

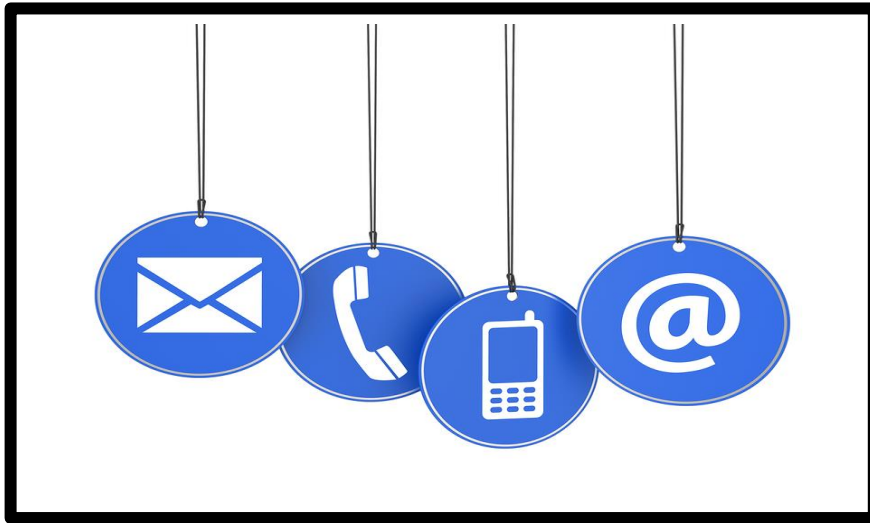


AN INTRODUCTION TO CHRONIC DIGESTIVE ILLNESSES

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An Introduction to Chronic Digestive Illnesses

Dean C. Kramer, M.D.

CAROLINE'S CASE HISTORY

My encounter with Caroline was the inspiration for writing this. I am indebted to her for allowing me to relate her story.

Caroline is a 45-year-old legal secretary. She has a history of multisystem complaints including nausea, chronic fatigue, abdominal fullness after meals, abdominal bloating, belching, abdominal distention, flatulence, migraine headaches, muscle aches, anxiety, depression, insomnia, irregular bowel habits, attention deficit and weight loss.

She had been evaluated by several functional and integrative medicine specialists, two gastroenterologists and a nutritionist. Her evaluations have included multiple blood tests, stool examinations, gallbladder x-rays, stomach emptying tests, CT scans of the abdomen, and esophagus/stomach and colon endoscopies. All these studies were reported to be in normal range.

Caroline gave a significant history of dental pathology. By the time Caroline was an adolescent, many of her teeth had some degree of dental decay that required dental fillings

many of which have been replaced with caps/crowns on her teeth.

In the last several years, she has been under the care of a periodontist (gum specialist) and has been having “deep cleaning” and “root planing and scaling” to control inflammation and infection. Three teeth have required root canal procedures.

Caroline was recently referred to an intestinal specialty clinic at a nearby medical center and was told she would be best treated by a psychiatrist. After her evaluation by a psychiatrist, she began taking antianxiety and antidepressant medications as prescribed but discontinued their use, indicating that they made her feel worse.

Caroline had tried lactose free diets, low-fat diets, low FODMAP diets, low histamine diets, sugar free diets, gluten-free diets, nightshade free diets, bone broth diets, keto diets, Paleo diets and intermittent fasting. She had been treated with several rounds of antibiotics to cover the possibility of bacterial overgrowth in her small intestines, small intestinal bacterial overgrowth (SIBO).

When first evaluated, Caroline was taking four prescription medications, seven minerals and vitamins, a probiotic and 15 other unregulated supplements. Most of the non-prescription items that she was taking came from advertisements on the Internet and from the advice of friends or family members.

Caroline's story is not unique. Every medical care provider has evaluated many patients like Caroline in their practices. Most of these patients have been diagnosed by their providers with "irritable bowel syndrome," "functional gastrointestinal disorder," or a "nervous stomach."

Most often, Caroline had been told that her symptoms were due to the stresses in her life. Many, like Caroline, have left the offices of their medical providers still feeling ill, confused, belittled, frustrated and despondent.

CHANGING ASSUMPTIONS

Devising a plan to help Caroline, and others like Caroline, is based on the premise that nearly all physiologic processes in the body are associated in some way with the microbiome, the community of microorganisms that coexist within the body.

The plan for Caroline has required a change in basic assumptions about how medical care providers think about medical treatment of the body.

Challenge Your ASSUMPTIONS Change Your WORLD

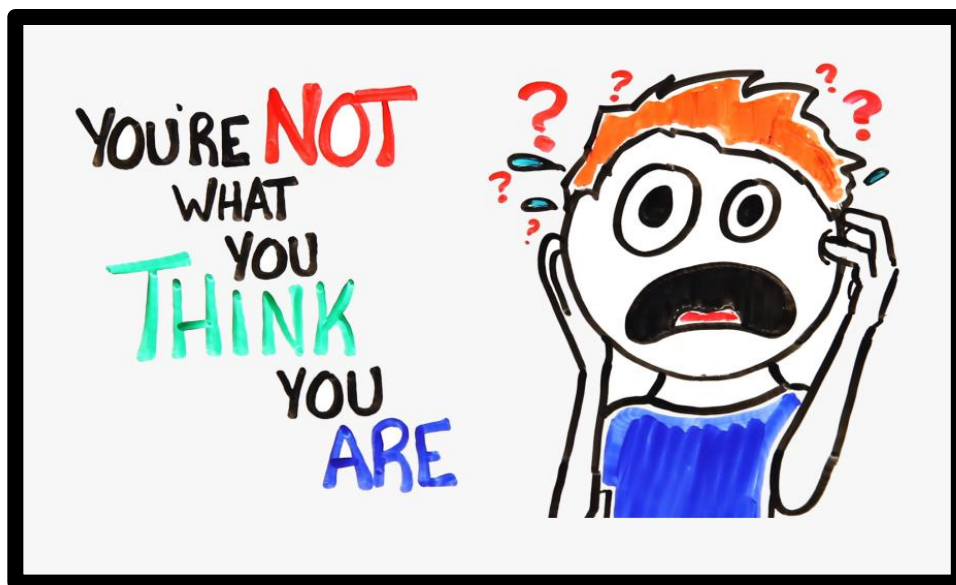
For nearly 350 years, since the discovery of microorganisms in the human body, medical care providers have maintained that the only “good” microbes were “dead” microbes. With the discovery of antibiotics in the 1920’s, it was felt that infectious diseases would no longer be a threat to humans. Such was not the case.

A much more nuanced view of humans and their relationship to microorganisms in their body was ushered in about 20 years ago. The topic has been explored and explained in detail by the Pulitzer Prize winning science journalist, Ed Yong, in his book, *I Contain Multitudes: The Microbes Within Us and a Grander View of Life*. (See References).

It is now accepted that many microbes in the body are critical partners helping to maintain a state of well-being in the human host.

Much of the following document reflects this paradigm shift which recognizes the destructive capability of some microorganisms, particularly some of those upon entry into

the body through the mouth, nose, facial sinuses, and lungs, but also appreciates the role of microbes and their metabolic by products that they create as they pass through and cohabitate within the intestines. The topic is explored further in the section that follows that proposes that the value of microorganisms within the body is situational--based on the microbes density, diversity, location, and functioning capabilities.



Understanding chronic medical illnesses and how to treat them first requires an understanding that the body is a composite of multiple divergent life forms. Each of these life forms have uniquely differing compositions of DNA.

Much like the Greek mythological creature, the chimera, which was composed of three different living animals, a lion, a goat, and a serpent, each with different DNA compositions, the human body is chimeric.



The Mythological Chimera

The cells within the human body all contain the same DNA and, except in rare instances, the same number of genes. Within the body, five additional kingdoms of life exist, bacteria, viruses, fungi, protozoa, and archaea. Each of the five other life forms have different DNA compositions and genes and exist in different concentrations, in separate locations and with different capabilities.

Freedom from chronic illness requires a state of mutual coexistence and symbiosis between the body and all the other life forms that coexist with the body.

Justin Sonnenburg, PhD, microbiologist at Stanford University, suggests that we regard the human body as just “an elaborate vessel optimized to accommodate our microorganisms.”

Alessio Fasano, M.D., chief of Pediatric Gastroenterology and Nutrition at Massachusetts General Hospital for Children, states in his book, *The Microbiota and Our Health*, “studying one—namely the human genome—without analyzing the other—namely the microbiome, will not provide the answers as to why we develop diseases.”

If one accepts the paradigm shift suggested by Drs. Sonnenburg and Fasano, it would lead us to believe that nearly all chronic diseases and treatments need to be redefined taking into consideration the microbiome.

THE TWO CHEMICAL “GENERATORS” OF THE BODY

Human cells, like all living cells on the universe, require energy to survive. The 78 organs of the body rely on two “chemical generators” to create that energy. Those two generators include the following:

“GENERATOR ONE”

Generator one is represented by the lining surface of the digestive tract with the help of enzymes, receptors, and

transporters that carry nutrients into the body. That generator is located primarily in the small intestine where a select group of carbohydrates, proteins, and fats are processed, prepared, transported and absorbed. The small intestine, however, is endowed with only a limited repertoire of enzymes, emulsifiers, receptors and transporters to fully digest and absorb all food products.

“GENERATOR TWO”

The “second generator” comes from the recruited help of microbes which have taken up residence primarily in the large bowel (colon) which are capable of processing undigested residue that cannot be metabolized in the small intestine. The colon, therefore, is more than just a conduit for disposal of waste, but is a producer of critical chemicals needed for intestinal well-being.

THE BODY REQUIRES BOTH “GENERATORS”

Both generators must be fully operational for intestinal well being. Without a small intestine the body suffers from major problems of malabsorption and survival is only possible through infusion of nutrients directly into the vascular system.

Likewise, without the help of our cohabiting microbes in the large bowel, the body develops a more insidious deterioration but ultimately, over years, suffers multiple

maladies that have been associated with microbe imbalances, including vitamin deficiencies, diabetes, irregular bowel habits, mood disorders, osteoporosis, lack of adequate immune defenses, heart, lung, skin, kidney, liver and brain disorders and more.

Microbes have perfected their biochemical capabilities over a history of 3.5 billion years. Human bodies, however, have only had 300,000 years to establish a peaceful coexistence with the earth's longtime residents, the microbes.

One cannot underestimate the importance of establishing a peaceful and mutually beneficial coexistence with microbes. This beneficial interaction requires supplying the microbes among other things with adequate nutrients for their survival, minimal exposure to toxic food additives, antibiotics, unregulated and unproven dietary supplements and environmental pressure, such as radiation (environmental, diagnostic and therapeutic) all of which may contribute to a condition labelled dysbiosis.

Humans are given the choice of how well they are going to care for their body “generators” and particularly how well they are going to treat their “second generators”, their microbes.

THERE ARE NO *GOOD* OR *BAD* **MICROBES—MICROBES HAVE NO** **MORALS**

(Abstracted from Ed Yong's book, *I Contain Multitudes: The Microbes Within Us and a Grand View of Life.*)



Ed Yong writes. . . “In the 1870’s experiments by a German physician Robert Koch and French scientist Louis Pasteur confirmed that many diseases were caused by microscopic organisms. Microbes, which had been largely neglected for a couple of centuries, were quickly cast as avatars of death. They were germs, pathogens, bringers of pestilence. Within two decades it was discovered that bacteria were associated with leprosy, gonorrhea, typhoid, tuberculosis, cholera,

diphtheria, tetanus, and plague. Microbes became synonymous with squalor and sickness. They became foes for us to annihilate and repel.”

“Today, we know this view is wrong” continues Yong. “Some bacteria cause disease but are in the minority. Most are harmless, and many are even beneficial. We now know that the trillions of microbes that share our bodies – the so-called *microbiome* – are an essential part of our lives. Far from making us sick, they can protect us from disease; digest our food, train our immune system, and influence our behavior.”

Yong goes on to say, “These discoveries have shifted the narrative. Many people now see microbes as allies to be protected. Slowly, the view that ‘all bacteria must be killed’ is giving ground to ‘bacteria are our friends and want to help us’.

“The problem is that the latter view is just as wrong as the former. We cannot simply assume that a particular microbe is ‘good’ just because it lives inside us. There’s no such thing as a ‘good microbe’ or a ‘bad microbe’. These broad-brush terms belong in children’s stories. They are ill-suited for describing the messy, fractious, contextual relationships of the natural world.”

“In reality, bacteria exist along a continuum of lifestyles. If they do us harm, we describe them as parasites or

pathogens. If they exist neutrally, we call them commensals. If they benefit us, we bill them as mutualists.”

“But these are hardly fixed categories. Some microbes can slide from one end of this parasite-mutualist spectrum to the other, depending on the strain and on the host they find themselves in.”

“Other microbes can be pathogen and mutualist at the exact same time. The stomach bacterium *Helicobacter pylori* is well known as a cause of ulcers and stomach cancer. But it also protects against esophageal cancer – and it’s the same strains that account for both these pros and cons. *H. pylori* is neither a good nor a bad microbe; it’s both.”

“All of this means that labels like mutualist, commensal, pathogen or parasite don’t work as definitive badges of identity. These terms are more like states of being, like hungry or awake or alive, or behaviors like cooperating or fighting. . . . They describe how two partners relate to one another at a given time and place”.

COVID INFECTION AND THE **MICROBIOME**

The SARS-CoV-2 coronavirus is the Vladimir Putin of the microbial world. The virus is out to annex as much territory

as it can, and when human host defenses are diminished it can achieve its “scorched earth” policy.

SARS-CoV-2 is capable of damaging, diminishing, and in some cases totally and permanently destroying bacteria and other intestinal microorganisms that are critical to functioning of the human host.

Post COVID infections are followed, in many instances, with annoying and debilitating symptoms including, but not limited to, the following:

- **Change in bowel habits with either increase or decrease in bowel movements**
- **Nausea and/or vomiting**
- **Indigestion**
- **Abdominal pain**
- **Excess intestinal gas**
- **Symptoms of abdominal fullness, bloating, and abdominal distention**
- **Loss of appetite**
- **Loss of taste**
- **Loss of smell**
- **Loss of hearing**
- **Excess belching**
- **Weight loss**
- **Fatigue**
- **Shortness of breath**
- **Formation of blood clots**
- **Impaired problem solving**

- **Attention deficits, i.e., “brain fog”**
- **Altered sleep patterns**
- **Mood swings**
- **Anxiety/Depression**

The challenge for medical care providers will be to find ways to protect the human host and prevent infections and long-term sequelae.

The traditional approach to prevention has been to rely on immunizations; however, the SARS-CoV-2 organism is mutating so quickly that building protective antibodies with immunizations has proven to be of only modest success requiring repeated immunizations of different types that are effective against the prevailing strain.

Medical providers have been forced to turn to the “spaghetti on the wall” approach, namely, throwing every modality of theoretical value for prevention and treatment at the wall (i.e., the body) in hopes that something “sticks.”

A partial list of interventions that have influenced immunity in the past that are now being given to patients with prolonged COVID symptoms include the following:

- **Ingestion of a plant-based diet**
- **Vitamin C supplement***
- **Vitamin D supplement***
- **Vitamin E supplement***
- **Selenium supplement***

- Zinc supplement*
- Probiotics**
- Prebiotics**
- Postbiotics**
- Exercise
- Hydration
- Avoidance of toxins including alcohol, tobacco, recreational drugs and ultraprocessed foods.

Many of these treatment modalities are discussed in more detail later in the monograph.

It may take numerous long-term studies to determine how much damage the different iterations of the SARS-CoV-2 coronavirus have left behind and how much success medical care providers have in restoring and rehabilitating the infected host's microbiome.

**Most of the vitamin supplements can be obtained from a single multivitamin preparation that contains 100% of recommended daily allowances.*

***Xavier-Santos, D., Padilha, M., Fabiano, G. A., Vinderola, G., Gomes Cruz, A., Sivieri, K., et al. (2022). Evidences and perspectives of the use of probiotics, prebiotics, synbiotics, and postbiotics as adjuvants for prevention and treatment of COVID-19: A bibliometric analysis and systematic review. Trends Food Sci. Technol. 120, 174–192. doi: 10.1016/j.tifs.2021.12.033*

Note: *There still remain conflicting results between different studies. More trials are needed for further verification, focusing on its rational use and safety. The application of probiotics in the clinical treatment of COVID-19 still requires long-term research and may not be suitable for all patients.*

THE DIGESTIVE TRACT BEGINS AT THE TIP OF THE TONGUE



**THE ORAL CAVITY—AN UNDER
APPRECIATED SOURCE OF CHRONIC
INFLAMMATION AND CHRONIC ILLNESS**

Thousands of microorganisms enter the oral and nasal cavity every minute of the day. To date, scientists have identified over 770 distinct species of bacteria that can be found in the oral cavity. (Deo, P; *Oral Microbiome: Unveiling the Fundamentals*, J. Oral and Maxillofac Pathol. 2019 Jan-Apr; 23(1): 122-128.) , Most are harmless. In many instances, however, an adversarial relationship develops between the body and microorganisms that are trying to reestablish a new site where they can survive, thrive, and replicate.

DENTAL PLAQUE



PLAQUE: Microorganisms that land in the mouth coalesce in living communities known as biofilms and rapidly secrete a thick protein material that forms on the surface of the gums and teeth and proliferates beneath the gum line in the space between the gum and the teeth. This thick, protein, organism-filled, substance is known as dental plaque.

Dental plaque is a source of communal living that allows microbes to share nutrients, share genetic information and protect themselves from being destroyed by chewing, salivary chemicals, toothbrushing and mouthwashes. Dental plaque forms within minutes after contact and it is estimated that the numbers of microbes double thereafter every 20 minutes.

Millions of microbes live within dental plaque. These organisms generate chemicals as they metabolize refined sugar and starches that pass through the mouth. The chemicals produced during metabolism are acidic and with time can destroy dental enamel resulting in tooth decay.

Dental plaque, particularly that which accumulates below the gum line, is difficult to remove with toothbrushing, mouthwashes and flossing alone and requires the assistance of a dental professional using ultrasonic scaling devices and sharp tools to remove plaque and microbes.

RECEDING GUMS



RECEDING GUMS: The process during which the gum tissue that surrounds the teeth wears away, or pulls back, exposing more of the tooth, or root is referred to as receding gums. When gum recession occurs, "pockets," or gaps, form between the teeth and gum line allowing bacteria to proliferate, form plaque and calcify. If left untreated, the supporting tissue and bone structures of the teeth can be severely damaged, referred to as periodontitis, and may ultimately result in tooth loss.

How those microorganisms affect digestive health and the health of other organs of the body has not been fully explored, but it has been suggested that many chronic illnesses may be related to the proliferation, swallowing and translocation of these organisms including the following:

COLON CANCER: Oral microbes that are common in dental decay and gum disease have been identified in colon cancers. (Flemer, B., et. al. *The oral microbiota in colorectal cancer is distinctive and predictive*. Gut, (2018), 1:67(8): 1453-63.)

PARKINSON'S DISEASE: Jeong, E., et. al. *Evaluation of the association between periodontitis and risk of Parkinson's disease: a nationwide retrospective cohort study*. Sci Rep 11, 16594 (2021)

ALZHEIMER'S DEMENTIA: Beydoun M, et. al. *Clinical and bacterial markers of periodontitis and their association*

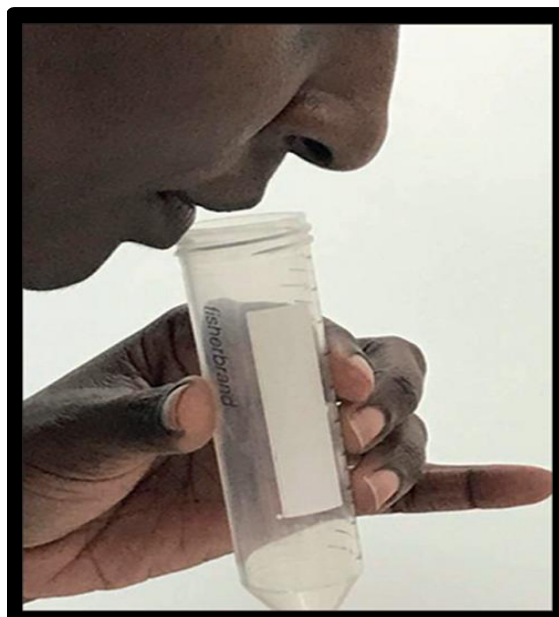
with incidental-cause and Alzheimer's disease dementia in a large national survey, Journal of Alzheimer's Disease. 2020;75(1):157-172

COVID OUTCOME: Marouf, N. et. al. *Association between periodontitis and severity of COVID-19 infection: A case-control study*, J. Clin Periodontol. 2021 Apr: 48(4): 483-491.

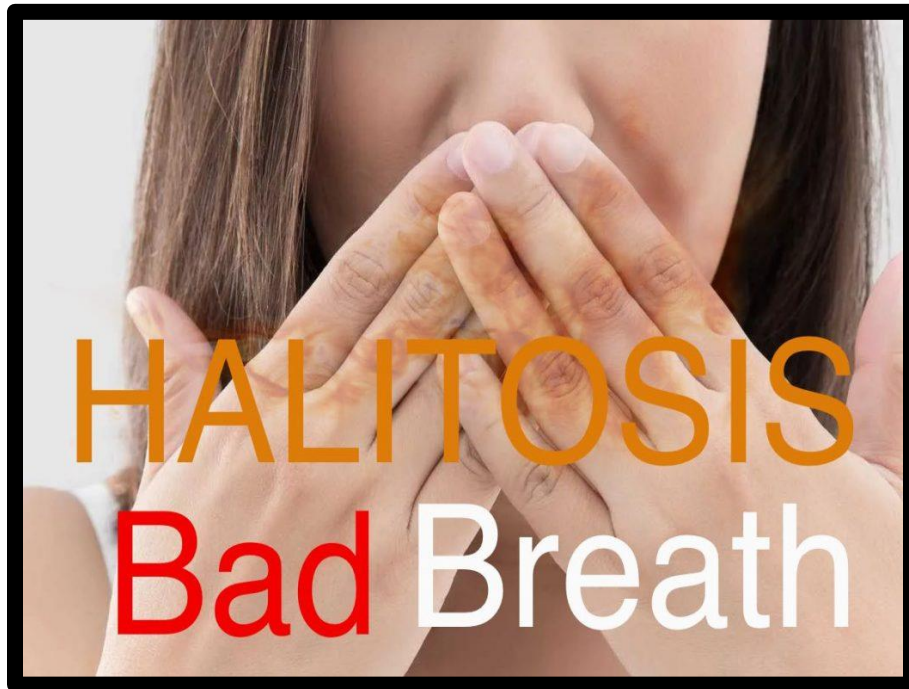
ATRIAL FIBRILLATION: Miyauchi, S. *Relationship between periodontitis and atrial fibrosis in atrial fibrillation: histologic evaluation of left atrial appendages*, J Am Coll Cardio EP. Oct 31, 2022.

Long term follow-up studies are still required to prove causation in all these conditions.

SALIVA



SALIVA: Saliva, which contains large quantities of microorganisms, is continually swallowed throughout the day. Dental researchers have calculated that healthy humans swallow 100 *billion* microorganisms every 24 hours. (M.A. Curtis, et. al., *The relationship of the oral microbiota to periodontal health and disease*, Cell Host Microbe, 10-4-2011, 302-306.) Those with dental decay, gum disease, oral pharyngeal, nasal and/or sinus disease may swallow substantially more.



HALITOSIS—A POTENTIAL EARLY WARNING SIGN OF ORAL PATHOLOGY

Halitosis describes any disagreeable, bad or unpleasant odor coming from mouth-air or breath. Although there are many causes for halitosis, ninety percent of halitosis originates from dysfunction within the oral cavity.

Halitosis is caused primarily by volatile sulfur compounds (VSC's). Multiple bacteria are active producers of VSC's. Poor oral hygiene plays a key role by allowing proliferation of these halitosis producing microorganisms. These microbes are retained on the teeth, gums, and on the surface of the tongue. They degrade sugars, proteins, and oral soft tissue, and retain debris to produce odiferous compounds.

Inflammation of the gums and supporting tissues are typical sources for halitosis as is untreated deep dental decay which allows food debris and dental plaque to accumulate.

Reduction of bacterial load in the mouth with appropriate management of inflammation is an important step. The tongue surface shelters large numbers of bacteria, and cleaning by brushing or using a tongue scraper can reduce the production of VSC's by 40%.



Treatment of tooth decay with proper restorations is another critical step in reducing halitosis and inflammation in the oral cavity. (Aylikci, U. *Halitosis: From diagnosis to management*, Journal of Natural Science, Biology and Medicine, Jan 2013, 4:1)

IN THE BEGINNING-- **HOW INFANTS GET THEIR** **FIRST MICROBES**



At the time of birth, the newborn passes through the birth canal (unless born by Cesarean section) and is anointed with a veneer of maternal secretions that contain the five kingdoms of life— bacteria, viruses, fungi, protozoa, and

archaea--the microbiota. The microbiota combined with their genes are collectively known as the microbiome.

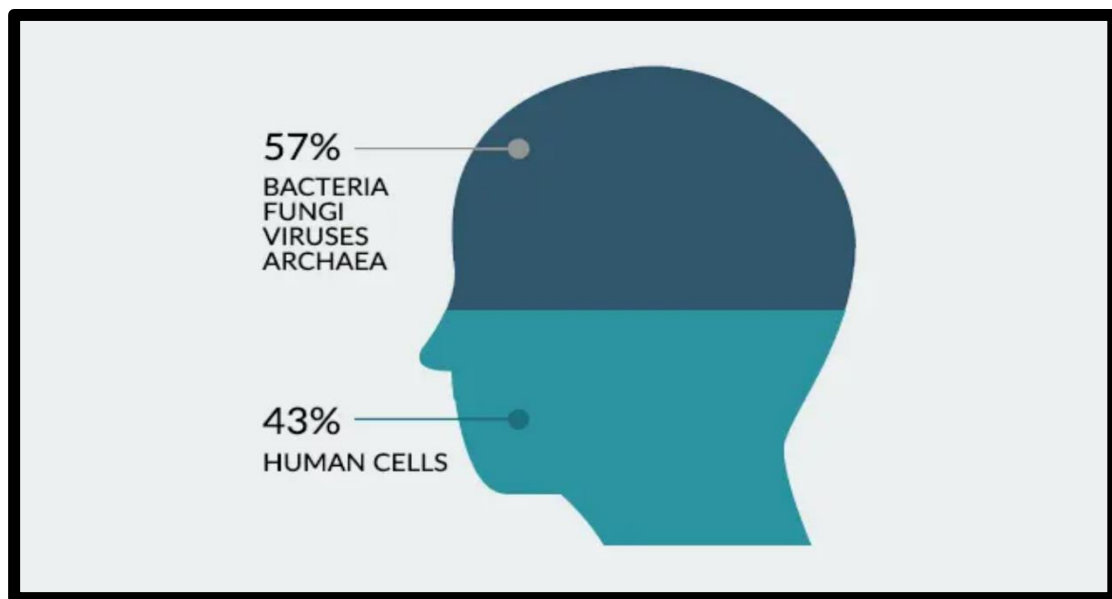
Large numbers of these microbes enter the oral cavity and nasal passages of the baby during the birthing process. They are subsequently swallowed and establish residence in the digestive tract where they multiply. From that point forward, humans share their existence with this vast collection of microorganisms. What humans eat, drink, breathe and otherwise allow into their bodies shapes their microbiome.

STAGGERING NUMBERS **(ONLY HALF OF YOU IS HUMAN)**



**ADULT HUMANS HAVE
30 TRILLION CELLS WITH
23,000 GENES**

As the infant grows over the first few years, the density and diversity of the microbe population grows as well. The total number of microbial cells soon outnumber those of the human host—39 trillion microbe cells versus 30 trillion human cells. It's humbling to realize that less than half of you is human!



39 TRILLION MICROBES WITH 3.5 MILLION GENES

Just like human cells, every microbe contains genes. The microbe population has 150 times more genes (3½ million) compared to the 23,000 genes in the human genome.

Over one thousand different microbial species and more than 7000 microbial strains have been identified. This

extensive community of microorganisms conduct metabolic activities that the human body is unable to perform and without which humans might not be able to survive.

OUR SIGNIFICANT OTHERS-- **HOW HUMANS RELY ON THEIR** **MICROBES**



The body relies on many of its microbes to assist with essential functions. These functions include metabolism, immunity, and communication with the brain. Examples of functions conducted by the body's microbes include the following:

- **Help digest nutrients.¹**
- **Generate chemicals used as energy for intestinal cells.¹**
- **Control blood sugar levels by stimulating insulin production.²**
- **Produce vitamins like vitamin B12 and vitamin K.³**
- **Regulate and control the storage of fat.⁴**
- **Regulate the secretion and composition of bile.⁵**
- **Modulate the sensation and sensitivity of the gut lining.⁶**
- **Regulate hormones responsible for hunger and satiety.⁷**
- **Regulate hormones responsible for bone growth.⁸**
- **Reinforce the gut lining defenses against toxins.⁹**
- **Reinforce the gut lining defenses against harmful microbes.⁹**
- **Reinforce the gut lining defenses against harmful food antigens.⁹**
- **Educate the immune system to respond appropriately to threats.¹⁰**
- **Regulate motility of the intestinal tract.¹¹**
- **Regulate transport across the intestinal lining, i.e., permeability.¹²**
- **Stimulate production of hormones that control mood and behavior.¹³**
- **Help prevent the development of intestinal malignancies.¹⁴**

- ¹Brown, Rosa, *Effects of gut microbes on nutrient absorption*, Nutr Clin Pract 2012 April; 27(2): 201-214.
- ²Khan, Muhammad, *Microbial modulation of insulin sensitivity*, Cell Metab., 20, Nov 4, 2014.
- ³Pham, Van, *Vitamins, the gut microbiome and gastrointestinal health in humans*, Nutrition Research, (95), Nov 2021, 35-53.
- ⁴Backhed, Fredrik, *The gut microbiota as an environmental factor that regulates fat storage*, PNAS 101 (44) 15718-15723.
- ⁵Guzior, Douglas, *Review: Microbial transformations of human bile acids*, Microbiome 9, Article:140 (2021).
- ⁶van Thiel, Isabelle, *Microbiota-neuroimmune cross talk in stress-induced visceral hypersensitivity of the bowel*, Am. J. Physiology, May 28, 2019.
- ⁷Aldock, J. *Is eating behavior manipulated by gut microbiota? Evolutionary pressures and potential mechanisms*, Bioassays, 36(10), 940-949.
- ⁸Jau-Yi Li, *Parathyroid hormone-dependent bone formation requires butyrate production by intestinal microbiota*, JCI, 1767-81, January 2020.
- ⁹Claus, S. *The gut microbiota: a major player in the toxicity of environmental pollutants?* NPJ Biofilms and Microbiomes, 2017 June 22; 3: 17001.
- ¹⁰Katsnelson, A. *How microbes train our immune system*, Nature (2021).
- ¹¹Waclawikova, Barbora, *Gut microbiota—motility inter-regulation: insights in vivo, ex vivo and in silico studies*, Gut Microbes. 2022; 14(1): 1997296.
- ¹²Ghosh, S., *Review: Regulation of intestinal barrier function by microbial metabolites*, Cellular and Molecular Gastroenterology and Hepatology, 2021.

¹³Appleton, Jeremy, *Commentary: The gut-brain axis: influence of microbiota on mood and mental health*, Integrative Medicine, vol 17 (4), Aug. 2018.

¹⁴Yujie Zhao, *The Relationship Between Plant-Based Diet and Risk of Digestive System Cancers: An Analysis Based on 3,059,009 Subjects*, Frontiers in Public Health, June, 2022.

INFLAMMATION-- **THE BEDROCK OF** **CHRONIC ILLNESSES**



Dr. Alessio Fasano, takes the position that inflammation is the underlying physiologic process causing most chronic illnesses. He describes five factors or pillars that exist together and are responsible for chronic inflammation.

- Genetic susceptibility
- Environmental exposures
- Tissue permeability

- Immunity
- Microbial dysbiosis

Analyzing these five factors is a helpful way for establishing a logical approach to treating chronic illnesses.



GENETIC SUSCEPTIBILITY

Screening to identify genetic defects is available but only for a relatively few conditions compared to all the potential illnesses that can befall a human, e.g., celiac disease, phenylketonuria, pernicious anemia, hereditary polyposis syndrome, iron storage disease, hemophilia, among others.

Modification of genes (splicing, editing and substitution of genes) to correct inflammation is presently not an option. Genetic susceptibility, however, is one of the essential elements of inflammation.

EXPOSURES

EXOGENOUS AND ENDOGENOUS

Exposures begin at the moment of conception. They can take two forms, **external**, i.e., *exogenous*, namely those received from outside the body and **internal**, i.e., *endogenous*, those that are present and expected inside the body. The number of exposures over a lifetime both *in utero* and after birth are innumerable.

Four major categories of **external** exposures in humans include the following:

- **Nutrients (foods and beverages)**
- **Medications (both regulated pharmaceuticals and unregulated supplements, i.e., nutraceuticals) including alcohol, tobacco, and recreational drugs**
- **Environmental exposures including air, water, sunlight, radiation, gases, contaminants, toxins, food additives and pollutants**
- **Microorganisms**

Major internal exposures include saliva, tears, mucus, stomach acid, bile, pancreas secretions, enzymes, hormones, and gases.

EPITHELIAL PERMEABILITY

Permeability of the epithelial gut lining refers to the ability to filter foods, toxins, and microbes through the gut into the blood stream. A preponderance of evidence supports the theory that increased permeability, sometimes referred to as “leaky gut,” allows microorganisms, enterotoxins, food antigens and other harmful foreign elements into the body.

IMMUNITY

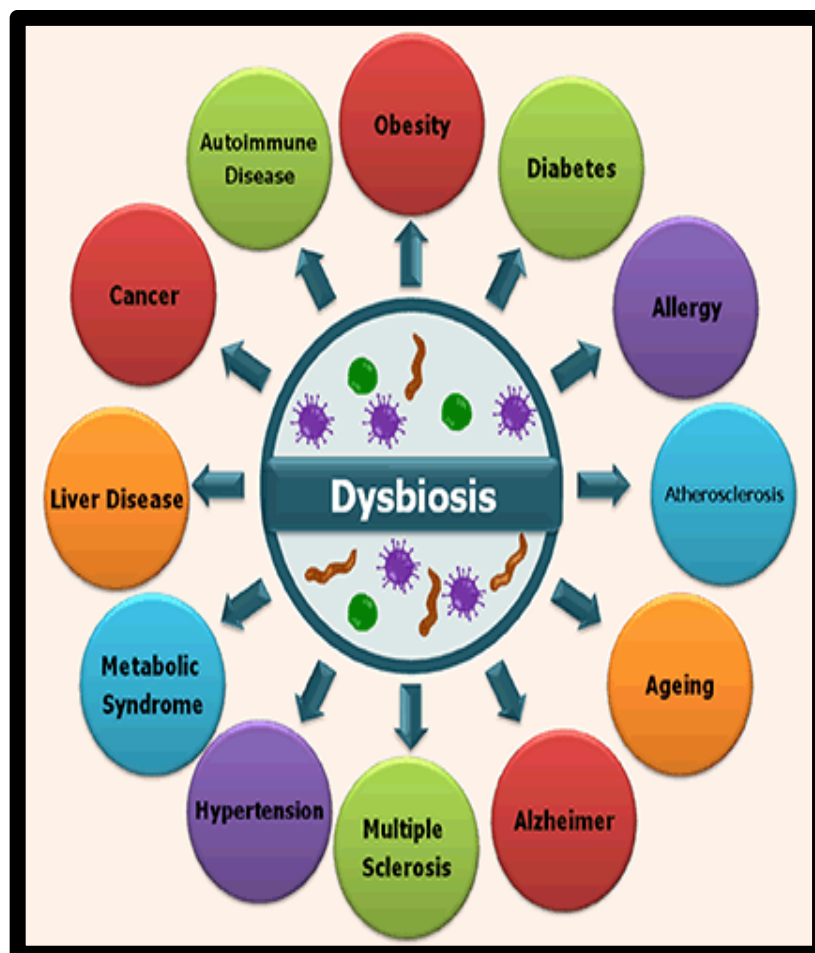
Immunity is the ability of the body to recognize and resist substances that are perceived to be harmful. A whole army of specialized cells within the body can recognize harmful bacteria, viruses, and fungi and can launch a defensive attack to prevent invasion of threatening substances.

Increased permeability can be compounded by the presence of an unruly, hyper-belligerent immune system that fails to initiate a proportionate response to the threats and lacks the discipline to withdraw from the fight when the threats have been neutralized. The chemical and antibody response initiated by the immune system in defense of the

body may proceed unfettered causing local tissue damage as well as disease to distant organs.

MICROBIAL DYBIOSIS

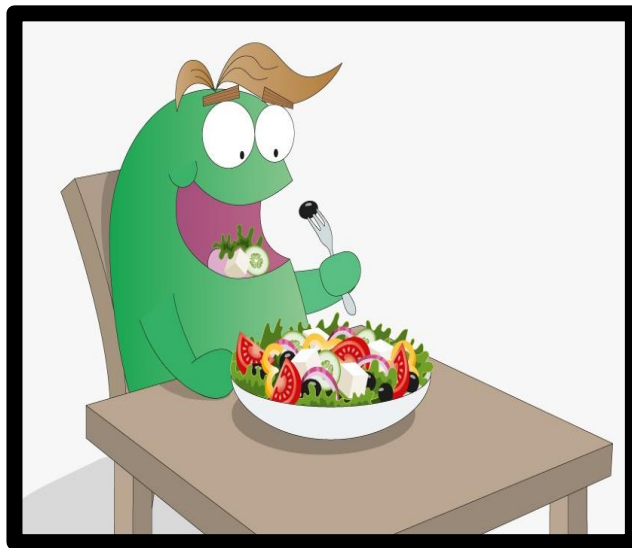
Microbial dysbiosis is an alteration of the numbers (density), diversity (different strain types), location (distribution) and/or the function of microorganisms—as described above. Dysbiosis has been associated with numerous chronic illnesses.



THE IMPORTANCE OF THE LARGE INTESTINE (COLON)

The colon is more than an organ for waste disposal. It contains trillions of microorganisms that provide all the benefits that have been listed above.

COLON MICROBES SURVIVE PRIMARILY ON DIETARY FIBER



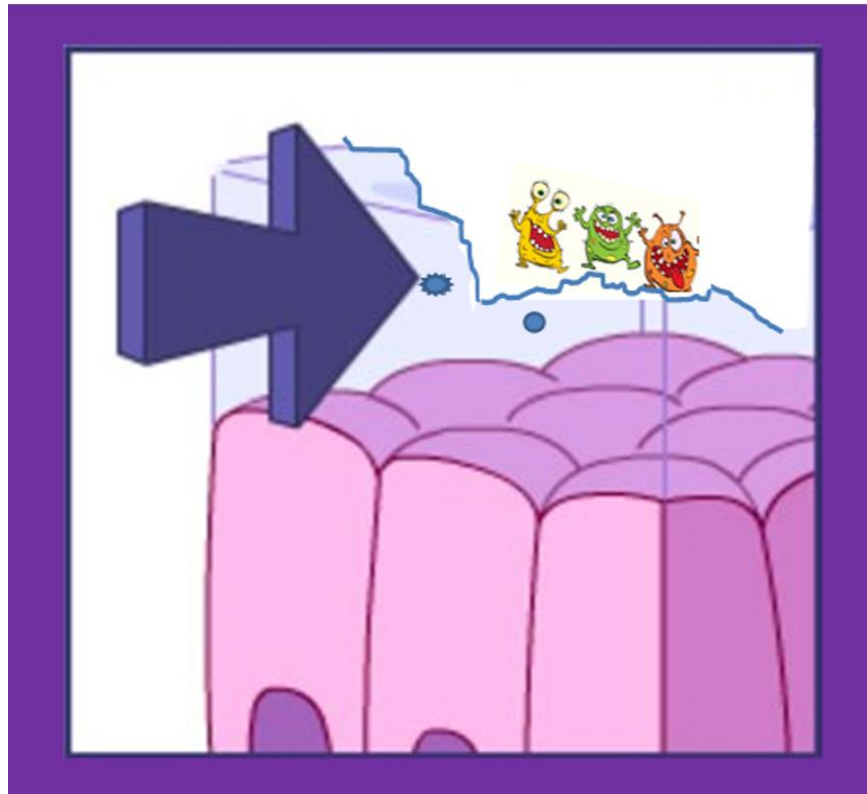
Like all other life forms, microorganisms in the colon require a source of energy to survive. Their preferred source of energy is derived from undigested, sugar-containing, food substances that the small intestine is incapable of digesting. These substances are known as dietary fiber and are contained in fruits, vegetable, nuts, seeds, whole grains,

legumes, beans, and certain forms of starch. Dietary fiber serves as the major and preferred source of nutrients that microorganisms metabolize to survive, thrive, and replicate.



**WHEN DIETARY FIBER IS
SCARCE—YOUR MICROBES EAT
YOU!**

**THE FUEL FOR THE GUT IS
DIETARY FIBER**



IN THE ABSENCE OF FIBER, MICROBES HARVEST NUTRIENTS FROM THE PROTECTIVE MUCUS LINING

Without dietary fiber, microbes can digest away the protective mucus lining of the intestines resulting in a thinner more permeable surface allowing microorganisms, toxins, and foreign antigens easier access into the body—commonly referred to as “leaky gut.” These substances can then pass through the gut lining and initiate an inflammatory response by the body’s immune system.

Researchers continue to conduct studies to establish whether lack of dietary fiber is the cause of chronic diseases or is merely associated with chronic diseases. Although definitive evidence proving causation has yet to be achieved, compelling evidence is accumulating.

GENERAL RECOMMENDATIONS

MOUTH



- Brush your teeth a minimum of twice daily, a.m. and p.m. Ideally, brush teeth upon arising, after meals, and at bedtime.
- Brush your teeth using a rechargeable, electronic, oscillating toothbrush. Brush for a minimum of two minutes each time. Two leading brands are Sonicare® and Oral B®.

- **Brush your tongue or use a tongue scraper every time you brush your teeth.**
- **Change the tip of the oscillating toothbrush every three months.**
- **Floss your teeth or use interdental brushes (Dental Picks®), or both, after meals.**
- **Schedule visits to the dentist and dental hygienist at least once every six months. Those who have had multiple dental issues and restorations in the past, root canals, or gum disease, should see their dentist and dental hygienist more frequently, ideally every 90 days or at the intervals recommended by their dental professional.**
- **Avoid allowing sugary foods and beverages to remain in prolonged contact with gums and teeth enamel. Do not eat nutrients or confections prepared as a “gummy” or take medications suspended in gum drops. Avoid sugar containing mints and gum.**

EYES AND NOSE



- Only use steroid containing nasal inhalers, eye drops and oral inhalers when recommended by your healthcare provider.
- Minimize the use of nasal decongestants.
- Avoid foreign body piercings of the nose that can serve as an entry point for pathogens.
- Contact lens wearers should consider wearing daily replaceable contact lenses when possible.
- Apply moisturizing eyedrops before going to sleep and upon awakening.
- Avoid the placement of cosmetic jewelry in the eyebrows.

- Minimize eye cosmetics such as mascara, artificial lashes, glitter, and eyeliners, which block the natural secretions of glands surrounding the eyelashes.

STOMACH



- Only use acid reducing medications as recommended by a medical healthcare provider.
- Eat a plant-based diet made up primarily of fruits, vegetables, nuts, seeds, beans, lentils, legumes, whole grains, and resistant starches. Examples of recommended food items include the following: (See List 1 for a more comprehensive listing.) Popularized plant-based diets include the Mediterranean diet and the DASH diet.

☐ **Vegetables:** tomatoes, broccoli, kale, spinach, onions, cauliflower, carrots, Brussels sprouts, cucumbers, potatoes, sweet potatoes, turnips

- ☐ **Fruits:** apples, bananas, oranges, pears, strawberries, grapes, dates, figs, melons, raisins, peaches
- ☐ **Nuts and seeds:** almonds, walnuts, Macadamia nuts, hazelnuts, cashews, sunflower seeds, pumpkin seeds
- ☐ **Legumes:** beans, peas, lentils, peanuts, chickpeas
- ☐ **Whole grains:** oats, brown rice, rye, barley, corn, buckwheat, whole-wheat bread and whole-wheat pasta
- ☐ **Fish and seafood:** salmon, sardines, trout, tuna, mackerel, shrimp, oysters, clams, crab, mussels
- ☐ **Poultry:** chicken, duck, turkey
- ☐ **Eggs:** chicken, quail, duck
- ☐ **Dairy:** cheese, yogurt, milk
- ☐ **Herbs and spices:** garlic, basil, mint, rosemary, sage, nutmeg, cinnamon, pepper
- ☐ **“Healthy” fats:** extra virgin olive oil, olives, avocados, avocado oil

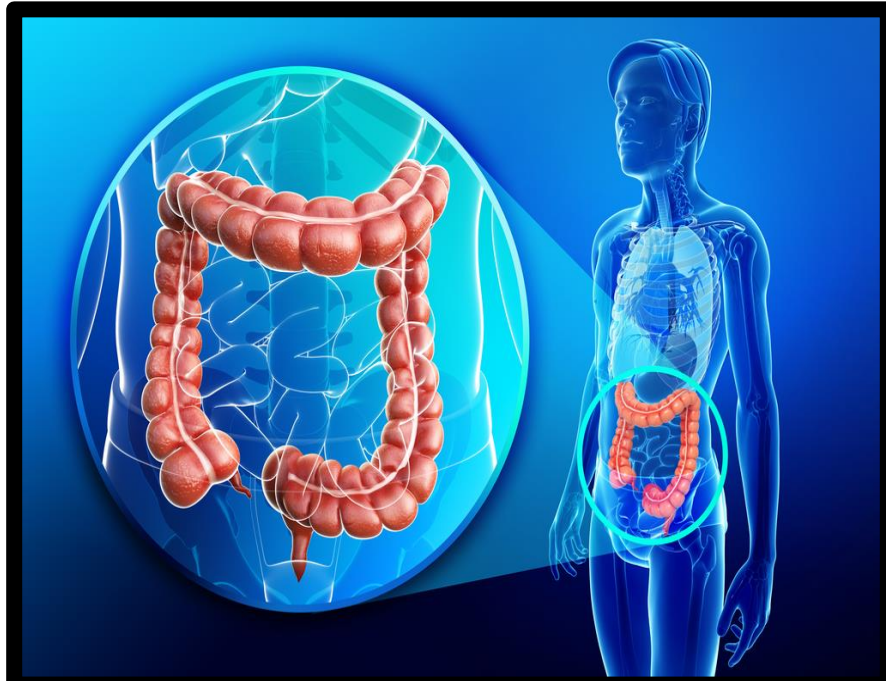
Foods to Limit:

- ☐ **Added sugar:** found in carbonated beverages, sport drinks, juice boxes, candies, ice cream, table sugar, syrup, and baked goods
 - ☐ **Refined grains:** white bread, pasta, tortillas, chips, crackers
 - ☐ **Trans fats:** found in margarine, fried foods, and other processed foods
 - ☐ **Refined oils:** soybean oil, canola oil, cottonseed oil, grape seed oil
 - ☐ **Processed meats:** processed sausages, hotdogs, deli meats, baloney, salami, beef jerky
 - ☐ **Highly processed foods:** fast foods, convenience meals, microwave popcorn, granola bars
-
- **Incorporate a wide variety of fruits and vegetables into the diet. Try to avoid eating the same food items every day.**
 - **Reduce wheat products in the diet like white bread, yeast rolls, pie crusts, and the like. Gluten contained in wheat products is associated with increased gut permeability which**

may activate an immune response resulting in inflammation. Try to eat a “gluten reduced” diet.

- **Include in the diet resistant starches contained in foods like cooked and cooled potatoes, cooked and cooled rice, and “greenish” un-ripened bananas among other food items.**
- **If seasonally available and affordable, eat organic foods.**
- **Although most non-prescription supplements are to be avoided, deficiencies in iron, magnesium, calcium, vitamin D and vitamin B12 are common enough to warrant supplementation. A single daily multivitamin (for example, Centrum®) can provide most of the recommended amounts of the above vitamins and minerals. Blood levels of the above vitamins and minerals should be checked by your primary health care provider periodically.**

LARGE INTESTINE (COLON)



- **Provide the microorganisms in the large intestine with generous amounts of dietary fiber. (See List 1 below and discussion above).**
- **Try to have one or two soft bowel movements per day.**
- **Talk to your healthcare provider if you are having more than three movements per day, skipping multiple days without having bowel movements, straining to initiate bowel movements, passing hard stools the shape and consistency of rocks or marbles, losing control of bowel function, i.e. (“accidents”), or seeing blood in or on the stool.**

- For those with no family history of colon polyps or colon cancer and are not otherwise at increased risk for colon malignancies, schedule colorectal cancer screening examinations beginning at age 45.

AIR POLLUTION



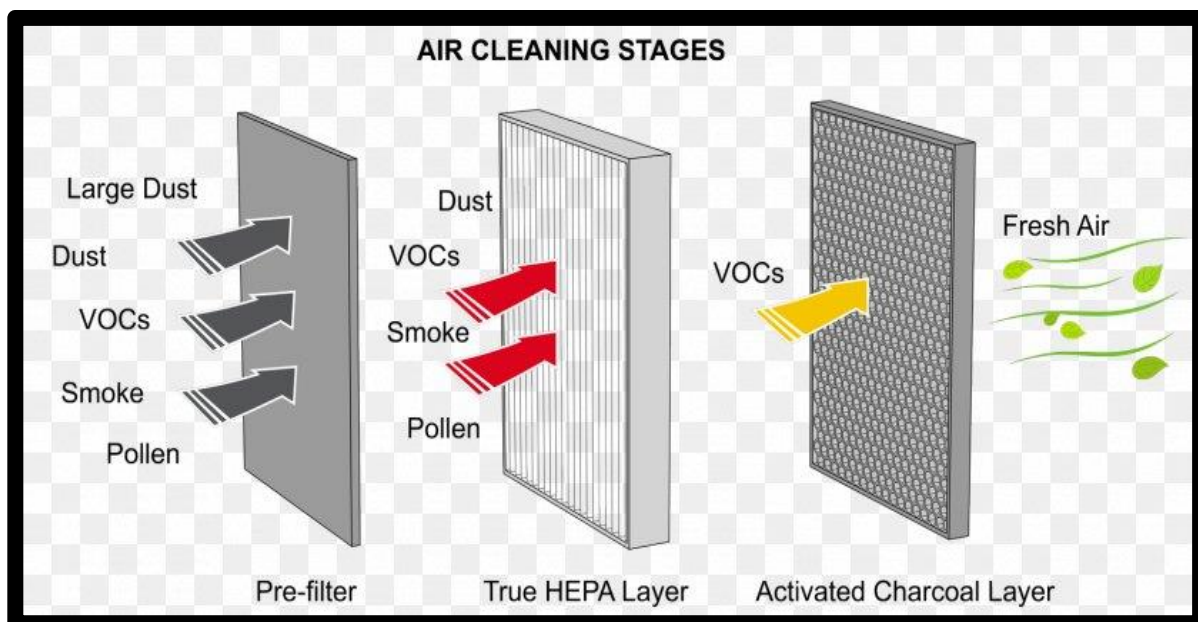
In 2012, Korean scientists set up equipment to catch viruses and bacteria floating in the air. Their research was published in the August, 2012 issue of *The Journal of Virology*. They calculated that in each cubic meter of air there was between 1.6 million and 40 million viruses. Each cubic meter of air also contained between 860,000 and 11 million bacteria.

Humans breathe in roughly 0.1 cubic meters of air every minute resulting in an intake of several hundred thousand viruses. Half of the viruses the researchers trapped were previously unknown viral species.

Air pollutants have been shown to disrupt the protective intestinal lining barrier. A recent study examined the relationship between air pollution and a baby's developing gut microbiome. (Bailey, M.J., et. al., *Postnatal exposure to ambient air pollutants is associated with the composition of the infant gut microbiota at 6-months of age*, Gut Microbes, 14:1, 2022)

Researchers found that air pollution in the first six months of life is associated with a gut microbe composition linked to allergies and inflammatory illnesses. Comparable results have been found in adolescents and young adults.

It would be reasonable to have portable air filtration units that contain a HEPA filter and an activated carbon filter in sleeping and recreational areas within a household but also in work environments, if possible.



Every few years, the ambient air in your residence should be tested for radon gas. Radon is a toxic, odorless gas related to cancers. Inexpensive testing kits are available on the Internet.



HYDRATION



Every organ in the body requires water to function properly. It makes up 50 to 70% of the body weight of an adult human and is needed to survive. Water is required to get rid of waste products that accumulate in the body through urination, bowel movements and perspiration. It helps maintain normal body temperature. It lubricates joints and protects sensitive tissues.

The United States National Academy of Sciences, Engineering in Medicine recommends a daily intake of 3 to 4 liters of *fluids* for men (90-120 ounces) and 2 to 3 liters for women (60-90 ounces). These recommendations include, not just water, but other foods and beverages that contain water.

Only about 80% of the recommended amounts need come from water and the other 20% may come from foods and other drinks.

The amount of water may vary based on several factors including the following:

Exercise: Activities that cause large amounts of sweating require increased water intake to cover the losses.

Environment: Hot and humid environmental conditions increase fluid requirements.

State of health: Losses from fever, vomiting, diarrhea, require fluid replacement. Increased fluid intake is therapeutic for those with urinary tract infections and kidney stones.

Breast feeding: Breast feeding requires increased fluid intake to remain hydrated.

DRINKING WATER



Drinking water comes in many different formulations including tap water, filtered water, “purified water,” alkaline water, spring water, artesian well water, carbonated water (Seltzer) and distilled water. Distilled water should be your water of choice.

Distilled water is prepared by boiling water then cooling the steam and collecting the condensation. No chemicals with a boiling point above 212° are present in the cooled steam of distilled water. The purity of water is based on four things:

- Amount of sediment**
- Presence of microorganisms**
- Presence of dissolved gases (volatile organic compounds)**
- The number of chemical ions present in the water including lead, mercury, arsenic, chromium, etc.**

Distilled water that has undergone passage through activated carbon and microfiltration, then subjected to ozonation or ultraviolet treatment after distillation has the least impurities.

Those with well water supplying their residence should submit a sample of their well water to their county health department to check for bacterial contamination once a year.

THINGS TO AVOID



TOBACCO

- Avoid using all tobacco products which includes vaping.

RECREATIONAL DRUGS

- Avoid recreational drugs unless otherwise directed by a medical care professional.

ALCOHOL

The use of alcohol has been heavily promoted by stakeholders as beneficial for heart health. According to the World Heart Federation, “research in the last decade has led to a major reversal in the perception of alcohol in relation to

health in general and cardiovascular disease in particular. Contrary to popular opinion, alcohol is not good for the heart.” (*World Heart Federation Policy Statement—The Impact of Alcohol Consumption on Cardiovascular Health: Myths and Measures.*)

Alcohol has been proven to have a significant adverse effect on multiple organ systems including the liver¹, brain², and intestinal microbiome,³ and now evidence shows that alcohol not only lacks beneficial effects on heart health but can be harmful⁴.

¹V Subramaniyan, S et al. Alcohol-associated liver disease: A review on its pathophysiology, diagnosis and drug therapy, Toxicology Reports, 2021 –

²Anya Topiwala, No safe level of alcohol consumption for brain health: observational cohort study of 25,378 UK Biobank participants, medRxiv 2021

³BA White, GP Ramos, S Kane, [The impact of alcohol in inflammatory bowel diseases](#), *Inflammatory Bowel Diseases*, 2022 –

⁴[Kiran J. Biddinger](#) et al. *JAMA Netw Open*. 2022;5(3):e223849. doi:10.1001/jamanetworkopen.2022.3849

THE POTENTIAL DANGERS OF **HYPER-POLYPHARMACY**



Combining multiple, unregulated, over the counter supplements may result in serious unintended consequences. The chemical interactions between different combinations of supplements on both human host cells and body microorganisms are largely unknown.

Many of these unregulated drugs are made in foreign countries where manufacturing conditions and conditions of cleanliness are unknown. And. . . most of these unregulated drugs have never been the subject of published scientific studies.

Confer with your medical care provider and pharmacist before introducing new chemicals into your body. (Weersma,

R. et. al. *Interaction between drugs and the gut microbiome*, Gut, 69:1510-1519, 2020.)

IS THERE ANY VALUE TO DOING A STOOL ANALYSIS TO IDENTIFY THE DENSITY AND DIVERSITY OF THE GUT MICROBIOME?

The ability to successfully identify species and quantity of microorganisms in the human microbiome is an exciting breakthrough. As yet, however, medical care providers don't have the tools to interpret the data.

Though certain microbes may be present, providers still don't know if those microbes are functionally active and what factors activate or deactivate them. Furthermore, medical care providers still do not fully understand how organisms interact with each other. Nor do they know whether microbes affect many prescription medications and supplements that the individuals may be taking.

Knowing which microbes are present in the gut is an important first step. Knowing what these microbes are doing, how they do it, and how and when to supplement them is the next challenge in patient care.

THE “BIOTICS” FAMILY—PROBIOTICS, PREBIOTICS AND POSTBIOTICS

The International Scientific Association for Probiotics and Prebiotics and the World Health Organization have defined ***probiotics*** as live microorganisms that when administered in adequate amounts confer a health benefit on the host. Originally, the organisms were classified primarily as species of *Lactobacillus* and/or *Bifidobacterium* but over the years have been expanded to other microbial species.

Prebiotics have been defined as substrates that are selectively utilized by host microorganisms conferring a health benefit. Prebiotics initially were composed of non-digestible dietary fiber consumed by the host that nourish intestinal microorganisms. In addition to dietary fiber, prebiotics now include human breast milk oligosaccharides, resistant starches, and selected amino acids. They can be considered “fertilizer” to enrich host microorganisms.

The newest members of the “biotics” family are ***postbiotics***. Postbiotics represent a preparation of inanimate microorganisms and/or their components that confer a health benefit on the host. Thus, a postbiotic must include some non-living microbial mass, whether it be whole microbial cells or cell components.

The notion has been proposed that probiotics serve as reinforcements or replacement recruits that repopulate the

compromised microbial landscape. There are difficulties, however, embracing this concept as the sole mechanism by which probiotics influence host well-being.

Probiotics that are ingested by the host must traverse a hostile environment in the gut passing through baths of microbe destroying hydrochloric acid in the stomach then protein damaging enzymes secreted by the pancreas before they can reach the lower intestinal tract where they are required. Few probiotics survive the travels to reach the large intestine alive and remain capable of establishing their niche in a highly competitive landscape occupied by other microorganisms.

An alternative theory that might be considered is that probiotics are actually prebiotics and as they are destroyed during transit become supercharged nutrients that benefit the growth and reproduction of the waning commensal microbes, ie. postbiotics. Perhaps probiotics become prebiotics in their conversion to postbiotics.

Probiotics have been widely advertised and promoted by food manufacturers and in many cases the hype and the hope outpace the science. Besides questioning their mechanism of action, other questions remain when initiating probiotics for therapy including the following:

- Of the thousands of different microbial species and strains that occupy the gut, how is it possible to know which ones are missing and need replacing when selecting a probiotic?
- How many colonies of microorganisms (CFU's-colony forming units) are needed to qualify as an “adequate” dose?
- How long should a probiotic be taken?
- Is it better to take probiotics that are contained in food products or those that are manufactured and sold commercially?
- Is it better to take a probiotic before a meal, with a meal, or after a meal?
- Do probiotics cross-react with any other medications being taken by the host?
- Should probiotics be taken at the same time as an antibiotic and, if so, for how long thereafter?
- What health problems have been scientifically proven to improve with the use of a probiotic?

Abstracted from *WIRED World 2023*

We know that gut microbes help develop and sustain the immune system. They do this by producing high levels short-chain fatty acid molecules: acetic acid, propionic acid, and

butyric acid (or butyrate) among others. Butyrate, in particular promotes the activity of immune cells called regulatory T cells, or T-regs.

Increased levels of fatty acid molecules create an “anti-inflammatory” environment—both locally in the digestive tract and throughout the whole body.

In 2023, the understanding of gut microbes will deepen through the development of technology. Laboratory hardware will be used to rapidly sequence large amounts of genetic material. Computer hardware and software will allow the ability to sort through microbial gene sequences, seek patterns and correlate results with diet or state of health. Probiotics may become one prospect for manipulating the microbiome. There is some evidence that probiotics may ease symptoms of an ongoing illness, however, the authorities in Europe and the US have yet to approve any probiotic as a medicine.

With immense variability in the precise makeup of each person’s gut microbes, scientists are unable to define what constitutes a “healthy” one. A core set of various bacteria seems important and the absence of food antigens, toxins and pathogen. But beyond this, many questions still remain.

Rather than a few types of microbes being needed, perhaps what’s important is an overarching ecology. Once this is understood, scientists will be able to design and manufacture

healthy microbe cocktails that can be administered as medicine. We are not there yet!

PERSPECTIVE ON PROBIOTICS

FOR THOSE WHO USE THEM

- It is preferable to take food based probiotics when available rather than synthetic probiotics.
- It is preferable to purchase probiotics manufactured in the United States by reputable pharmaceutical companies.
- It is preferable to select commercial probiotics that have been tested by the manufacturer on diverse populations of individuals to prove efficacy and reproducibility.
- It is preferable to select probiotics that have had their research published in peer reviewed medical journals.
- It is preferable to select and use probiotics with the guidance of a knowledgeable health care professional.

IMPROVING BOWEL REGULARITY

FIBER AND THE MICROBIOME

In large part, the frequency and consistency of bowel movements is regulated by intestinal microorganisms.

There are trillions of microbes that exist in the large intestine. To carry out their function of adjusting motility, i.e. (intestinal peristalsis), they must survive, thrive and replicate.

The chemical compounds that allow these microorganisms to flourish and assist with the function of bowel regularity are contained primarily in dietary fiber.

Dietary fiber is a diverse group of compounds that cannot be digested by human enzymes in the small intestine and, therefore, pass undigested into the large bowel (colon). Microbes in the colon are well adapted to utilizing dietary fiber as a source of energy.

As microbes metabolize fiber present in the diet, they generate a class of compounds known as short chain fatty acids (scfa). One specific scfa, butyrate, has been proven to stimulate motility and adjust the composition of bowel actions.

The Institute of Medicine, which provides science-based advice on matters of medicine and health recommends an intake of 38 grams of fiber daily for adult men and 25 grams for adult women. Less than 5% of the US population get the recommended daily amount of fiber in their diet.¹

For those wanting examples of food choices to improve bowel regularity and promote other health benefits, a diet which emphasizes fiber containing food items is a good place to start.

See Table I at the end of the booklet for high fiber choices.

¹Quagliani D, Felt-Gunderson P. Closing America's Fiber Intake Gap: Communication Strategies From a Food and Fiber Summit. *Am J Lifestyle Med.* 2016;11(1):80-85. Published 2016 Jul 7. doi:10.1177/1559827615588079

POSTSCRIPT

WHAT HAPPENED TO CAROLINE?

Caroline is better—not perfect, but better. Caroline has tried to remain compliant with most of the recommendations given above. Many of her presenting symptoms have abated. Her energy level has improved. She is getting more restful sleep. Her mental acuity has returned. Body aches and pains have diminished. Her burping, bloating, flatulence, and distention have all decreased. Foods that she thought she would never be able to tolerate again are now appearing on her plate after

many years of avoidance without precipitating an increase in symptoms.

Caroline still, on occasion, has periods of bowel irregularity with occasional diarrhea interspersed with periods of constipation. The episodes, however, are less frequent and are brief. She attributes these episodes mostly to times when she did not eat enough fiber or was prescribed an antibiotic.

Caroline feels she is on the right path. She pays more attention now to what she allows to go through her mouth as well as to her dental care. She says that she can now see a more hopeful and healthy future ahead of her.

LIST 1

FOODS CONTAINING

FERMENTABLE FIBER

FRUITS

- Apples
- Apricots
- Bananas
- Blackberries
- Blueberries
- Coconut
- Dates
- Figs
- Kiwifruit
- Nectarines
- Oranges
- Peaches
- Pears
- Plums
- Pomegranates
- Prunes
- Raisins
- Raspberries
- Strawberries



VEGETABLES

- Acorn squash
- Artichokes
- Arugula
- Asparagus
- Avocados
- Beets
- Broccoli
- Brussels sprouts
- Cabbage
- Carrots
- Celery
- Collard greens
- Corn (sweet, boiled)
- Cauliflower
- Eggplant
- Green beans
- Green peas
- Edamame
- Kale
- Okra
- Olives
- Onions
- Parsnips
- Peppers
- Potato (baked, with skin)
- Pumpkin
- Radishes
- Rutabaga
- Shallots



- Snap peas
- Snow peas
- Spinach
- Squash
- Sweet potatoes
- Tomatoes
- Turnips
- White mushrooms
- Zucchini

NUTS

- Brazil nuts
- Cashews
- Chestnuts
- Granola
- Hazelnuts
- Macadamia nuts
- Pine nuts
- Peanuts
- Pecans
- Sunflower kernels
- Walnuts



SEEDS AND GRAINS

- Chia
- Flax
- Hemp
- Pistachios
- Pumpkin
- Sesame
- Sunflower



BEANS AND LENTILS

- Wheat bran
- Baked beans
- Black beans
- Black-eyed peas
- Garbanzo beans
- Kidney beans
- Lentils
- Lima beans
- Mung beans
- Northern beans
- Navy beans
- Pinto beans
- Split peas
- Soybeans
- Soy yogurt
- Tempe
- Tofu



DRY CEREALS

- All Bran
- Kashi® Crunch
- Kashi® Original
- Raisin Bran
- Shredded wheat
- Nature's Path® Organic Flax
Plus Multi-Bran Flakes or Smart Bran

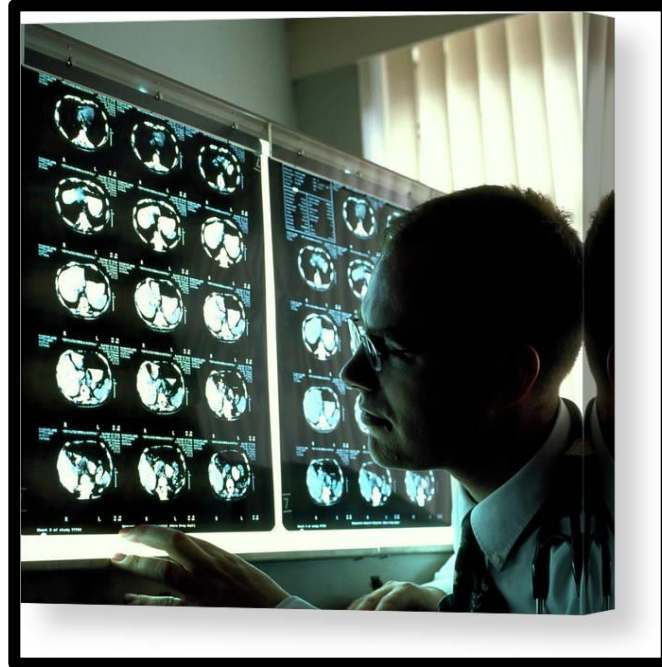


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BACK TO THE FUTURE



The scientific literature exploring topics covered in this monograph is expanding exponentially. Scientists are far from being at the end of that inquiry.

Updates to the monograph will be forthcoming that will present new findings about causes and treatment of chronic intestinal illnesses.

More to follow. . .