Countering chronic inflammation

for healthier aging, part one: The food connection

Research points to plant-based nutrition as a lifestyle cornerstone in preventing and/or alleviating 'inflamm-aging'—and other forms of chronic inflammation—as we age. Here's a review to bolster your knowledge and help engage clients in making 'everyday choices' for healthier aging

by Shirley Archer, JD, MA

Do you wake up feeling fatigued? Do you suffer from joint pain or stiffness? Digestive problems? If you have one or more of these symptoms, you may be dealing with chronic or long-term inflammation.

"An easy way to describe inflammation is the body's natural response to an agent that can harm the body," says Sandra Arevalo Valencia, MPH, RDN, CDN, director of Community and Patient Education, Montefiore Nyack Hospital in New York. "This means, when you get a virus, like the flu for example—that's the agent—your body reacts with fever and pain. That is an [acute] inflammatory response. Obviously, inflammation doesn't feel good at any age, but is necessary to

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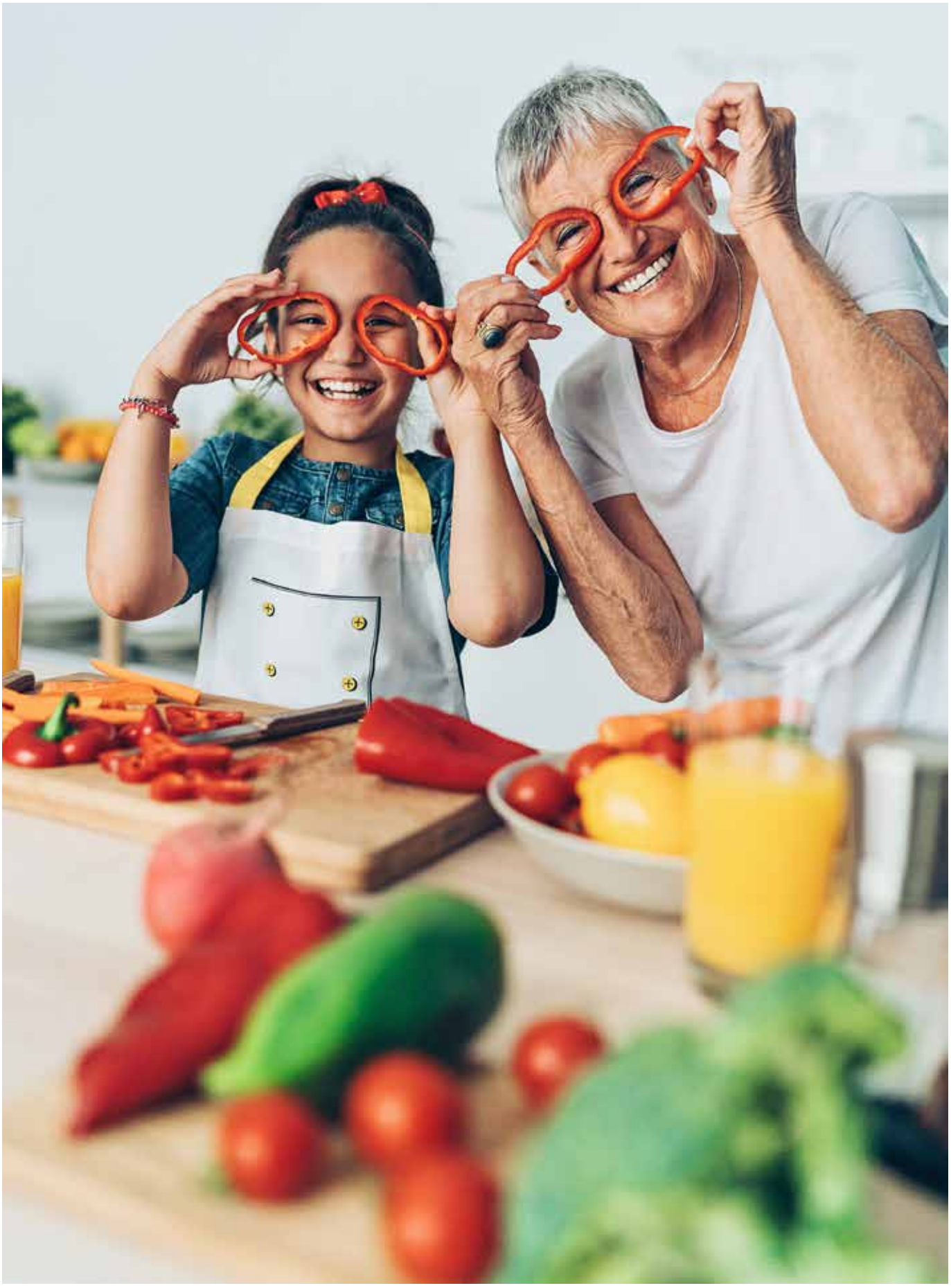

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Research links chronic inflammation with digestive disorders. Shirley Archer writes that 'a broad group of inflammatory conditions'—among them irritable bowel syndrome and Crohn's disease—'affects the digestive system.' Researchers are investigating 'whether chronic inflammation is a cause, a consequence or both'

stop [harmful] agents from damaging our body.

"Due to aging, inflammation can appear without the presence of an agent and can persist over time," Valencia says. "This chronic inflammation is not as severe [as acute inflammation] but, over time, can lead to some damage of nerves, muscles, joints and bones." This condition has been referred to in popular media as "inflamm-aging."[1]

The good news: Scientists have become better not only at identifying chronic inflammation's presence, but also in how to reduce it for better well-being. As an individual who's aging—namely, all of us—and as an active-aging professional, it's valuable to understand this "top of mind" topic to educate others and to implement programs that can reduce excess inflammation and promote health.

This article explains inflammation and describes nutritional approaches. A follow-up article will address further lifestyle strategies that counter chronic inflammation's negative health effects.

[Ed. With nutritional advice, the *Journal on Active Aging*® encourages readers, unless qualified in this area, to recommend clients see a registered dietitian for personalized counseling and to use information from recognized sources in educational programming.]

What is inflammation?

Inflammation may sound ominous but does not justify alarmism. Available tests measure inflammation's physical presence, evidence-based strategies successfully lower chronic inflammation, and scientists are continually learning more. Sufficient evidence exists for us to make educated decisions regarding how to cope with chronic inflammation, if and when it's needed.

Here's an update on what we know:

Normal process

Systemic inflammation is natural; it's part of the body's immune response system. It's not inherently negative. In fact, it's positive. Inflammation fights the invasion of viruses and bacteria and other pathogens, which enables healing and restores health. What's needed for optimal health, however, is a balanced immune system.

Medical experts often refer to a "Goldilocks principle" when talking about different processes that contribute to health. Based on *The Three Bears* fairy tale and its heroine who always chose the middle ground, this analogy can be used to explain inflammation and the immune system's response to harm. Simply put, balanced systems are not overactive and highly reactive nor underactive and unresponsive but respond "just right"—precisely how and with what is needed to cope with harmful agents attacking the body.

Acute inflammation
Swelling, heat, redness, pain and loss of function characterize acute inflammation. Multiple immune system cells are involved. Smaller blood vessels expand and become more porous to allow blood and immune cells to reach injured tissues. This increased flow of blood and cells leads to swelling, redness, heat and pressure.

Biochemicals in immune cells can irritate nerves and cause pain. This pain is *not* negative and can even be adaptive, because it encourages a person to protect and limit use of injured areas. In essence, pain signals announce that our body is not well and needs attention and extra care to heal. When more fluids enter these injured tissues, they flush out unwanted agents—like germs—which further aids healing.[2]

Even intense physical workouts can cause acute inflammation—the muscle soreness or fatigue experienced from normal tissue destruction after training. As the inflammatory process repairs these damaged tissues, the body can become stronger. This is why rest and restoration are important to optimize training results: The body requires time to heal.

Acute inflammation ends when the injured tissues and/or infection heals. Damaged cells are replaced by newly regenerated cells. In organs that cannot regenerate cells, scar tissue may form. Ideally, the immune system returns to its normal active and balanced state, ready to activate when next needed.

Chronic inflammation
This is a prolonged inflammatory response that involves a progressive change in the types of cells present at the inflammation site. It's characterized by simultaneous tissue repair *and* destruction from the inflammatory process. This occurs when the immune response is continuously triggered or when the immune system is reacting as if there's a threat even when no harmful agents are present, as for people with chronic allergies or autoimmune conditions. Chronic inflammation can follow acute inflammation or be a prolonged, low-grade form of persistent inflammation, particularly in the presence of chronic inflammatory diseases like rheumatoid arthritis or Alzheimer's.[3]

Chronic inflammation may occur at any age. It is *not* the same as inflamm-aging. Risk factors for chronic inflammation include genetic predisposition, exposure to environmental toxins, or lifestyle choices like poor diet, lack of physical activity, unmanaged stress, poor dental hygiene and smoking. In the United States, inflammation levels among children and young adults are predicted by weight, obesity, exposure to cigarette smoke and air pollution.[4]

"Inflammation is an issue for all, regardless of age," says holistic nutritionist Teri Mosey, PhD, of Portland, Oregon. "Chronic diseases such as hypertension, diabetes and obesity are already being diagnosed in adolescents."

Research continues to reveal new complexities related to dynamics that cause inflammation and methods to calm it. Chronic diseases like diabetes, metabolic syndrome, heart disease, asthma and inflammatory bowel disease create inflammation in the body; scientists are investigating whether inflammation itself may be a causal factor for these diseases. This means that chronic inflammation is *not* a linear process but can include both cause *and* effect. In other words, inflammation can both trigger an adverse health condition *and* also result from one.

Researchers think that the dramatic rise in chronic disease associated with aging worldwide may be related to the complex interplay of a lifetime exposure to stressors, the inflammatory response to these stressors and to a genetic predisposition to diseases that have an inflammatory component in their development as, for example, with atherosclerosis or Alzheimer's.[1]

Inflamm-aging
Inflamm-aging is a more recent concept. While scientists continue to research causes and propose differing theories, consensus exists that progressive physiological changes occur with aging—also referred to as senescence or biological aging—along with accumulated damage from disease or injury, accompanied by increases in inflammation.[5] Our body and our immune system experience gradual functional deterioration as we age. Some cells die; others reproduce less efficiently. Accordingly, aging itself is associated with chronic low-grade inflammation. As such, inflamm-aging is a form of inflammation that is unique to older adults.

Inflammation in an older adult, therefore, may include any combination of chronic inflammation from long-term, unhealthy lifestyle choices; toxin exposure; various chronic diseases; genetic predisposition and/or an autoimmune disorder *and* from inflamm-aging—the presence of higher levels of inflammation as part of the natural aging process.

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Chronic inflammation has a food connection. By promoting obesity and disrupting the gut microbiome, poor dietary choices can 'set the stage' for inflammation. One approach to counter inflammation is to adopt a healthy, mostly plant-based eating pattern

Scientists theorize that genetic predisposition also plays a role in inflamm-aging. All organisms are exposed to stress over a lifetime. A certain amount is pro-adaptive and makes organisms stronger. In other words, researchers think that the immune system learns and adapts over a lifetime. Some individuals are genetically predisposed to more successfully cope with these stressors than others, and therefore, live longer and experience less inflamm-aging.[1]

Identifying chronic inflammation

Typically, physicians determine whether a person has chronic inflammation when treating associated medical conditions. Inflammation indicators also include the symptoms and consequences mentioned in the section below. Keep in mind, inflammation may be "silent." For example, an individual may not feel at his or her best—a bit tired, achy, with digestive complaints—not sick but unaware of underlying conditions.

Tests to determine inflammation's presence are relatively inexpensive and widely available. Blood tests can accurately measure sensitive systemic markers of inflammation and tissue damage. Here are some known biomarkers:

- **CRP**, also known as C-reactive protein, circulates in the bloodstream; the circulating value of CRP reflects ongoing inflammation more accurately than other biochemical parameters. It tends to increase with age, with women showing slightly higher circulating concentrations than men.[6]
- **Fibrinogen** circulates in the blood stream and increases in response to systemic inflammation, tissue injury, heart disease, certain cancers and other conditions. Some researchers suggest that higher levels may not only be an inflammation marker but also may be a contributor to heart disease by adversely affecting blood vessel function.[7]
- **White blood cell count (WBC)** is another routinely measured indicator of systemic inflammation. Higher levels occur during infection, in cardiovascular disease, metabolic syndrome and more.[8]

More sophisticated tests are available but may be inaccessible due to lack of easy access or expense.

Consequences of chronic inflammation

While short-term or acute inflammation is a positive restorative process, chronic low-grade inflammation can damage tissues and organs and contribute to the development and progression of many chronic diseases.[9]

Below are some evidence-based consequences of persistent inflammation:

- **Increased chronic disease risks:** Scientists note that "the inflammatory response constitutes the 'common soil' of the multifactorial diseases, including cardiovascular and metabolic diseases, psychotic neurodegenerative disorders and cancer."[10] Growing evidence shows an association between chronic inflammation and diabetes, obesity, fatty liver disease, arthritis, cancer, inflammatory bowel disease and more. For some diseases, like metabolic syndrome, scientists have identified chronic low-grade inflammation as both cause and consequence.

- **Accelerated aging:** Emerging evidence shows a link between inflammation and telomere length, an important indicator of cellular health and biological age. Telomeres are located at the ends of chromosomes and protect against DNA damage for heathy cell replication. Progressive telomere shortening with cellular divisions over time indicates impending cell death and is an aging marker. Short telomere length is related to mortality.

  In a study conducted by a European research consortium, scientists found that longer telomeres co-occurred with lower levels of metabolites that have been implicated in inflammation, oxidative stress, cardiovascular disease and diabetes, among other drivers of increased death risks. The study included blood samples from 7,853 male and female adults between ages 18 and 62 years. More research is recommended.[11] **[Ed.** See "Resources" on page 61 for information about an earlier *Journal on Active Aging®* article on telomeres.]

- **Fatigue and insomnia:** In a review of clinical and animal studies conducted by University of Texas, Houston, and European researchers, scientists reported that chronic low-grade inflammation may lead to persistent fatigue as a result of reduced cellular-energy availability from metabolism changes.[12]

  To simplify, investigators have discovered that inflammation affects metabolism by depleting the body's glucose reserves. In other words, immune cells use the body's glucose for energy to fight inflammation. This means the body must rely more on fats and

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Foods to eat less often; foods to eat more often

Here are evidence-based guidelines for which foods and beverages to eat and drink less and more of:

Eat and drink less:

- *High glycemic index (GI) foods:* sodas and processed foods, refined carbohydrates (white breads, pastas), fructose corn syrup.
- *Saturated and trans fats:* processed vegetable oils like soybean, canola and corn oils; processed baked goods with hydrogenated vegetable oils.
- *Red meat:* Eat like a side dish; choose free-range, organic grass-fed beef, if possible, that is richer in healthier fats and does not include added hormones, antibiotics, pesticides.
- *Artificial sweeteners:* Studies suggest certain sweeteners like aspartame can be inflammatory; others may alter glucose tolerance.
- *High-sodium processed foods:* High salt intake, particularly among older adults, is linked to increased heart disease and inflammation risks.

Eat and drink more:

- *Fatty fish:* Omega-3 fatty acids found in fatty fish like salmon, tuna, sardines and mackerel lower inflammation. Limit tuna to once weekly due to high mercury content.
- *Fruits and vegetables:* Berries, apples and cruciferous vegetables (broccoli, cauliflower, etc.) in particular are high in anti-inflammatory compounds. Aim to eat a "rainbow" of colorful foods daily for nutrient variety (see the sidebar on page 59 for examples).
- *Fiber:* Foods high in soluble and insoluble fiber support a healthy gut microbiome. Aim for 34 grams daily for men; 28 grams for women.
- *Nuts and seeds:* Choose unsalted varieties to keep sodium levels low.
- *Green and black teas:* Various teas are rich in polyphenols that lower inflammation.
- *Water:* Drink water throughout the day. Dehydration, particularly among older adults, increases inflammation.[14,22,25,26]

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A healthy diet includes lots of plant-based foods, ideally locally grown and seasonal selections. With their colorful displays of fresh fruits and vegetables, farmers markets and fruit stands are an enjoyable place to explore a 'rainbow' of foods

proteins for energy, which is slower and less efficient, and diverts proteins from growth stimulation. As a practical matter, this leads to feelings of fatigue. Inflammation is also associated with more insulin resistance and reduced glucose tolerance, which may set the stage for type 2 diabetes.[13]

Low-grade inflammation also impacts sleep quality and circadian rhythms, as people with persistent fatigue tend to nap or sleep irregularly. Scientists theorize that this combination of change in energy production and sleep habits creates fatigue and they recommend more research to further validate their findings.

- **Joint pain and swelling:** In chronic inflammatory autoimmune diseases, the immune system mistakenly perceives parts of a person's own body as a foreign agent. Rheumatoid arthritis is one of the more common autoimmune diseases where the system attacks joint linings. This can cause tissue, cartilage and bone damage, joint swelling and stiffness, increased fluid, nerve irritation and pain.

  Arthritis and joint diseases affect approximately 350 million people worldwide and nearly 43 million people in the United States, or almost 20% of the population. Nearly 2.1 million Americans live with rheumatoid arthritis.[14]

- **Cognitive decline, mood disorders and "brain fog":** Systemic inflammation is associated with neurodegenerative disorders including Alzheimer's, depression and delirium. Scientists think that systemic inflammation can cause changes in brain structure and function, including damage to the brain's white matter.[15]

  New findings support that this systemic inflammation as early as midlife may be a driver of cognitive decline in older adulthood. Mayo Clinic researchers in Rochester, Minnesota, conducted a study among 12,336 males and females with a baseline age of 56 years. Cognition was assessed among participants over three visits spanning 20 years and measuring memory, executive function and language.

  Investigators found that people with the highest levels of midlife inflammation experienced the most cognitive decline, and that high inflam-

mation levels were most associated with memory deterioration. Further research is needed to confirm whether inflammation is only a marker of cognitive decline or a cause.[15]

[**Ed.** White matter conducts electrical nerve signals quickly along axons, or nerve fibers,[16] to connect brain regions and the spinal cord. Damage to this brain tissue is associated with impaired cognitive function[17,18] and linked to impaired mobility, gait and balance plus increased falls risk.[19]]

- **Digestive disorders:** While many are familiar with irritable bowel syndrome (IBS), a broad group of inflammatory conditions affects the digestive system. These include IBS, Crohn's disease, ulcerative colitis, food allergies and sensitivities, and gastroesophageal reflux disease (GERD). As with other conditions, researchers continue to investigate whether chronic inflammation is a cause, a consequence or both.

  For example, in a preliminary study of 12 patients with GERD, Harvard University, University of Texas and Veteran's Affairs Health Care system researchers withdrew medication from participants and noted that return of the GERD condition was not a result of exposure to stomach acids, but rather from return of pro-inflammatory agents. Study authors suggested that the cause of GERD, therefore, may be from inflammation rather than from stomach acid chemical injury as previously believed. More research is being conducted.[20]

Nutrition and the inflammatory response

"Managing inflammation and aging gracefully is about everyday choices," says Mosey. "Know that at the end of

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Eating the rainbow: anti-inflammation foods

The colors of foods indicate different nutritional qualities and concentrations. So, by choosing a variety of colors at each meal, we are more likely to receive a wider spectrum of nutrients vital to good health especially as we age. The most important takeaway is to encourage your residents and members to eat lots of fresh fruits and veggies, ideally "a rainbow" of colorful, local foods.

Some examples:

- **Red:** tomatoes, melons, pomegranate, red berries/cranberries, cherries, red grapes, strawberries, raspberries, apples, red onions, radishes, sweet red peppers
- **Yellow & orange:** Oranges, cantaloupe, grapefruit, yellow apples, peaches, apricots, lemons, persimmons, carrots, orange and yellow peppers, bananas, squash, corn
- **Green:** Dark leafy greens like watercress, lettuce, spinach; cruciferous vegetables like broccoli and brussels sprouts; kale, chard, honeydew melons, avocados, peas
- **Blue & purple:** blueberries, blackberries, mulberries, plums, figs, raisins, prunes; purple cabbage, eggplant/aubergines, beets
- **White and gold/white:** mushrooms, cabbage, cauliflower, onion, jicama

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the day it's our entire lifestyle that determines health. How we eat is certainly a great place to start, just don't stop there."

The inflammation and food connection is particularly important for the following three reasons:

- **The Standard American Diet (SAD) disrupts the gut microbiome.** Researchers have identified an important relationship among the gut microbiome, the immune and central nervous systems, and other bodily systems. Most Americans eat a high calorie, low fiber diet with few vegetables, fruits or healthy oils. Americans overconsume sugar, saturated fat, salt and food additives and exceed recommendations for refined grains and protein foods.[21,22] This typical SAD eating pattern negatively alters the gut microbiome—the trillions of bacteria, viruses and fungi that live in the intestines and control how the immune system works—setting the stage for inflammation. [**Ed.** For information about a *Journal on Active Aging*® article on the microbiome, see "Resources" on page 61.]

- **SAD creates a "leaky gut."** Studies show that SAD reduces gut barrier integrity, contributing to systemic inflammation compromising the intestinal lining, which allows toxins and other harmful agents to enter the bloodstream.[22]

- **Obesity is pro-inflammatory.** The SAD eating pattern includes too many calories and unhealthy fats. Excess weight gain leading to obesity and fat deposits, particularly in and around organs, increases the likelihood of inflammation. Fat tissue is metabolically active and simultaneously contains and produces pro-inflammatory factors. Reducing excess fat lowers bodywide inflammation.[23]

Adopt a healthy overall eating pattern

A simple strategy to immediately start countering inflammation is to change eating habits. Experts agree that an "anti-inflammation" diet does not need to be complex—focus on eating a primarily plant-based, whole food plan like a Mediterranean Diet (MD). [**Ed.** For information about an article on the Mediterranean Diet, see "Resources" on page 61.]

A Mediterranean Diet is characterized by high intake of vegetables, fruits, cereals, legumes, extra-virgin olive oil and fish, moderate red wine consumption and reduced intake of high-fat milk, dairy products, meat and meat products. In a study of 194 hospitalized older adults conducted by Italian researchers, low adherence to MD at hospital admission among patients was associated with a longer hospital stay, higher inflammatory marker levels and unfavorable body composition, compared with patients with high MD adherence upon admission.[24]

"I recommend foods high in Omegas 3 and 6," says Montefiore Nyack Hospital's Valencia. "These fatty acids help with inflammation, lower bad cholesterol and help increase good fats. Eating soluble fiber is also essential as it helps clean your system of compounds that stay in your body and can eventually cause inflammation. To help maintain strong bones and tissues, it's important to eat three low-fat dairy servings per day. If milk isn't tolerated, try yogurt, cheese or lactose-free milk and foods. Green leafy vegetables like spinach, collards, broccoli or broccoli rabe contain nice amounts of calcium too and are rich in collagen, which helps connective tissues stay healthy."

Introduce dietary changes gradually

Since many older adults are accustomed to certain eating habits, experts agree that a gentle and fun approach to adding different foods is best. Rather than immediate and dramatic wholesale changes in diet, older adults can make gradual lifestyle changes that are comfortable and understandable. Says Valencia: "They just need to include a bit more fresh fruits and vegetables, olive oil, fish, nuts and whole grains in their diet and avoid alcohol, red meats, processed, sugary and greasy foods. They can eat the same but make small modifications. How? Eat smaller dessert and eat a fruit instead. Or, eat grilled chicken instead of fried, fish instead of meat." This approach to dietary change can lead to measurable results that ensure compliance over the long term.

Angel Planells, MS, RDN, a Seattle, Washington-based registered dietitian and spokesperson for the Academy of Nutrition & Dietetics, agrees. He advises clients: "Be realistic about dietary changes. Don't go from one serving of fruits and vegetables a day to seven. Instead, make gradual improvements from your current intake. If you consume one serving per day, make the goal two and increase from there. Don't be afraid to use canned and frozen foods. They are ready to be prepared quickly and economically, which are two concerns an older person may have when it comes to meal prep."

Educational webinar

Learn more about inflammation and an anti-inflammatory lifestyle from Shirley Archer through the International Council on Active Aging's Webinar Series. Archer will present "How to live an anti-inflammatory lifestyle" in this educational webinar on Thursday, November 14, 12–1 p.m. EST.

Join this session to learn more about inflammation and its relevance to aging along with practical strategies to reduce inflammation. Watch for information to be posted at www.icaa.cc/conferenceandevents/webinars.htm.

Planells recommends encouraging clients to have an adventurous palate. Try a new food and/or a new method of preparation every week or month. Look to the Internet for recipe ideas—sometimes reluctance may simply be from lack of knowledge on how to prepare certain foods—and keep it fun. For example, cooking classes may be offered at the local seniors center or parks and recreation facility, as well as at adult education, university extension or community college classes. Activity directors at seniors centers and residences can bring in chefs, organize health fairs with food and cooking demonstrations, offer excursions to local farmers markets and ethnic food festivals to help older adults try different foods and expand their palates.

Healing takes time

Modern medicine enables human beings to enjoy far greater longevity than our ancestors. Our challenge today is improving life quality during those later years. Understanding inflammation and its relationship to many chronic conditions that older adults face is part of addressing this challenge: Evolution means that our immune systems, which were set long ago to control pathogens for some 50 years, now must function for decades longer, which in itself can lead to chronic inflammation and age-related diseases.[7] This longer activity of the immune response, according to researchers, is a natural phenomenon but one that is now considered a major risk factor for age-related chronic diseases like Alzheimer's, atherosclerosis, diabetes and cancer.[7]

The good news is that the more we learn about inflammation and the interconnectivity among various bodily systems, we can modify our lifestyles accordingly to emphasize our healing relationship with the plant world and the nutritional balance that is essential for optimizing health and well-being.

Hippocrates, considered the father of medicine, is often quoted as saying, "Healing is a matter of time, but it is sometimes also a matter of opportunity." Perhaps the opportunity presented by what chronic inflammation is teaching us is that mind, body and spirit are integrated; that people are meant to live in harmony with the environment; and that the body has an intelligence that requires us to listen and to support.

In part two of "Countering chronic inflammation for healthier aging," Shirley Archer will delve into what the latest research shows about additional lifestyle strategies to reduce inflammation. Watch for this article in a future Journal on Active Aging® *issue.*

Shirley Archer, JD, MA, is an integrative health and longevity educator, public speaker, yoga and meditation teacher and

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Resources

Internet

EatRight (Academy of Nutrition and Dietetics)
www.eatright.org

CDC Healthy Aging: Promoting Well-being in Older Adults
www.cdc.gov/grand-rounds/pp/2017/20170919-senior-aging.html

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* Available free online to ICAA members in the "Articles" archives at www.icaa.cc [search on individual keywords "mediterranean diet," "telomeres" and "microbiome"]

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blogger. She provides integrative training and mind-body resources to help people achieve health, happiness and optimal well-being. An award-winning author of 16 books, including Pilates Fusion: Well-Being for Body, Mind & Spirit, *Archer is based in Los Angeles, California, and Zürich, Switzerland. She can be reached at www.shirleyarcher.com, @shirleyarcher (Twitter), @shirleyarcher (Instagram) and @shirley_archer (Pinterest).*

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