all people." If you are interested in applying for these speaking opportunities, please see our request for proposals on our DIFM Discussion Board and apply!

I also want to introduce our new treasurer, Basheerah Enahora, MBA, MS, RDN, LDN. Our previous treasurer, Kelly Morrow, had to step down related to a change in work schedule, and we were honored and excited that Basheerah could join us in September. Welcome, Basheerah!

Virtual FNCE® was a great success, and I hope you were able to attend our Spotlight Session "Evidence and Practice for Building Nutrigenomics Dietitians" with Yael Joffe, PhD, RDN, FACN, and Amy Ellis, PhD, MPH, RDN.

In true DIFM style, it was both educational and inspiring! This year, we decided to give our FNCE® member gift to all members, regardless of whether or not you attended FNCE®. We hope you enjoyed the goodie gift bag you received via email, and we thank everyone who contributed to these offerings! Our mind-body co-chairs, Anu Kaur, MS, RDN, RYT, and Stacy Leung, RDN, RYT, created original guided meditations and a slow-flow yoga routine, respectively, complete with Spotify playlists to help you relax and unwind after all the screen time/Zoom fatigue!

Please reach out if you would like to propose a webinar topic, share additional DEI offerings you would like to see, or let us know what would be helpful for your own professional intentions for the upcoming year—we are here to support you!

Warmly,

Kory

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and physical distancing. By contrast, largely unqualified advice abounds but seems primarily focused on recommending supraphysiological doses of isolated nutrients such as vitamins C and D and the trace element zinc—an approach representative of a pharmaceutical model, not a nutritional model. A closer examination of the mechanisms human cells use to detect and respond to exogenous threats leads us to several biochemical pathways readily accessible to nutritional intervention; this article highlights some of these options.

How Cells Respond to Exogenous Threats

To understand how the integrity of the immune system is dependent on optimized nutrition, it is important to consider how human cells counter exogenous threats to their normal function. Such threats may be due not just to infectious organisms but also to environmental factors as well as to compromised physiological function that results in aberrant biochemical pathways that lead to accumulation of endogenous metabolites. The presence of certain single nucleotide polymorphisms (SNPs) in an individual may also nutrigenetically impact the response to food molecules.

It has been long acknowledged epidemiologically that those populations consuming the highest proportion of plant foods typically exhibit the most favorable health status markers. For decades, it was assumed that this effect was due to the antioxidant vitamins in fruits and vegetables—an incomplete and erroneous assumption that heralded the burgeoning of the antioxidant supplement industry. However, several large meta-analyses were unable to show any preventive benefits of such supplements in cancer and type 2 diabetes, with some studies being stopped early due to serious adverse effects, including death.¹

Nrf2 and the Importance of Signalling

It was not until 1994 with the isolation of the transcription factor Nrf2 that the more complex

mechanisms of cellular defense became apparent. Nrf2 acts as a cytoplasmic “switch” to activate a battery of cytoprotective genes, thereby providing the first real clue that diet-derived non-nutrient compounds have the potential to co-ordinately influence large banks of function-specific genes, including those coding for the primary antioxidant and detoxification enzymes, many times more potent in their redox-modulating effects than are exogenous vitamin antioxidants.² The phytochemicals and other food-derived molecules capable of activating Nrf2 are readily available in an optimized diet and in some cases as standardized high-potency whole-food supplements. More so, nondietary interventions such as exercise are also shown to exhibit some of their health-promoting effects by activating Nrf2 in response to the additional superoxide, a stressor generated through the greater oxygen requirement of the mitochondria.³

Nrf2 is bound in the cytoplasm to Keap-1, a protein that acts as a sensor to detect stressors to the cell; frequently these stressors are pro-oxidant in nature. Perhaps counter-intuitively, it is the effect of *pro-oxidant* stressors that activates synthesis of the cell's protective *antioxidant* and detoxification enzymes as well as the non-enzyme antioxidant, glutathione.

Because Nrf2 is responsive to a variety of cellular threats, the cell determines its own need for the synthesis of antioxidant enzymes, a process precisely tuned on a moment-to-moment basis according to cellular demand. This is quite unlike the cellular responses that result from an arbitrary increase in synthetic vitamin antioxidants from supraphysiological supplement doses. In such high cellular concentrations, the *antioxidant* vitamins can mask the weak *pro-oxidant* signals of the stressor in activating Nrf2.⁴ As a result, the cell will fail to activate its defense mechanisms as needed. The use of phytochemicals and other Nrf2 activators provides a tool for *upstream* modulation of the multifaceted cellular environment as distinct from using blunt instruments

like individual nutrients for their inconsistent *downstream* effects.

A Premise that Drives a Therapeutic Approach

The foundation of this article rests on the premise that the immune system is comprised of a network of intricate interactive pathways carefully modulated to address the presence of an infective micro-organism in such a way that it maximizes its biochemical attack until the threat no longer exists, thereby carefully preventing the destruction of its own cells. The “cytokine storm” which has been extensively discussed in a COVID-19 context reflects the situation wherein the host attack on the virus fails to shut down when the virus is no longer a direct threat. The pro-inflammatory cytokines and other destructive molecules required to eradicate the virus continue to be secreted, thereby destroying the cells of the host.

Clearly, there is a turning point wherein the immune system must shut down its synthesis of antiviral “weaponry” and switch its defense mechanisms over to protection and repair of its own cells. From a clinician's perspective, it is not possible to know when the “change-over” occurs. Such uncertainty was evident in the early days of the pandemic when witnessing discussions on whether or not one should recommend traditional immune-influencing medicines like elderberry (*Sambucus spp*), touted as “immune boosting.” When considering *upstream* nutrigenomic immunomodulation, the direct anti-inflammatory effect of a plant extract is largely irrelevant.

A Carefully Orchestrated Four-Stage Antiviral Response

Long before the individual is aware of any illness, the intact immune system is already actively mounting its attack. In the first step, the cells must identify the presence of a threat which is subsequently identified by cells of the immune system as a viral threat.

Recognizing that the threat is viral, the immune system tailors its

response accordingly. Not only is the virus destroyed by the cell's chemical "weaponry," but the virally infected cells of the host become collateral damage—a process which requires the support of detoxification enzymes and other Nrf2 targets of the cellular defense mechanisms. In a further stage, the immune system recognizes that the threat has passed and must subsequently switch to synthesizing a range of anti-inflammatory biomolecules designed to prevent further collateral damage to the cells of the host; at this point, homeostasis has been restored (Figure 1).

Innate Immune Functions

This article highlights a vastly simplified sequence of these four essential steps associated with innate immunity, subtly different in each epithelial location. The innate immune system is an immediate responder, generating large quantities of inflammatory cytokines designed to destroy its own virus-infected cells. Innate immunity is largely characterized by six key processes, several of which are direct targets of Nrf2 activation. Innate defenses act rapidly to prevent unwanted "invaders" from penetrating the epithelial cells lining the gut and respiratory system in particular, as well as providing similar protection to the endothelial cells of the circulatory system.

In the current COVID-aware environment, there would appear to be little reference to the extremely important role of the innate immune system which is largely neglected as a key intervention point with both preventive and therapeutic potential. That its response is immediate is a key indicator that it could be considered as an important intervention target.

Examining Three Key Innate Targets

1. EPITHELIAL TIGHT JUNCTIONS (TJs). In healthy cells, the TJs form a barrier to prevent entry of microbes, their metabolites, and other unwanted molecules from penetrating the underlying immune network. All types of epithelial and endothelial membranes are

equipped with TJs. Particular food molecules such as *ethanol*, *gliadin*, and *piperine* are among those which can compromise TJs; but the integrity of the gut barrier is influenced more broadly by numerous factors which include redox status and glucose metabolism.⁵

2. TOLL-LIKE RECEPTORS (TLRs) and T cells. The presence of specific TLRs on epithelial and endothelial surfaces enables the detection of pathogens including viruses. TLRs recognize molecular patterns on the outer wall of microbes. Different TLRs can recognize and differentiate between bacteria, parasites, viruses, and other undesirable microbes. Whereas a virus is *detected* by certain innate epithelial TLRs, the weaponry of the innate immune system can be activated by probiotic *gram-positive* organisms such as the *Lactobacillus spp.*⁶ When this organism's surface molecule, lipoteichoic acid (LTA), binds to TLR2, it activates macrophages which, through a series of signalling steps, results in rapid synthesis of pro-inflammatory cytokines together with potent antiviral molecules such as natural killer cells, cytotoxic T cells and interferons.⁷

What has emerged in recent years is that this response is active whether the probiotic species is dead or alive. Heat-killed probiotics standardized for optimal LTA content have been developed and clinically trialled for their immune-modulating effects in humans.⁸ T helper cells of different types

are active in this process and where there has been a successful resolution of a viral infection, regulatory T cells (or T reg cells) play a key role in restoring homeostasis. At this point, specific T memory cells can remain for some time to defend against future attacks by that microbe.⁹

Although fermented foods have formed an important part of the diets of many cultures for centuries, their role as sources of immune-modulating microbes such as the *Lactobacilli spp* has only recently been appreciated. Such probiotic microbes abound in foods such as yogurt, kefir, sauerkraut, kimchi, and others.¹⁰

3. ANTIMICROBIAL PEPTIDES (AMPs). These include *beta-defensins* and *cathelecidins*, potent antimicrobial molecules capable of selectively destroying pathogens without adversely affecting commensal organisms. Epithelium-derived beta-defensins are coded by Nrf2 target genes, thereby providing an accessible therapeutic target.¹¹ Beta-defensins and other AMPs are synthesized abundantly by healthy epithelial and endothelial membranes and form a key component of innate immune defenses.¹²

Adaptive Immune Functions

By contrast, the second stage adaptive immune system may take five to seven days to respond. It is in this second stage that neutralizing antibodies are produced. Instead of destroying cells from within as occurs

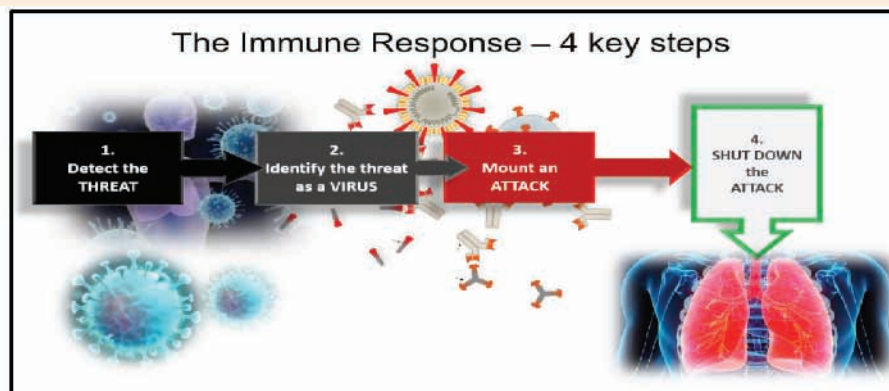


Figure 1: For the immune system to mount a defense against an invading pathogen such as the SARS-CoV-2 virus, it must first detect that the host's cells are under threat; identify the threat as a virus; mount an attack; and, when the pathogen has been destroyed, shut down the release of its "weaponry" to minimize further destruction to its own cells, many of which will have become collateral damage as infected cells are destroyed.

Figure 1 Courtesy of author.

in the first few days of infection, the antibodies remain outside the cells in an active surveillance mode, primed and ready for further attack. It is generally considered that when antiviral antibodies are present in a large proportion of the population, a state of herd immunity may exist with the virus then becoming a minimal threat to the community. This definition of herd immunity has been recently challenged by some who claim that T cell immunity may also play a role.¹³

Nrf2 in the COVID-Threatened Cell

Because clinicians lack the ability to manipulate such intricate and self-modulating processes, another approach might be to intervene further biochemically upstream where such “micromanagement” is neither appropriate nor effective.

The value of targeting a cellular “switch” like Nrf2 is that it does act *upstream* in a way that can activate several hundred cytoprotective genes simultaneously. Nrf2 has been variously referred to as the “master regulator of cytoprotective genes,” a “master redox switch,” “the guardian of healthspan and keeper of species longevity,” confirming its key role in supporting cellular defense mechanisms.¹⁴

The Role of the ACE2 Receptors

It is now well accepted that the SARS-CoV-2 virus gains entry to human cells by the attachment of its characteristic spike protein to the ACE2 receptors abundant on epithelial and endothelial cells. ACE2 receptors are that part of the RAS-Angiotensin System to provide vascular protection. What is less well-known is that a second epithelial enzyme is essential for viral entry.¹⁵ (**Figure 2**)

Analogously, the attachment of the spike protein to the ACE2 receptor is like putting a key in a lock; whereas activation of the second protein is like turning the key in that lock. The second protein is a trans-membrane protease, TMPRSS2, and when activated, cleaves part of the viral spike to subsequently allow the membranes of the spike and the cell to fuse, allowing the virus to enter the cells. At the same time, the protective ACE receptor becomes

non-functional.¹⁶ It is considered likely that loss of protective ACE2 receptor function contributes significantly to the vascular effects which are responsible for much of the morbidity evident in some of the more seriously ill COVID-19 patients.

SLPI: Blocking the ACE2–CoV-2 “Lock”

As is frequently the case in cellular systems, nature has provided for modulation of the TMPRSS2 protease with the presence of another enzyme, Secretory Leukocyte Protease Inhibitor (SLPI), which is coded by a Nrf2 target gene. Reduced

in maintaining homeostasis in part by induction of antioxidant and detoxification enzymes.

As shown in **Figure 3B**, SLPI blocks the action of TMPRSS2, so that it would seem logical to assume that Nrf2 activation might upregulate SLPI to inhibit TMPRSS2 and consequently prevent ACE2 cleavage. SLPI then becomes a clinically relevant potential intervention point, relatively easy to target by activating Nrf2.¹⁶

Nrf2 Activation and Lifestyle Factors

The Brassica-derived phytochemical sulforaphane (SFN)

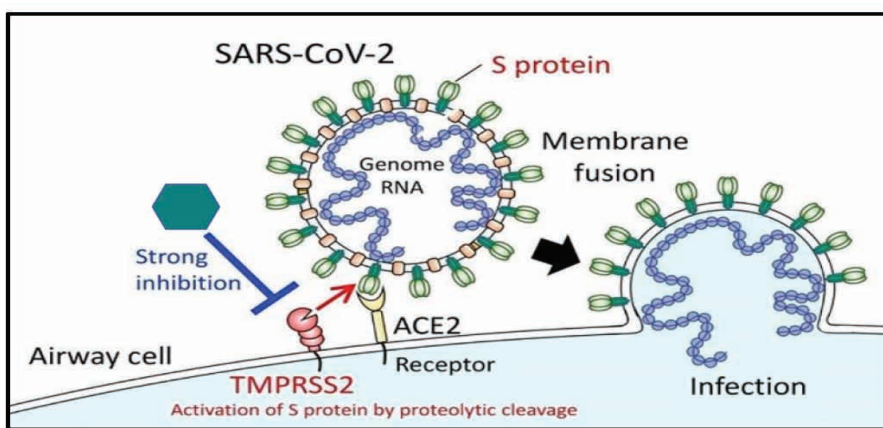


Figure 2: How SARS-CoV-2 enters human cells, utilizing both the ACE2 receptor and the TMPRSS2 protease enzyme. Image Credit: 2020 The University of Tokyo.

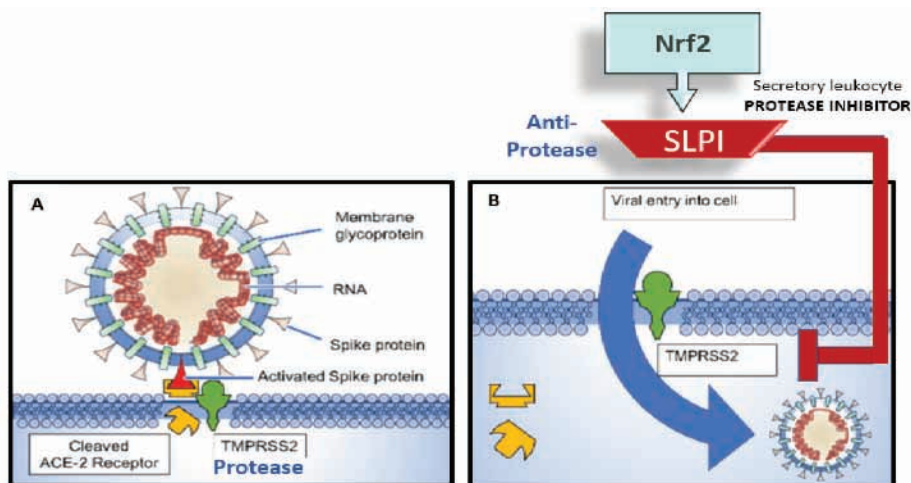


Figure 3 (A & B): The 2-enzyme requirement for SARS-CoV-2 entry into human cells. In **A**, the viral spike “docks” onto the ACE2 receptor; and assisted by the protease, TMPRSS2, the ACE2 receptor is cleaved and the membranes of the spike and the host cells fuse, allowing the virus to enter. In **B**, a protease inhibitor, SLPI, coded by a Nrf2 target gene, inhibits TMPRSS2, thereby preventing viral entry. (Image adapted from Rabi et al.¹⁶)

SLPI activity has been associated with several respiratory conditions such as emphysema and cystic fibrosis and is highly expressed in epithelial cells, especially in nasal epithelia and immune cells.¹⁷ Nrf2 is also active in these cell types, playing a critical role

is acknowledged as the most potent naturally occurring Nrf2 activator, known to be active in all cell types. A 2013 clinical trial of healthy volunteers confirmed that supplementation with a SFN-yielding broccoli sprout homogenate over

3 days activated both Nrf2 and SLPI. It concluded that SFN has the therapeutic potential to augment SLPI expression in the nasal mucosa.¹⁸ The study dose of 20 mg SFN yield daily is readily achievable in practice via a high SFN-yielding myrosinase-active broccoli sprout supplement. Although SFN is recognized as the most potent naturally occurring Nrf2 activator, there are numerous other food sources that when combined, are responsible for significant Nrf2 activation. This fact could be considered intuitive given the benefits of a diet high in plant food coupled with the acknowledged role of Nrf2 in disease prevention.¹⁹

Such a diet is abundant in polyphenols, phytochemicals which are large bulky molecules, a property contributing to their very poor bioavailability. In addition, they are extensively metabolised by the gut microbiota such that some of the observed cellular effects are likely to be due to the metabolite rather than to the intact polyphenol.²⁰ Clinical responses to well-known supplemental polyphenolic molecules such as curcumin, resveratrol, epigallocatechin gallate (EGCG) and others are equivocal and a 2016 global position paper investigated the many factors that may contribute to the observed inter-individual variability.²¹ Too numerous to list individually, polyphenol-rich plant foods in combination additively activate Nrf2, further supporting the relevance of dietary diversity in human health. Many questions in the field of polyphenol nutrition remain unanswered in relation to their clinical effects both individually and in combination, especially when compared with *in vitro* findings.²²

Other lifestyle factors such as sleep and exercise also contribute to Nrf2 activation.²³ Melatonin, the sleep-inducing chemical, is an Nrf2 activator, perhaps reinforcing the value of adequate sleep as an important immune-protective factor.²⁴ Recently a role for melatonin as an adjuvant in the management of COVID-19 has been suggested.²⁵ Exercise as another key lifestyle factor has also been shown to benefit the immune system, at least partially by Nrf2 activation.^{26, 27}

Other Adverse Effects of SARS-CoV-2 on Human Physiology

The SARS-CoV-2 virus directly attacks the beta-1 chain of the hemoglobin molecule, thereby releasing highly oxidative unbound ferrous ions, further contributing to cellular and tissue damage. With one-quarter of the damaged hemoglobin molecule non-oxygen transporting, the COVID-19 patient readily becomes hypoxic, a factor readily observed in the most serious cases. Activation of Nrf2 as discussed earlier may assist in reducing the severe oxidative damage seriously compromising the recovery of those with the most severe COVID-19 illness.²⁸

Practical Interventions

As outlined earlier, there is no evidence to indicate that isolated trace element or synthetic vitamin supplements play any role in the host's detection of a viral threat, the initiation of an antiviral response, nor the shut-down of that response at the appropriate time. Even though nutrients like vitamin C exhibit some antiviral effects at a molecular level, there is limited evidence for any benefit of vitamin C supplementation in those whose ascorbate levels are normal.²⁹ Similarly, zinc³⁰ and vitamin D³¹ are associated with immune-modulating effects at the cellular level but evidence for supplementation at supraphysiological levels remains equivocal. All nutrients, by definition, are essential for peak function of human cells; a well-planned diet can, in most cases, achieve appropriate nutrient status. *All* nutrients are required for normal immune function.

This article highlights several practical means an individual may readily and inexpensively implement. Because Nrf2 activation plays several roles in immune modulation, a plant-rich well-balanced diet, moderate exercise, and adequate sleep play key roles in Nrf2 activation. Furthermore, the inclusion of *Lactobacillus*-rich fermented foods supplies the signalling molecules which activate the immune-modulating pathways downstream from TLR2.

Conclusion

By highlighting the mechanisms by which the SARS-CoV-2 virus enters and damages several key elements of the host's cells, this article illustrates several *upstream* intervention points that may assist in both the prevention of SARS-CoV-2 infection and treatment of patients who may already be infected. The mechanisms herein discussed highlight the fact that supraphysiological doses of isolated nutrients used as interventions do not have the capacity to detect the threat of the virus, nor can they intervene in the mechanisms identified herein. A clinician would naturally encourage the patient to observe dietary practices and other lifestyle habits that ensure that nutrient intake at least meets recommended levels. In addition, foods or supplements that optimize Nrf2 activity and TLR2 activation may be considered as a further enhancement to the nutrient-replete diet.



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CPE Activity: New Instructions

REMINDER: New Instructions for Completing the CPE Activity for Credit

1. Access the Continuing Professional Education article from the eatrightStore: <https://www.eatrightstore.org/dpg-products/difm>. DIFM members will receive the articles for \$0. Non-DIFM members can purchase CPE for \$24 (Academy members) or \$54 (non-members).
2. Check your email for instructions on how to access the CPE Activity.
3. Read the Continuing Professional Education article, answer the associated quiz questions, and complete the Critical Thinking Tool. For each question, select the one best response. Compare your answers to the answer key on this page.
4. After passing the quiz, claim your credits, view/print your certificate, and access your CPEU credit history through <http://eatrightcpe.org/>.



Integrative Dietitians as Environmental Stewards and Climate Champions

Mary Purdy, MS, RDN
Integrative Eco-Dietitian



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medicine and functional nutrition approach. She has given over 100 nutrition workshops and webinars, speaks regularly at nutrition conferences and was the keynote speaker at Bastyr University's 2019 Commencement Ceremony. Additionally, she hosts the podcast *The Nutrition Show*, authored the books *Serving the Broccoli Gods* and *The Microbiome Diet Reset*, and is a consultant around creating a sustainable and resilient food system that supports our environment and helps to mitigate climate change. She's the proud recipient of DIFM's 2020 Excellence in Practice Award. Her website is www.marypurdy.co

The climate crisis is in full force, and yet our greenhouse gas emissions continue to rise. Experts predict this will likely make our planet uninhabitable by the end of the century and contribute to numerous environmental disasters, in addition to food and water shortages well before then, if action is not taken.¹ Global warming has already had many negative health repercussions, not only by increasing the incidence and spread of diseases like malaria and dengue fever in developing countries, but by contributing to many of the chronic conditions we as practitioners see on a regular basis in developed areas like the United States that include respiratory, cardiovascular, and heat-related health issues. Additionally, experts claim that these kinds of chronic health issues have been associated with poorer outcomes of COVID-19, creating further urgency around the need to make significant changes.²

Climate change also threatens our food system which ultimately means it threatens our survival. In their *Special Report on Climate Change and Land* released in 2019, the Intergovernmental Panel on Climate Change warned that extreme weather events like drought, flood, and fires are resulting in reduced crop yields, increased pests, less arable land, and soil that is not only less healthy but less resilient to natural and unnatural disasters. If global warming is to be kept below the goal of 2°C set by

the Paris Agreement, greenhouse gas emissions need to be at zero by mid-century.³ But there's hope! Food is a critical component in the fight against climate change. Did someone say "food"? Yes. And where food is, dietitians are. Or, where we need to be, especially as it relates to the rapidly changing climate.

Many individuals have sought to reduce their carbon footprint by driving or flying less, recycling more, taking shorter showers, buying eco-friendly products, using different lightbulbs, and perhaps by participating in political actions targeting the fossil fuel industry. What is not commonly known is that around 30% of our greenhouse gas emissions come from our global food system.⁴ Additionally, our food system is one of largest drivers of biodiversity loss and ocean acidification, which further exacerbate the climate crisis by reducing the earth's ability to sequester carbon from the atmosphere. It's imperative that dietitians and future dietitians are a part of creating a sustainable, resilient, and regenerative food system that is aligned with the Paris Agreement and UN Sustainable Development Goals. How we grow, harvest, transport, process, produce, package, distribute, consume, and waste food is a major part of the climate problem. It may also be part of the solution.

Specifically, as aspiring or established integrative and functional medicine practitioners, we have a tremendous role to play. Addressing climate change takes a systems-thinking approach both in understanding the contributing factors and finding the potential solutions. Functional dietitians understand what it means to seek out and tackle those root causes and work to restore balance in a disrupted and dysfunctional system. We have a keen understanding of the interplay of the numerous components that determine a person's wellness picture. The food system, like the human body, is also a series of interacting components all of which have an impact on the health of that food system and ultimately the planet. Effectively addressing the crisis means getting to the underlying causes

and understanding how to make impactful shifts that have exponential positive effects.

Additionally, many of us see nature as a healing force and an integral part of therapeutic lifestyle interventions for numerous health issues, so we may already be incorporating discussions of the environment into our patient interactions. Lastly, we work to prevent disease with food and lifestyle-as-medicine approaches that can potentially reduce the need for additional healthcare, purported to be responsible for around 9% of greenhouse gases.⁵

So where does one begin? You may have heard the buzzword "sustainable" in relationship to diets and the food system, and yet many argue that the current system is not anything that we would want to sustain. Industrial agricultural practices have had a devastating effect on the health of our soil, harming this underground ecosystem which helps bring nutritional value to the very foods we are recommending. The goal now is to bring resilience and regeneration to the system as it faces more challenges with extreme weather patterns wreaking havoc on the land and with COVID-19 further revealing the immense disparities and lack of equity apparent in communities of color and indigenous populations in terms of both environment-related health repercussions and food access.⁶ We need to work towards a food system that "conserves and renews natural resources, advances social justice and animal welfare, builds community wealth, and fulfills the food and nutrition needs of all eaters now and in the future."⁷ Below are three key ways for dietitians to take an active role.

1. Advocate for more plant-based foods and less meat consumption and production. One of the largest contributors to greenhouse gases in our food system is our current industrial animal agriculture system. Animal products like beef and dairy contribute to around 15% of global greenhouse gases which is more than the entire transportation sector.⁸ This is attributed to (1) massive deforestation to raise both

cattle and grow the crops that feed them, which releases carbon dioxide into the atmosphere; (2) chemical inputs into the land, like fertilizer which produces the greenhouse gas nitrous oxide; and (3) the burped-up byproducts of cattle digestion that emit massive amounts of methane, a greenhouse gas that is far stronger and traps more heat than carbon dioxide. Interestingly enough, globally, the supply of red meat is at 568% of what the population needs for a healthy diet. Yet, we fall short of meeting the recommended amounts of fruits and vegetables as well as the beans, grains, nuts, and seeds that are produced using less energy-intensive systems and far fewer resources.⁹ While there is, of course, an important place in our food system for humane and sustainable animal agriculture,¹⁰ one of the biggest changes we can help individuals, communities, and institutions make is to promote a more plant-based diet. Whether this is in one-on-one counseling, efforts made in a hospital or cafeteria food service setting, in the planning for an in-person conference or event, or working with large food brands and companies, dietitians can change the conversation. Unfortunately, the argument for meat reduction isn't as simple as individuals substituting a burger for a veggie patty a few times a week. As dietitians, we need to also be working with and demanding that food service management companies like Compass, Sodexo, and Aramark make their offerings more climate-friendly. These organizations are providing much of the food for millions of individuals at universities, colleges, stadiums, and hospitals. Reducing the purchasing of red meat by 30% would be the equivalent of taking a million cars off the roads over 10 years.¹¹ We also need a major systemic overhaul of the US government's role, including subsidizing different foods and changing public policy. While it's clear that agribusinesses need to be shouldering much of the responsibility for greenhouse gas emissions, we also know from watching numerous movements that consumer demand has and can participate in driving system change. Multiply these kinds of consumer and institutional decisions and purchases by 10,000 (or even 10 million), and the food

industry is going to take notice. We may not have to do all the convincing. There has been a growing interest from consumers in purchasing foods with lower environmental impact.¹²

2. **Encourage and promote regenerative agriculture and agroecological practices.**

Regenerative agriculture goes beyond "organic" in that it actively focuses on improving upon the health of the system by working in harmony with nature as well as supporting farmer and animal welfare. Soil is also key here. We know that when the soil is healthier, the humans who eat food grown in that soil are healthier. But soil is so much more than that. It can act as both a "carbon sink"—that is, holding carbon in the ground instead of it entering into the atmosphere—and as a water filter. Because of current industrial agricultural practices, soil has been degraded and its carbon-holding potential compromised.¹³ Healthy soil not only increases nutrient status and bolsters plant resistance to disease, but it is also more resilient to the effects of extreme weather events and promotes biodiversity which makes the land less susceptible to pathogens. Agroecology takes it a step further in that it brings in both a respect for food culture and food governance by local populations and indigenous peoples.¹⁴ Not only is this key for helping to promote racial justice, which is intricately intertwined with climate justice, but we also have much to learn from the farming practices of indigenous peoples who may be able to offer invaluable support and wisdom through this crisis.

As dietitians, we should not only advocate for shopping at local farmers' markets for those who are fortunate enough to have access to them. We can also work with restaurants, chefs, and institutions to include more locally and regeneratively grown foods as part of their food sourcing. In fact, we are perfectly positioned to solidify the argument that these eco-friendlier practices also foster human health. We can work to amplify the voices of indigenous and black farmers and be involved in the world of policy as well, working to ensure that the

USDA and our dietary guidelines consider the potential benefits of promoting these kinds of agricultural practices as well as the risks of maintaining the system as is.¹⁵

3. **Work to reduce food loss and waste.** This might be the action we can champion that would have the least amount of friction, since it may not pose the same challenges as changing dietary habits or having access to certain foods. Food loss and waste is significant worldwide. When food decomposes in landfills, it generates substantial quantities of methane, which, as mentioned above is more potent than carbon dioxide. On average we waste around 30% to 40% of the food currently produced (about 1200 calories/person) which accounts for approximately 8% of total greenhouse gas emissions. The peach never makes it off the tree, farmers can't sell eggplant with an extra nose, many of us allow groceries and prepared foods to rot in our refrigerators, restaurants discard plates of unfinished hash browns, and numerous institutional facilities throw out tons of food yearly. In fact, if all the world's food losses and waste were represented as a country, that "country" would be the third highest greenhouse gas emitter, after China and the United States.¹⁶ Yes, composting is an option, but all the energy and resources that went into creating that wasted food doesn't just disappear and must be factored in. Again, dietitians can be educators and allies here, not only in our ability to get creative about how to turn imperfect produce into delicious meals, but to advise around the "best by" labels, design composting programs, alerting consumers about nearby 'misfit' markets and offer guidance around conservative purchasing practices.

The intersection of the food system, the environment, and human health is nothing short of complex; but as experts in the food and nutrition space, we have an incredible opportunity (and obligation) to be trailblazers in the fight around climate change. No matter what sector we work in, dietitians can exert influence in many areas, from individual and institutional food consumption to national-level food policy. Whether we work with what's being eaten, how it's being grown, or how it's being

disposed of, we can make a difference. If you write, speak publicly, or have an online platform, you can use it to educate on and promote these ideas and to make plant-based food look as delicious as humanly possible. If you are in academia, you can incorporate issues of sustainability and regenerative agriculture into any and all aspects of your curriculum. Again, as systems thinkers and those with a vested interest in human wellness, we cannot separate a healthy food system from a healthy biological or ecosystem. The good news is that the foods that are healthy for humans are usually those that have a lighter environmental footprint.¹⁷ It appears that once again, food is not only medicine for the person but also for the planet; and dietitians are leading the charge.

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DIFM and Diversity, Equity and Inclusion

By Fatima Bahary, RDN, DIFM Diversity, Equity, and Inclusion Committee Chair, and DEI Committee Members



Fatima Bahary, RDN, is a pediatric and adolescent outpatient clinical dietitian at University Hospital in Newark, NJ, and the Adult Cystic Fibrosis Clinical Dietitian at the Cystic Fibrosis Center at Rutgers

Robert Wood Johnson Medical School. She also runs her private practice, NutriJaan Nutrition Services, where she utilizes an integrative and functional approach to help her clients reach their personal goals. She also speaks at various events to help educate her community about nutrition and overall health and wellness. In her spare time, she loves to bond with loved ones, travel, and dance.

Writing this took me some time. As much as I felt the need to soften my words in hopes of not making anyone feel uncomfortable, this information needs to be vocalized in its raw form. There has been a heightened focus on this topic, and it's about time. *There needs to be inclusivity and representation within our field of dietetics.* Not only for obvious reasons, but because as dietitians this can be our way to help combat what has been happening in regard to racial and identity injustices. This is a crisis. Blacks, Hispanics, Indigenous, and other Americans from minority groups—whether based on religion, ethnicity, gender identity, or sexual orientation—are at risk of health inequities stemming from systemic racism and historical policies.

Some may ask if this is really even an issue. The answer is yes. All factors play a role, but I want to shed light particularly on implicit bias. Implicit bias is defined as the attitudes or stereotypes that affect our understanding, actions, and decisions in an unconscious manner.¹ These biases leave legacies over time in the form of systemic bigotry. As healthcare professionals, this is a major concern as it can impact our decision-making in care. Our self-reflection and self-awareness become critical as we make decisions and formulate treatment plans for diverse patients.

According to the 2019 Compensation and Benefits Survey of the Dietetics Profession, over 80% of the 93,000 RDNs in the United States are white;² therefore our field fails to reflect the populations we serve. Furthermore, the absence of diversity

can shun and perpetuate this lack of representation. Images that we are fed reinforce certain ideas. So by consistently depicting representation, this allows for a change of mental software, and therefore more acceptance. Efforts can be made to have current nutrition professionals of color and various backgrounds included in panels and discussions, for example. Not only to bring a different perspective and be inclusive, but to also make it more welcoming to students of color and various backgrounds who may be interested in joining our field. When you see people you associate and identify with, you are more inclined to feel a sense of belonging. This will allow you to believe that it is attainable and meant for you, too.

DIFM is committed to taking action on diversity, equity, and inclusion (DEI). Promoting diversity was always on our radar, but in light of recent events, it has become one of DIFM's top priorities. The Diversity Committee was started in 2014 by Rita Kashi Batheja, MS, RDN, CDN, FAND, AFMCP, to shed light on cultural sensitivity and competency within our field. However, targeting only diversity wasn't enough, and thus we broadened our focus to include equity and inclusivity—so that not only cultures, but individuals with different values, beliefs, and ways of life are represented. And thus the committee's name was changed to Diversity, Equity, and Inclusion (DEI). Knowing that there is a lot of work to be done, we increased our team from two members to five members (including myself): Lora Silver, MS, RD, LD; Manju Karkare, MS, RDN, LDN, CLT, FAND; Elise Harrison, RDN; and Miho Hatanaka, RD (also DIFM's Secretary). The efforts and goals set forth by DIFM's DEI Committee are a continuation of who we are, what we stand for, and what we have been doing. We are taking steps to tackle inequity, address the lack of inclusion, and actively diversify the field of dietetics. The following are initiatives the DEI Committee will be working on for 2020-2021.

Storytelling in Brave Spaces: Through the Lens of Diverse RDNs

In June of this year, the DEI Committee started a board

development campaign. The goal behind it is to recognize our own implicit biases and to generate empathy and trust. At the beginning of each bi-monthly leadership call, there is an open dialogue about personal and lived experiences of bias, racism, and oppression. Each member who volunteers is given one minute to speak. Subsequent members are able to respond to the previous story, or they can share a different experience. "What is said here, stays here, and what is learned here, leaves here," said DEI Committee member Manju Karkare while moderating one of our first sessions. We emphasize that this is a safe space, since these can be difficult conversations to have. But as difficult as they may be, it is much needed. They enhance everyone's self-awareness and ability to take anti-racist and anti-oppressive action in our personal and professional lives. Because without recognizing that these issues exist, how will they truly be addressed? There is power in storytelling, and we hope to use this power to tap into each other's emotions so that more of us can take a stand.

This ongoing reflection about bias and racism is valuable for all of us regardless of specialty or practice area. These conversations are uncomfortable, yet they reveal unconscious biases that must be dismantled in order to achieve equitable health outcomes for all. Currently, this is done at the start of each leadership meeting, but we hope to offer this to all DIFM members in the coming months.

Podcast

In 2019 after winning the Academy's Diversity Grant, the DEI Committee used the funds to start a podcast, "The EmpowerRD Nutritionist: DIFM's Strength in Diversity." Dietitians from various backgrounds are invited to discuss food habits and the use of complementary and alternative medicine common to their culture. The goal is to empower the listener by increasing familiarity with cultures, their practices, and addressing common stereotypes. With this goal in mind, we hope that it becomes easier for the practitioner to build rapport so that the client or patient can trustfully share their concerns and habits

without feeling judged. You can tune into our podcast on iTunes, Stitcher, and Google Play. If you're interested in being a guest and sharing your knowledge and insight about your culture, please email fatima.bahary@gmail.com.

Stipends

Each year we award two Diversity Stipends—one for a professional and one for a student studying to become an RDN. The winners must self-identify with a diverse community and must also be working with or intend to work with an underrepresented population. This year the stipends were awarded to Malu Trehan RDN, MPH, and Demetria L. Cox-Thomas. Malu is a dietitian in private practice in San Ramon, California. With this stipend, Malu plans to create a Diabetes Prevention Program (DPP) telemedicine offering that focuses on the South Asian population in the East San Francisco Bay Area. Demetria is a MS/DPD student in the Human Nutrition program at Winthrop University in Rock Hill, South Carolina. With this stipend, Demetria plans to

further her education and complete DIFM's Integrative and Functional Nutrition Certificate of Training.

Webinars

The DEI Committee sponsors a fall and spring diversity webinar each year. Topics can range from different cultures, to religions, to ways of life. Each webinar goes into detail about the history, practices, and key takeaways for that specific group. Again, the goal here is to increase competency, sensitivity, and appreciation. Webinars are free to DIFM members, and recordings of all our webinars are in the archives section on DIFM's website.

Celebrating diversity leads to inclusivity and can help in yielding equity. In addition to making our field a better representation of everyone that we serve, let us not forget that celebrating diversity allows us to draw strengths and inspiration from our unique backgrounds and experiences. The DEI Committee and DIFM are determined now more than ever. The following are a few things each

of us can do today to promote a more inclusive and equitable world: have hard conversations with close friends and colleagues, fund black and indigenous people of color, ask yourself how you embody an agent of change. Furthermore, recognize personal implicit bias—there are many tests available online that you can take. Harvard University offers a free Implicit Association Test that can project certain attitudes and beliefs of which you may be unaware.³ This isn't to put down white people but rather to give a chance to non-white people because history was unfair to them. Folks of all races and ethnicities benefit from this work, and our field becomes much stronger as a result.

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The RDN's Guide to Reducing Food Waste

Amanda Terillo, MS, RD, IFNCP



Amanda Terillo is an Integrative and Functional Nutrition Certified Practitioner, Registered Dietitian, and an environmentalist. Early in her studies, she saw a disconnect between agriculture and

nutrition. She pursued her passion and obtained a master's degree in Sustainable Food Systems. Amanda is the author of *Kitchen Confidence: Improve Your Health, Save Money, Waste Less*, which is a guidebook for consumers to learn how to cook without recipes and reduce food waste. Amanda lives and works on Olive Branch Gardens which is a small organic vegetable farm that also includes potbellied pigs, chickens, and honeybees.

Food waste has long been a problem in the United States and around the world. During the past decade, food waste and its consequences have received a lot of attention; and many organizations and new programs have emerged to help reduce or redistribute food waste. The United States wastes the most food as nation. Nearly 80 billion pounds of food is wasted each year, which is 30% to 40% of the food supply, and a majority of it ends up in the landfill. This averages to 219 pounds per person annually and roughly \$1,160 yearly for a family. Food waste comprises 22% of municipal solid waste.¹ These are troubling numbers considering more than 37 million people struggle with hunger in the United States, including more than 11 million children.²

In the developed world, the greatest food waste occurs at the consumer level. This means that after food is grown, processed, harvested, and transported, we are throwing out the end product which is perfectly good and edible food. Households are not the only ones responsible for food waste. US restaurants generate an estimated 22 billion to 33 billion pounds of food waste; and institutions such as schools, hotels, and hospitals generate an estimated 7 billion to 11 billion pounds of food waste.³ The most commonly wasted foods are fruits and vegetables followed by cereals. Food is wasted for many reasons including:

- Physical damage during handling
- Expired use by date or confusion with label dates
 - * Did you know that the only food that legally has to have an expiration date is infant formula? All other dates are optional and decided by the food manufacturer.
- Biophysical degradation of product (dehydration, wilting, discoloration)
- Over-purchasing or inappropriate purchasing while grocery shopping
- Excessive portioning at meals
- Incomplete emptying of container
- Trimmings and other food prep waste
- Not consuming leftovers

With COVID-19, there are new issues and challenges within our food system and food is now being wasted in different ways. According to the American Farm Bureau Federation, it is estimated that only 8% of US farms supply food locally through avenues such as farmers markets, Community Supported Agriculture (CSAs), grocery stores, etc. The rest of US farms supply national food chains that involve many suppliers and handlers. The two main food supply chains are grocery stores and food service establishments. When stay-at-home orders went into effect, many food service establishments such as restaurants, hospitals, nursing homes, and schools closed or began serving limited numbers of people. This was especially troublesome for farmers who only produce food to supply these types of institutions. The farmers were then left with a product that their normal supplier did not need. This forced many farmers to either forgo harvesting, leaving their product on the field to be plowed under or bring it into landfills. Farmers are not able to quickly and simply change their supplier or process their product for a different type of need. For example, 30% of eggs produced in the United States are sold in a liquid form to be used by larger institutions such as hospitals, nursing homes, and restaurants. When the demand dropped suddenly, the facilities that raise chickens for liquid eggs were unable to simply switch to selling whole

eggs.⁴ These types of disruptions in the food supply chain forces farmers to make difficult decisions about what to do with their product.

Diverting food waste to those who are hungry would be ideal, but there are several factors that make this difficult to do. One includes storage issues. Food banks and other antihunger organizations often do not have adequate refrigerated storage for such a large amount of perishable food. Another challenge is transportation. Shipping hundreds or thousands of pounds of food is very expensive, and farmers and food banks most likely do not have the funds to pay for it.

Food waste is not just a social issue, but it is also an environmental issue. Growing food requires many inputs and resources such as land, water, soil, organic and chemical fertilizers, labor, fuel, equipment, and packaging materials. When food is wasted, those resources are wasted as well which leads to environmental implications:

- Land
 - * 28% of the world's land is used for food that is never consumed.⁵
- Water
 - * According to the World Resources Institute, food waste uses 45 trillion gallons of water, which is 24% of all water used in agriculture.⁶
- Packaging materials
 - * A lot of food is wrapped and shipped in plastic which winds up in the landfills along with the food.
- Greenhouse gases
 - * When food is sent to landfill, it rots and emits methane which is a potent greenhouse gas. According to the Food and Agriculture Organization, this is responsible for 8% of total greenhouse gas emissions.⁷

The Environmental Protection Agency has a Food Waste Hierarchy of the most and least preferred usages for food waste.⁸ Although landfill is ranked as the least preferred, it is currently where a majority of our food waste ends up.

As food and nutrition experts, RDNs can have a positive impact on reducing food waste through the following actions.

1. Educate patients and clients about the importance of reducing food waste and the steps they can take to reduce food waste in their own homes:

- Meal planning
- Re-using leftovers
- Proper storage practices
- Conscious grocery shopping
- Food label education

2. Work with the food service director at hospitals, nursing homes, schools, etc. to look at how food is being wasted. UCSF Medical Center at Parnassus reduced food waste by 50% by tracking and educating staff about how to handle and serve food with intentions of wasting less.

3. Learn and teach others about composting. While composting is still considered wasting food, it is a much more environmentally

friendly step than sending it to landfills. Composting at home is not a daunting process and can even be done in small apartments!

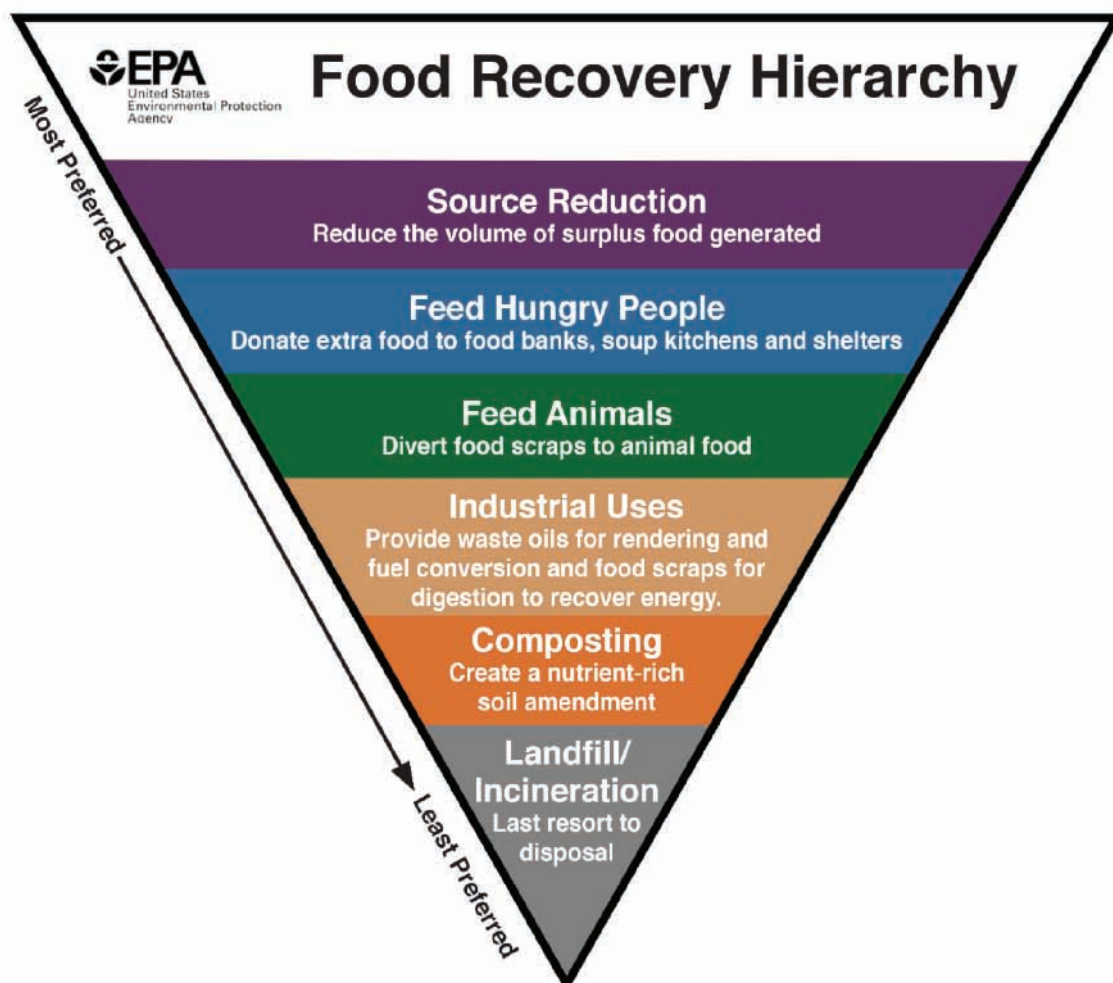
4. Consider purchasing food from food waste gleaners. There are now several online companies that purchase excess food from growers that would normally end up in the landfill and sell it to consumers for less than supermarket prices. Some of these companies include Imperfect Foods, Misfits, and Hungry Harvest.

It is important for RDNs to be aware of and to address the issue of food waste. Since we are so involved in working with people and with food, we can have a positive impact and help to reduce waste.

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News You Can Use

Nutritional Genomics Research Publications – July 15, 2020

Courtesy of the International Society of Nutrigenetics and Nutrigenomics (ISNN) at www.NutritionAndGenetics.org/, and of ron@nutrigenetics.net.

Genome-wide screen to identify genetic loci associated with cognitive decline in late-life depression.

Int Psychogeriatr. Published online July 9, 2020. doi:10.1017/S1041610220001143 (PubMed ID: 32641180)

A number of genes associated with cognitive decline were identified, including SLC27A1 which is involved with the metabolism of DHA, an omega-3 fatty acid.

Nutrigenetics/nutrigenomics, personalized nutrition, and precision healthcare.

Curr Nutr Rep. Published online June 23, 2020. doi:10.1007/s13668-020-00327-z (PubMed ID: 32578026)

The author describes why nutrigenetics and nutrigenomics are complementary and why both will be important to the future of precision nutrition and healthcare.

Nutritional genomics, inflammation and obesity.

Arch Endocrinol Metab. 2020 May-Jun;64(3):205-222. doi:10.20945/2359-3997000000255 (PubMed ID: 32555987)

Table 1 lists a number of biomarkers relevant to inflammation; Table 2 lists multiple gene variants which have been studied showing their relationships with the Mediterranean diet and with obesity or obesity-related traits.

Science and healthy meals in the world: nutritional epigenomics and nutrigenetics of the Mediterranean diet.

Nutrients. 2020 Jun 11;12(6). pii: E1748. doi:10.3390/nu12061748 (PubMed ID: 32545252)

Table 1 lists various types of foods found within Mediterranean-type diets where one or more “nutrigenomics effects” have been reported.

Genetic and physiological factors affecting human milk production and composition.

Nutrients. 2020 May 21;12(5). pii: E1500. doi:10.3390/nu12051500 (PubMed ID: 32455695)

Table 1 lists genetic variants which have been associated with changes in human milk and possible effects on infants.

Tripartite combination of candidate pandemic mitigation agents: vitamin D, quercetin, and estradiol manifest properties of medicinal agents for targeted mitigation of the COVID-19 pandemic defined by genomics-guided tracing of SARS-CoV-2 targets in human cells.

Biomedicines. 2020 May 21;8(5). pii: E129. doi:10.3390/biomedicines8050129 (PubMed ID: 32455629)

The author discusses a number of human genes which are involved with COVID-19 infections and a number of potential mitigating agents worthy of closer study.

Nutraceutical activity in osteoarthritis biology: a focus on the nutrigenomic role.

Cells. 2020 May 16;9(5). pii: E1232. doi:10.3390/cells9051232 (PubMed ID: 32429348)

A number of dietary constituents with anti-inflammatory and antioxidant properties which can be relevant to osteoarthritis are described in some detail, including berberine, curcumin, quercetin, resveratrol, and wogonin among others.

Nutraceuticals and metastasis development.

Molecules. 2020 May 8;25(9). pii: E2222. doi:10.3390/molecules25092222 (PubMed ID: 32397337)

The role of nutritional genomics in neoplastic metastasis is discussed, including some dietary items that may promote (Table 1) and some that may prevent metastasis (Table 2).

What will it take to build an expert group of nutrigenomic practitioners?

Lifestyle Genom. 2020;13(3):122-128. doi:10.1159/000507252 (PubMed ID: 32369817)

The authors encourage education, information dissemination, networking, and partnering between educational institutions, genetics-related companies, and healthcare professionals as the best way to effectively assess and apply the emerging information in practical and responsible ways.

Genes and diet in the prevention of chronic diseases in future generations.

Int J Mol Sci. 2020 Apr 10;21(7). pii: E2633. doi:10.3390/ijms21072633 (PubMed ID: 32290086)

The authors discuss nutrigenetics (with its focus on genetic differences between individuals), nutrigenomics/ gene expression, and epigenetics (which can change gene expression even without changes in DNA), with mention also of the role of environmental and behavioral factors.

Mechanism of colorectal carcinogenesis triggered by heme iron from red meat.

Biochim Biophys Acta Rev Cancer. 2020 Jan;1873(1):188334. doi:10.1016/j.bbcan.2019.188334 (PubMed ID: 31783067)

The authors describe how heme iron can affect multiple pathways that are relevant to colorectal neoplasms, including but not limited to DNA damage.

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Immune-Supportive Smoothie



Ingredients:

- Handful of arugula
- 1 T Flax seed
- Fresh mint
- 1 Green apple
- 1 knob Fresh ginger
- 1/2 lemon
- 1/2 cup Frozen pineapple
- 4-6 oz Water
- 1 scoop Fiber powder
- 1 scoop Broccoli powder
- 1 tsp Astragalus powder

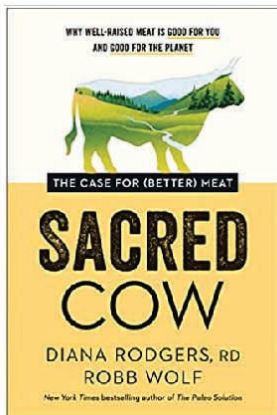
*Courtesy of Danielle Omar, MS, RDN.
Author of Super Green Smoothies.*

Resource Review

Janie Jacoby, MS, RDN, LDN

Sacred Cow: The Case for (Better) Meat

By Diana Rodgers, RD and Robb Wolf
BenBella Books, Dallas, TX 2020
ISBN: 9781948836913



Is eating meat good or bad? To make sense of the world, we tend to categorize things: “good or bad,” “right or wrong,” “healthy or unhealthy.” Of course, things are rarely that simple, including the topic of meat. Eating meat, especially red meat, is frequently labelled as environmentally harmful, unhealthy, and unethical. However, the book *Sacred Cow: The Case for (Better) Meat*

argues that animals play a vital role in our agricultural systems and diets.

The authors are Diana Rodgers, RD, and Robb Wolf. Rodgers lives on an organic farm, and both authors are part of the Paleo diet community. They state that their intent is not to be “anti-vegan.” Rather, they see their audience as mainly omnivores who are concerned about the health and environmental impacts of food, and people who are considering adding meat to their diets. *Sacred Cow* is divided into three sections which focus on nutritional, environmental, and ethical arguments about meat.

Sacred Cow is set up in a Q&A format, with headings such as “Does Meat Cause Heart Disease?” and “Doesn’t it Take Tons of Feed to Produce a Pound of Beef?”. The book covers a huge amount of ground, which is helpful for such a sprawling topic. However, the downside is that some topics are brought up, but not fully fleshed out. At times I found myself wishing for more in-depth information about fewer topics.

In the nutrition section, the authors discuss issues such as the problems with relying on epidemiological research and the debate over protein

requirements. They also discuss how animal foods are quite nutritionally dense, with higher bioavailability of protein and minerals than plant-based foods. *Sacred Cow’s* argument is that, even if it is possible to be healthy without eating animal products, it is much more difficult and is especially risky for nutritionally vulnerable populations such as children or those with health conditions.

Many believe that animals are responsible for most of the environmental harm from agriculture, and that removing them will help us be more sustainable. However, *Sacred Cow* explores how this view ignores the negative environmental impact of plant food production, including the impact of pesticides, chemical fertilizers, and the loss of topsoil. It ignores evidence that raising beef cattle may not be as destructive as is usually claimed. It also ignores how animals, raised in a certain way, can improve the health of the environment. This is one of the central themes of the book.

As the authors explain, fertile topsoil is essential to healthy ecosystems. Where did our topsoil come from? It was built up by grazing ruminants, such as bison and



antelope. When ruminants eat grass and leaves, it encourages root growth, fertilizes the soil, and improves the soil microbiome. The resulting soil sequesters substantial amounts of carbon, holds onto water, and supports a diversity of life. Predators keep the ruminants moving, so they do not stay in one spot too long and overgraze the land.

This is a snapshot of a resilient ecosystem. Regenerative agriculture practices mimic this ecosystem with domestic animals, such as cows and goats. Humans and electric fences play the role of the predators. These practices allow us to create a more sustainable food system; and *Sacred Cow* argues that without animals, we will continue to be reliant on a destructive industrial, monocrop system.

The third section explores a range of ethical questions. One interesting argument they make is that it is unethical to disparage eating animals when most people are not in the position to avoid this nutritious food. Animals have been integral to traditional diets and food systems throughout human history. They are mobile, less variable with the weather, nutrient dense, and able to thrive in climates that are unsuitable for farming. *Sacred Cow* emphasizes that

animals improve the quality of food systems by converting inedible or less nutrient dense foods (such as grass and grains) into highly nutrient-rich foods (such as meat and eggs).

For people with limited food access, animal products are a valuable source of nutrients. It takes more effort, knowledge, and resources to eat a vegetarian or vegan diet and still get enough nutrients. As they point out, we do not tell people to avoid vegetables just because they cannot get organic ones. Likewise, they suggest we should not tell people to avoid animal foods, even if they are not raised in an ideal way.

The last section of the book describes a 30-day diet challenge, based on a Paleo framework. This part seems out of place. They talk about avoiding excess fruit, limiting late-night snacking, and other things that are unrelated to the main themes. After defending traditional agricultural systems and regional cuisines, they shift gears to say that grains, legumes, and dairy should be avoided. In my view, a Paleo diet can be a healthy way to eat and a therapeutic tool—but to imply that everyone should, or can, eat a Paleo diet seems just as simplistic as saying that no one should eat meat.

Sacred Cow provides an engaging overview of a complex topic. There is also a documentary by the same name, directed and produced by the authors. The documentary inspired them to write the book. I look forward to being able to visually see examples of the concepts they write about. I would recommend *Sacred Cow* to those who want to explore a different perspective on the role of meat in our health and our environment.



Janie works as a community and corporate wellness dietitian, providing services such as in-home diabetes care, group programs, wellness coaching, program development, and more. She lives in Columbus,

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Views expressed are those of the reviewer and do not represent the views of DIFM or the Academy at large.



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