

Complimentary Chapter

# REGENERATE

UNLOCKING YOUR BODY'S  
RADICAL RESILIENCE THROUGH  
THE NEW BIOLOGY



Sayer Ji

Founder of GreenMedinfo

Praise for  
**REGENERATE**

“Sayer Ji holds the reader’s hand like a great guide to explore the exciting twists and turns of the new biology of the human body.

Beyond highlighting the body’s tremendous power of healing and regeneration, Sayer provides easy-to-understand steps to make this happen for everyone who follows his guidelines.

A great guide to a new regenerated you!”

— **STEVEN R. GUNDRY, M.D.**

*New York Times* bestselling author of *The Longevity Paradox* and *The Plant Paradox*, and medical director of The Centers for Restorative Medicine, Palm Springs and Santa Barbara, California

“Sayer Ji’s *Regenerate* is a must-read for anyone who wishes to understand the exciting implications of the New Biology, the awe-inspiring power of the human body to heal itself in face of adversity, and how to practically apply the cutting-edge science to one’s life.”

— **DR. MARK HYMAN**

founder of The UltraWellness Center and  
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“This book is a revolution! It goes way beyond the beliefs that have fueled modern pharmaceutical medicine for decades and gives you all the science you’ll ever need to prove that there is another way. In these pages, you will learn how to harness the amazing regenerative ability of your body through food, information, and direct experience. I highly recommend this book!”

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“*Regenerate* leverages leading-edge science to show how we can actually change the expression of our DNA to build resilience and reverse the biological clock of degeneration that we’ve all come to expect. This is powerful, deeply validated, but nonetheless user-friendly information that will clearly pave the way for health.”

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“*Regenerate* is a brilliant, enlightening blend of ancient traditions, modern medicine, cutting-edge science, and sacred spirituality, conscientiously woven into an alchemical roadmap of living life in the 21st century. A must-have for curious, soul-seeking readers in the pursuit of a high-vibe path!”

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nutritionist, educator, and author of *Whole Detox*

“I’ve long admired Sayer for not only the depth of his research in the new science of health but also his poetic communication style. His first book provides a radical reframing of what our bodies are capable of and simple steps to unleash that potential.”

— **JAMES MASKELL**

CEO of Knew Health, founder of Evolution of Medicine,  
and author of *The Evolution of Medicine*

“The answers Sayer Ji has found exploring the complex relationship between humans and their food are both surprising and awe-inspiring. This book is a must-read for anybody who thinks that ‘a calorie is a calorie.’”

— **STEPHANIE SENEFF**

senior scientist at MIT

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Sayer Ji



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This book is dedicated to Kelly Brogan,  
my beloved wife and partner, who, like  
a Force of Nature, turned my life upside down  
and inside out the moment I knew she existed.  
The alchemical crucible of our immense love  
inspired in me the courage to face and move  
beyond my deeply held fears, perceived  
limitations, and stories, and tap into the  
unlimited potential for physical and spiritual  
regeneration which I now know is buried  
deep within us all as a birthright.

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# INTRODUCTION

*R*egenerate means to rejuvenate, revitalize, and renew. These words hold great promise, especially for so many of us who feel something is wrong, most often in our bodies but increasingly in our souls. We yearn for a feeling of peace, wholeness, and vitality, but experience our bodies as the fallible and vulnerable structures we have been made to believe them to be. In fact, we have been designed to naturally draw strength, energy, and healing from deep within rather than succumb like clockwork to the “inevitable” downward spiral of biological time. On the cellular level, our bodies have the innate power and ability to reverse damage, regenerate, and restore a directly felt experience of well being we have lost.

This isn't just wishful thinking. A significant number of new studies in biomedical science confirms that our bodies are radically resilient and that all we need to do to reclaim our health and vitality is to eliminate sources of interference with our bodies' innate, robust self-regenerating capacity. Our physical form represents eons of adaptation to and mastery over constantly changing conditions, including powerful forces of environmental and

biological adversity. Our bodies have emerged from this crucible with veritable superpowers, not the least of which is our seemingly magical and irrepressible capacity for radical resilience.

The New Biology offers a revolutionary and breathtaking vision of the body as resilient, intelligent, and seamlessly interwoven with the larger universal patchwork. As you read this book, you will learn how to engage your body's self-healing mechanisms and unleash your cells' regenerative powers.

On a molecular level, every cell in your body is undergoing a constant process of coming into and out of being, much like the flicker of a flame, and doing it so perfectly that we only experience ourselves on a macroscopic level as immutable, relatively unchanging organisms. Yet there are trillions of changes and microadjustments occurring every moment in each cell, completely regenerating damaged and diseased tissue.

On the most basic level, regeneration follows from removing what the body does not need and adding back what it does.

In **Part I: Your Body and the Miracle of Regeneration**, you will learn about the secret relationship between human and plant evolution, your genes, and the most common health regenerators and disruptors. Contrary to popular dogma, your DNA is not your destiny. You are in the driver's seat and your choices—from the food you eat to your interactions with nature—powerfully impact your health. You will learn about the regenerative powers of your cells and how to optimize them for healing and longevity. You will pick up some fundamental scientific knowledge, like how microRNAs, the potent messengers in food that communicate directly with your cells, can orchestrate your gene expression, and how telomeres, the noncoding pieces of DNA at the end of your chromosomes, directly influence your experience of aging.

**Part II: Rethinking Chronic Disease, Prevention, and Healing** offers startling new information about the Western Pattern Diet—the archetypal grain-centric, chemically processed, industrialized food staples and preferences that emerged in the post-World War II era that has since been exported from the United States to almost every nation in the world—and its

connection to the emergence of chronic conditions that accelerate aging and adversely impact both the length and quality of life, including cancer, Alzheimer's, cardiovascular disease, and metabolic syndrome, clusters of health conditions referred to as "diseases of affluence" and all representing a short-circuiting of the regenerative processes within your body. Because fear is a major impediment to successful healing, Part II addresses the psycho-emotional dimension of cellular degeneration and the role the medical establishment plays in perpetuating these trends.

**Part III: Regenerate Rx** provides you with a road map to better health. You will learn how to detox from the Western Pattern Diet and heal with the foods of the ancestral diet. You will learn how to optimize the effects of the ancestral diet with natural supplements for long-term results and use nature's abundant energy sources to encourage the regenerative process, strengthening your body from the inside out. You will plunge into the joy of intentional movement and learn time-tested techniques for improving your sleep and diffusing stress to decelerate the aging process and help neutralize the underlying conditions that foster chronic disease.

Whether you are seeking to improve your quality of life, reverse a chronic condition, or harmonize your body with your ancestral and evolutionary healing mechanisms, using the principles of the New Biology will transform your body, mind, and soul, and enhance your ability to truly feel deeply alive and well again—experiences that I believe are your natural birthright.

## MY OWN JOURNEY OF HEALING

While today I find myself easily amazed at the extreme intelligence and resilience of the the human body, it took many years for me to experience its vitality firsthand. I came into this world as a sickly infant, and during my journey to recovery, I felt so saddled with hopelessness and dependency on medications that I often doubted that I would make it to adulthood. Yet, in so many ways, I am

stronger now than I have ever been. I've gone from being an overweight inactive asthmatic with a bum hip to a marathon-running natural health advocate who hasn't used a medication of any kind for decades.

My struggle to overcome disease started when I was six months old, at our doctor's office, where my big sister was getting a checkup while my mother held me in her arms. The nurse observed my pale skin and heard my shallow, wheezy breathing, and, instead of fetching my sister, she whisked me from my mother's arms for clinical evaluations and tests. That day, I was diagnosed with severe bronchial asthma and thereafter spent most of my childhood on a never-ending merry-go-round of doctor's appointments and hospital stays, struggling with a multitude of overlapping health issues, from recurrent colds to chronic allergies to severe "asthma attacks" requiring emergency trips to the hospital, at times as often as twice a week.

I received all the vaccines customary at the time—the first battery of which coincided exactly with the onset of my asthma—and was given powerful medications like antibiotics and steroid inhalers, which I continued to take throughout my childhood. When things got really bad, my parents would rush me to the nearest emergency room for an injection of epinephrine, an anxiety-provoking rush of adrenaline intended to dilate the bronchial passageways during an acute asthma attack. Between these shots, my vaccinations, and immunotherapy injections for allergies, I sometimes felt like a human pincushion. But even though my bathroom medical cabinet was overflowing, no remedy lasted, because the root causes of these episodes—which no one seemed to be searching for at the time—remained unaddressed.

When I was six, I had my adenoids removed, an immune organ, whose removal has now been linked to a range of diseases of the upper respiratory tract and increased risk of infectious/parasitic diseases later in life.<sup>1</sup> When I was 12 and 13, I underwent two major surgeries for a relatively rare bone and hip joint condition called slipped capital femoral epiphysis, a condition that we now know occurs more frequently in asthmatics whose

exposure to inhaled corticosteroids has had the unintended effect of disrupting normal bone and cartilage development. Given my physical limitations (to this day, my right femur bone is half an inch shorter than my left) and general lack of vitality, it was often difficult for me to play with the other kids or participate in school gym classes. I was overweight, unfit, and desolate. I felt like an outcast imprisoned within the dilapidated confines of my body. Sometimes my respiratory challenges were so bad that I had difficulty walking up the stairs.

When I was 17, my doctor assured me and my parents that if I had surgery on my sinuses, my breathing would improve. But the surgery left me with worsening nasal obstructions and chronic sinus infections that made it even more difficult to breathe.

These early life experiences of riding the medical merry-go-round left me deeply traumatized, prompting me to disassociate from my body, where so much physical and emotional pain was stored. Not only did modern medicine fail to significantly help me; it seemed to be, at times, actively torturing me. In retrospect, I see how my growing sense of powerlessness was reinforced by a medical system that believed chronic health conditions like asthma were outside one's sphere of control. Asthma was said to simply "run in the family," as if it were a settled matter of shoddy genetics.

At least a dozen doctors examined and treated me as a child and young adult, and not one investigated the environmental conditions, diet, toxicant burden, or mind-body-emotion connection as upstream triggers of my symptoms. It wasn't until my first year in college, when I was exposed to an entirely new realm of alternative health ideas and practices, that I considered the possibility that my asthma had been caused by dietary, behavioral, and emotional factors.

When I learned that cow's milk, far from being the calcium-rich elixir of health that millions have been encouraged to believe, has "mucus-forming properties," I decided to test the idea on myself by removing milk and cheese from my diet. The result was, and has continued to be, nothing less than miraculous. Within days, my lifelong asthma went into complete remission. After 17

years of nonstop asthma medication usage, I put it away—for good. The symptoms of asthma never came back unless I inadvertently consumed even the smallest amount of dairy products. (The one exception is clarified butter, or ghee, dairy products that are made safe by the removal of the antigenic casein protein.)

After a life defined and circumscribed by medical complaints, I felt simultaneously wronged and liberated. Even more exciting than being able to breathe again was realizing that I am not biologically destined to be weak and flawed. Thereafter, I began to deconstruct and question the medical institutions that everyone, myself included, held as the ultimate authorities on health.

I would eventually learn that cow's milk contains white, sticky proteins, such as A1  $\beta$ -casein, and powerful, gene-impacting microRNA molecules, packaged in little particles called exosomes, that are intended for bovine calves. The biological pathways<sup>2</sup> that cow's milk activated in my body presented the symptoms of asthma. Asthma, on some level, was my body trying to communicate a profound mismatch between my body's needs and the inadequacies of the conventional Western diet that I was consuming. The symptoms were not the enemy but were instead harbingers of the solution.

Later, I learned that other gastrointestinal symptoms (such as constipation and acid reflux) that had plagued me were caused not by bad genes or bad luck but by our biological incompatibility with gluten-containing grains like wheat. From that point onward, I became so absorbed by connections between adverse medical conditions, food, and the body's untapped potential for healing that it eventually became my life's work. So far, I have amassed a database of over 10,000 researched health topics that I share with the world via my brainchild, GreenMedInfo.com. I created GreenMedInfo.com with the intention to provide both cynics and believers with the published, empirically validated proof of what countless individuals have experienced firsthand: the transformative power of self-healing through nutrition, nature, and holistic medicine. To help expand public access to an entire arsenal of untapped modalities long revered by ancient medical systems.



To promote informed consent and medical freedom around every allopathic treatment. And most pivotally, to enable you to recapture autonomy in your life and to become the master of your own health destiny.

The New Biology revolution is happening quickly but so quietly that it flies under the radar of most conventional medical and pharmaceutical professionals. In fact, it's been happening in the annals of the most respected medical journals for more than two decades. However, you don't need a science degree to understand or apply the findings. This book distills my gleaned knowledge about how to ignite your body's natural healing powers—the very same ones that Hippocrates described when he said, “Natural forces within us are the true healers of disease.”

I'm writing this book in the hopes that I can help others who are experiencing persistent symptoms or sickness to pause and consider that their bodies, far from being flawed, are sending a message that something they are consuming, breathing, or thinking is toxic or biologically incompatible with wellness. Symptoms are the body's way of signaling distress, lack of equilibrium, and its desperate need for support. To truly heal, it's time to feed, nurture, and tend to your symptoms as you would a crying baby rather than silencing and suppressing them.

As you modify the lens through which you explore your symptoms, two truths will percolate to the surface. First, your birthright is health rather than disease and debility. And second, your illness is an opportunity for consciousness-awakening insights and radical transformation. Wherever you may be on your life's journey, every day you can make choices and decisions that will help make your body more capable of regeneration and radical resilience. Let me show you how.

# FOOD AS INFORMATION

## Living Water, Epigenetic Pathways, and the Wisdom of the Ancestral Diet

**F**ood delivers powerful healing properties that scientists have spent decades analyzing in detail. Take an apple, for example. This amazing fruit is brimming with pharmacologically (or better yet, nutrigenomically) active compounds, most notably ascorbic acid, also known as vitamin C. Another compound it contains is phlorizin, over a dozen polyphenols, potent antioxidants concentrated in the skin of the apple and known to elicit multitargeted effects that reduce the impact of high blood sugar in animal models.<sup>1</sup> But this strictly material layer of nutritional analysis barely touches the surface when it comes to appreciating the informational complexity of food.

Apples contain structured water molecules with a hexagonal crystalline configuration (H3O2) that's halfway between liquid and crystal. Named "the fourth phase of water" by Washington University professor Dr. Gerald Pollack, the micro-clustering

pattern of structured water is capable of holding and transmitting both energy and information.<sup>2</sup> In fact, all raw plant, animal, fungal, and bacterial cells contain this structured water, each with a configuration as unique as a snowflake, assuming it has not been desiccated and denatured through cooking, processing, or the gamma irradiation-based food preservation process known as “cold pasteurization.” “Raw” is a key word here. Raw fruit juice has a high concentration of naturally structured water, which accounts for a good portion of the anecdotal and scientific evidence regarding its healing benefits. Processed juice, on the other hand, is said to contain dys-information (*dys-* is a word-forming element meaning “bad, ill; hard, difficult; abnormal, imperfect,”) that may misdirect the expression of our genes and harm our physiology.<sup>3</sup>

Virtually all water in uncooked and unprocessed plant food possesses beneficial genetic-expression-modifying information. This is a profound departure from looking at water as a fundamentally material, inert bystander in biological systems, as has been the case for centuries. Additionally, within the biological tissue of which they are composed, all foods contain the noncoding RNA molecules known as microRNAs, which affect the expression of the majority of genes in our bodies and stimulate biological pathways conducive to our species’s health and wellness. Packaged in exosomes, which are roughly the size of a virus (~65 nanometers), microRNAs survive digestion, whereupon they penetrate systemic circulation in the body and affect the structure and function of all our tissues.

One example of the healing potential of microRNAs comes from a study of Chinese honeysuckle (*Lonicera japonica*), a traditional remedy for colds and flus. An animal study demonstrated that a microRNA isolated from this honeysuckle is delivered straight to the lungs, the area of active influenza infection, via the bloodstream. Once there, it targets and inhibits the replication of influenza A virus.<sup>4</sup> The authors of the study additionally proposed that ingestion of the Chinese honeysuckle decoction confers medicinal benefits by enhancing the dietary uptake of other microRNAs.

With every bite of food you take, you are deliberately choosing which messages you want to send to your genome. By simply being thoughtful and intentional with the foods you eat, you can remove interference in the moment-to-moment cellular regeneration that should *and will* naturally occur.

In this chapter you'll learn how regenerative foods communicate on the smallest levels, through micromolecules and via your microbiome. To understand the major role of these tiny players, let's go back to DNA and reexamine its role as the code at the center of life.

## RETHINKING THE ROLE DNA PLAYS IN OUR HEALTH

Since the 19th century, when Charles Darwin revolutionized humanity's perception of its evolutionary past, present, and future, we've been taught that all organisms are separate from one another and locked into a ruthless system of survival of the fittest. This competitive arms race for resources, territory, and self-preservation yields two distinct groups: winners and losers. In this model, our genes are independent players, hermetically sealed within the chromosomes and concerned only with the solitary task of propagating themselves to the next generation. DNA (deoxyribonucleic acid) is the conductor of this abstract symphony of life, in which our place—and our fate—has been predetermined.

Not unlike the Copernican Revolution, which, in the 16th century, dislodged Earth from the center of the universe and threatened rigid social and political conventions, the New Biology dethrones DNA as the center of life, heralding an alternative vision. In this vision, human molecules, cells, tissues, and organs are absorbed in dynamic flux, communication, and feedback. They are capable of constant change, working harmoniously within a networked biosphere that unifies each individual with the whole. Most importantly, the New Biology inaugurates the radical notion

that the body can directly access biologically useful energy from the quantum vacuum. In this reenvisioning, biological structures have access to an all-pervading vacuum energy, once described as an ether, and this quantum energy field is operative at subatomic, atomic, molecular, and supramolecular levels.

A particular groundbreaking facet of the New Biology is food's importance as a source of indispensable information, its function reaching far beyond its nutritional composition of varying macronutrients and micronutrients to help epigenetically modify the expression of the majority of our genome.

## MASTER MOLECULE OF HEREDITY VS. THE INTERDEPENDENT MODEL OF SYSTEMS

Which human organ do you view as most imperative to life? Some instinctively feel that the brain is the most important organ, because without it cognition would not be possible. Some say it is the heart, which keeps our circulation flowing, or the liver, which stands vigil, filtering the blood. But the answer is *none of the above*. They're all requisite for the intelligent design and operations of our somatic form. These organs are interdependent parts of overlapping systems, superimposed and interwoven into the intricate tapestry of our physiology. Like the notes in a musical composition by Bach, their beauty results from the composite and synergistic way in which they interact.

Consider this: for other domains of science, such as the study of aquatic, marine, and land-based ecosystems, we acknowledge a sophisticated interconnectedness among animal and plant species. Yet this awareness dissipates when we venture more deeply into the human body, down to the level of macromolecules. When it comes to DNA, biologists have abandoned the idea of an interdependent model of systems, embracing instead a hierarchical, linear process to create an origin story of life. In this "central

dogma of biology,” DNA makes RNA, which makes proteins. DNA, as the supreme biomolecule of life, oversees the genesis of all other biological constituents in a top-down, authoritative fashion. This model traces a one-way trajectory from DNA to RNA to proteins.

However, in truth, a more accurate model would be a bidirectional loop within a web. The New Biology shows us that DNA is not actually at the center of life but is instead one isolated facet of a complex biological economy composed of subsystems, none of which can be ascribed primacy or recognized to exert a privileged level of causation. The New Biology goes even further than that, demonstrating that *there is no center*. Science overwhelmingly shows that life is self-organized, emerging from a network of interpenetrating and interdependent relationships, each with its own niche, specialized in purpose and fundamental to the larger whole. This exquisitely calibrated organization has long been recognized by traditional Eastern philosophies that envisioned all phenomena, from the infinitesimal goings-on of the human body to the macro-level oscillations of the climate, the rhythms of the seasons, and the movements of the planets as a holofractal unity. No one dimension supersedes or holds dominion over another; life operates in an oscillating dance of give-and-take, expansion and contraction, and ebb and flow.

If we utilize a simple linguistic shift from “DNA controls the production of proteins” to “cells use DNA to make proteins,” a different narrative emerges. If we stop thinking of ourselves as permanently enslaved by a genetic inheritance predestined to manifest itself as we age.

## DNA and Your Health Destiny

This is what the New Biology says about the relationship between DNA, disease, and aging:

- *You*, not your DNA, have control over your health destiny.
- The symptoms of disease are often your body's intelligent response to being exposed to something that is unhealthy or inappropriate. It is always better to look for the disease's root cause than to suppress the symptoms.
- The accelerated decline that we associate with aging is not necessarily predestined by our genes, and it's neither normal nor inevitable.

There is a better way for our bodies to tap into the energy all around us. We need to seek to understand *all* parts of the system in which we live—not just DNA. These include our miraculous microbiome, a sophisticated, life-sustaining microbial reservoir that we are only beginning to learn about.

## MICRORNAs FOR REGENERATION

The New Biology contends that what you consume profoundly impacts in *real time* via the machinery of microRNAs. In fact, non-coding RNAs make up more than 80 percent of transcripts from our genome.<sup>5</sup> RNA is the only biomolecule present in all of life, making it a better candidate for being a universal biomolecule than DNA itself.

RNA can be difficult to study because it can't be extracted easily from cells, being so crucial to their function. Structurally, RNA is similar to DNA. However, it is single- rather than double-stranded, and is therefore much more chemically reactive and unstable. More importantly, it can assume an expanded repertoire of three-dimensional molecular shapes relative to DNA, giving it versatility in structure and function.<sup>6</sup>

RNA and DNA nucleotides are composed of different sugars, ribose in the case of the former and deoxyribose in the case of the latter, and carry slightly different base pairs, with the pyrimidine base uracil (U) found in RNA where thymine (T) occurs in DNA. In most cells, only two chemical modifications to DNA are possible, acetylation and methylation, which are the underlying mechanisms behind epigenetics, which you will remember is the activation or silencing of genes by environmental inputs such as diet and lifestyle. On the other hand, at least 66 chemical modifications can be made to RNA;<sup>7</sup> the roles of these modifications remain largely a mystery.

The explanation underlying these molecular differences between DNA and RNA is that the latter was the first to arrive on the scene, which means that life effectively began with RNA, likely predating the emergence of the first cells. In a transposition of conventional wisdom, then, DNA might have evolved as a specialized form of RNA—adopting chemical inertness and structural rigidity in order to serve as a more reliable warehouse for the safe-keeping of heritable information.

For the purposes of this discussion, we will focus in on microRNAs, which are the premier regulators of gene expression and the conduits for free information exchange among the plant, animal, and microbial kingdoms, not unlike cellular phone towers bouncing signals from one seemingly disparate region to the next. MicroRNA, as described by University of Gothenburg professor Jan Lötvall, can zip around from cell to cell inside the bubble-like exosomes—nanoparticle-sized vesicles that are produced when the membranes of cell-sorting compartments bud or pinch off.<sup>8</sup> Exosomes, which contain a mix of proteins, bioactive lipids,



and noncoding RNA, may have originally developed as a way for plant cells to talk to one another and to deploy a concerted first-line immune defense when under threat.<sup>9</sup> The exosomes liberated from edible plants when we ingest them may also serve as a portal through which our own digestive tracts can sense and communicate directly with the external environment.

Conventional wisdom holds that cells exchange messages through the secretion of hormones, cytokines, and neurotransmitters, which come from one cell and bind to receptors on neighboring receiving cells to produce physiological effects. But a newly discovered form of exosome-mediated communication suggests that the cargo transported by exosomes can be transferred directly to recipient cells without any intermediaries.<sup>10</sup>

The concept that microRNAs influence the expression of the majority of the human genome<sup>11</sup> and may also serve as a channel for cross-species communication<sup>12</sup> is highly biologically plausible since trillions of digested, plant-derived exosome nanoparticles navigate through our digestive systems on a day-to-day basis, interfacing with the mucosal lining of our gastrointestinal tracts.<sup>13</sup> Previous studies have also highlighted that food-derived microRNAs that piggyback on exosomes have been found to reside in the blood and tissues of animals.<sup>14</sup> MicroRNAs within plants share “molecular homology” with human RNAs, meaning that they look like and can mimic the effects of human RNAs. The significance of these diminutive, noncoding RNAs should not be underestimated. Because they can silence or activate mammalian gene expression, they may influence the course of development, aging, and various disease states.<sup>15</sup>

The animal model brought validity to the concept that exosomes and the microRNAs they contain are instruments of cross-species communication.<sup>16</sup> When administered to mice, exosome-like nanoparticles from grapes penetrated the intestines and triggered enhanced production of intestinal stem cells.<sup>17</sup> This is meaningful because stem cells are a one-way ticket to regeneration. Known as “multipotent progenitor cells,” stem cells can differentiate into and replace specialized cell types through a process called mitosis,

or cell division, as part of an internal repair system. This ability stands in sharp juxtaposition to terminally differentiated cells of the heart, blood cells of the circulatory system, and neurons of the nervous system, which do not normally proliferate, or multiply—and they also differ from stem cells in that only the latter are capable of long-term self-renewal.

In a study published in the *American Society of Gene and Cell Therapy* journal, researchers issued mice a toxic agent known to cause ulcerative colitis, an autoimmune disease of the colon. They then gave the mice exosome-like particles from grapes. Under ordinary conditions, mice given the toxic substance would have quickly developed colitis. But these mice did not. The mice lived twice as long as the mice that didn't receive the grape substance, suggesting that administration of the grape-derived particles protected them from development of chemically induced ulcerative colitis due to activation of these stem cells. The particles preserved normal histology, or microanatomy of the intestines, in the face of these toxic chemical agents, and they “promoted dramatic proliferation of intestinal stem cells and led to an intense acceleration of mucosal epithelium regeneration and a rapid restoration of the intestinal architecture throughout the entire length of the intestine.”<sup>18</sup> The grape particles were also completely safe for the mice, with zero side effects.

The shining gem uncovered by this study is that exosomes, which are present in a variety of plant foods we consume, may exert additive or synergistic effects in course-correcting our own biology, nudging it gently back to the mean or boldly stimulating tissue regeneration by activating our body's own reserve of stem cells. Conversely, one could argue that many acute and chronic diseases could be caused by a lack of dietary exosomes from ancestral foods. Exosomes have been isolated and characterized from an assortment of edible plants, including carrots, grapefruit, and ginger root, all of which have the power to lightly prod deviant biochemical pathways back to the straight and narrow.<sup>19</sup>

For instance, a microRNA derived from broccoli was found to be present in human sera and to inhibit growth of breast cancer

through its effect on the gene *TCF7*.<sup>20</sup> Exosome-like nanoparticles from ginger, on the other hand, were found to increase levels of a potent anti-inflammatory signaling molecule, interleukin 10 (IL-10), which tamps down excess immune system reactivity.<sup>21</sup> Flavonoid compounds from berries, known as anthocyanidins, delivered via milk-derived exosomes significantly suppressed both the growth and proliferation of chemotherapy-resistant ovarian cancer cells, suggesting that phytonutrients, or plant chemicals with health benefits, are more effective when carried by exosomes.<sup>22</sup>

While berry anthocyanidins have anticancer properties on their own, their bioavailability, or the proportion ingested that enters systemic circulation and elicits an active effect, is poor, and they are inherently unstable in the absence of attachment to exosomes.<sup>23</sup> Exosomes may therefore be mother nature's delivery service that safeguards healing noncoding RNAs and bioactive plant compounds until they arrive at their final destination.

Exosomes and the microRNAs that they shuttle are some of the reasons why fruits, vegetables, herbs, and spices that come directly from the earth into your kitchen or medicine cabinet set the stage for healing. Because microRNAs can travel horizontally across species—from fruit to mouse, or vegetable to human—they can send messages that tell genes when to express themselves and when to remain quiet. It doesn't take eons to make these changes; they can alter your genes in real time, and these changes can be passed down to your progeny, and from them to their progeny and so forth.

MicroRNAs shuttled about in their environmentally protected extracellular vesicles provide a viable scientific explanation for interspecies cross talk and for the interconnectedness between all the domains of life. Their discovery shows that the systems of the body, like the kingdoms of life and the ecosystems of the planet, all operate on the principles of harmony, symbiosis, balance, and holism. Rather than existential islands unto ourselves, we are united in a grand and awe-inspiring wholeness.

## MEET YOUR MIRACULOUS MICROBIOME

Since the late 1800s, when Robert Koch and Louis Pasteur tackled the challenge of foodborne infections, microorganisms have been uniformly demonized by the scientific community and pigeonholed as the singular causative agents behind diseases. Up until recently, the enduring legacy of germ theory, which promulgates the idea that specific germs are the sole cause of specific diseases, is that we have envisioned ourselves to be in a perpetual war against these microorganisms' hostile intrusion. Our conditioning has led us to perceive the microscopic world as the culpable party behind the plagues and pandemics that have snuffed out so much of humanity in singular episodes. Within this conceptual framework, the immune system has been fashioned as the militant armed force against the invasion, and vaccines and antibiotics our only true defense against certain destruction.

The relatively recent discovery of the microbiome, however, is completely redefining the role of microbes in our bodies and shifting the entire frame of reference for our species's self-definition. It turns out that some microbes are hardly the adversary; in fact, they are crucial to protecting us from disease and dysfunction.

A deceptively diminutive term, *the microbiome* refers to our unfathomably complex array of microscopic microbial inhabitants that together weigh only three or four pounds. Yet the microbiome's power is immense, as it contains 99.9 percent of our genetic material. Comprising bacteria, viruses, fungi, and archaea that reside in their respective niches on and inside our bodies, our microbiome is instrumental to digestion and assimilation of nutrients, detoxification of cells and organs, control of the immune system, competitive inhibition of pathogens, reinforcement of the gastrointestinal mucosal barrier, and production of neurotransmitters.<sup>24</sup> Indeed, we relegate life-sustaining functions to these friendly bacteria, including the breakdown of extremely toxic chemicals.<sup>25</sup>

The discovery of the microbiome has radical implications because it undercuts the theory that microbes are a leading cause

of disease and death. In fact, mortality from infectious disease—measles, scarlet fever, whooping cough, diphtheria, and polio—had declined precipitously due to improved living conditions, nutrition, hygiene, and sanitation infrastructure even before the use of antibiotics and vaccinations became widespread in the mid-20th century. Magic bullet medical interventions designed to combat germs were credited as being the primary factor in extending the human life-span and putting a discernible dent in the burden of human suffering from communicable disease. These medical interventions conceived from germ theory became the foundation of the allopathic medical paradigm that continues to be exalted as the be-all, end-all of human health.

Yet billions of years have primed our physiology to interface with virtually endless microbial challenges and prepared our body tissues for intimate contact with bacterial, fungal, protozoal, helminth, and viral co-inhabitants. Through our evolutionary past of hunting, foraging, and subsisting off the land, our bodies have undergone millions of years of immunologic evolution with the elements, soil, and fermentation, all of which have attuned us to countless interactions with the microbial world that have served to guide the trajectory of future immune responses, thereby fostering our dependence on microbes as some of our greatest allies.

Our bodies resemble plants in that our susceptibility to pests, or opportunistic infections, escalates when we aren't provided with the proper inputs, such as when our ecosystems are in a state of disharmony, when our microbial soil is depleted, and when our micronutrient status is compromised. The modern pressures of a sedentary lifestyle; pharmaceutical drugs; occupational stress; ultra-processed, nutrient-poor foods; electromagnetic pollution; man-made toxicants; and circadian rhythm-disrupting blue light cause our microbial diversity to suffer, in turn opening the door to sickness.

The ways in which we deviate from our evolutionarily encoded template are the ways in which our microbiomes suffer. When we unnecessarily forgo the fundamental inoculation of microbes that comes with vaginal birth in favor of Cesarean

section, for instance, we are sacrificing the postnatal transmission of maternal flora that seeds the baby's microbiome—one of the most critical exposures in molding the composition of the infant's microbial ecosystem. When we opt for bottle-feeding our babies instead of providing them with the gut-mammary transfer of mom-derived bacteria, gene-regulatory microRNAs, and prebiotic sugars designed to encourage bacterial growth in the infant, we set the stage for the bacterial imbalance known as dysbiosis, the precursor to a dysfunctional immune system, which is a breeding ground for infectious challenges. Breast milk contains special sugars known as oligosaccharides, including lactose and 1,000 other distinct nondigestible molecules that provide a substrate for bacterial fermentation<sup>26</sup>—in other words, one of the explicit purposes of breast milk is to allow our microbiomes to flourish. Babies with microbiota underdevelopment are at an increased risk of autoimmunity, allergies, asthma, allergic rhinitis, late-onset sepsis, coronary artery disease,<sup>27</sup> and obesity. The pattern of early seeding of the microbiome can even predispose babies to vaccine injury, with certain signatures of dysbiosis—absence of bifidobacteria in particular—leading to systemic inflammation and a greater likelihood that vaccines will cause adverse effects.<sup>28</sup>

Although how we are born and our initial feeding methods are not under the realm of our control—in some cases, Cesarean birth is the only option and breast milk is unavailable—other variables that either impede or cultivate microbial diversity fall well within our purview. These include avoiding gut-disrupting antibiotics, eating organic fruits and vegetables, managing stress, and minimizing exposure to toxicants in our home environment.

When we malign all bacteria as microorganisms to be feared and eradicated, we indiscriminately target commensal and virulent microbes alike. We do so with antibiotics, hand sanitizers, chemical cleaning agents, triclosan-laden antibacterial soaps, and gut-disrupting pharmaceuticals like acid-blocking drugs and over-the-counter pain relievers. While they are purportedly designed to heal, these prescriptions inevitably destroy the system that has evolved to protect us.

Being stalwart guardians of our microbiomes is of utmost importance if we are making the health of our future generations, which is perhaps the most fundamental evolutionary imperative we have, a priority. Because our microflora consists of a selective array of commensal microorganisms that ultimately originated from the environment—the air we breathe, the soil we interact with, and the water and food that we ingest—our mission must encompass a wider breadth and a more far-reaching scope if we are to save our microbiomes from certain demise.

## THE MICROBIOME AS A KEY TO EVOLUTIONARY SURVIVAL

A growing body of microbiome research is challenging the prevailing genome-centric story of human evolution, namely that extremely gradual changes in the protein-coding nucleotide sequences of our DNA are primarily responsible for the survival of our species over the ages. This is exemplified by a study published in the journal *Nature* that found that Japanese subjects had a strain of bacteria in their gut that were loaded with both the genes and enzymes required to digest the polysaccharides found in sea vegetation, which are normally indigestible to humans.<sup>29</sup> Absent from the human genome, these genes were found to originate from a strain of the marine bacteria *Bacteroidetes*, *Zobellia galactanivorans*, which naturally lives on the red marine algae commonly consumed in East Asia as nori—the dried and roasted sea vegetable that is formed into a sheet and used as the green wrapper of a sushi roll. These bacterium-derived genes fall outside the bounds of the human genome and are not found in the gut bacteria of North Americans.

The human genome contains an informational blueprint capable of producing a mere 17 carbohydrate-active enzymes (CAzymes),<sup>30</sup> a small armament developed over millions of years to help us digest terrestrial plants. The average human microbiome far outpaces our own carbohydrate-digesting ability, containing as

many as 16,000 different CAzymes. In other words, our microbiome is a treasure trove of carbohydrate-digesting enzymes, allowing us additional biosynthetic pathways to process new food supplies.

The astounding diversity of CAzymes found within strains like the human gut symbiont *Bacteroides thetaiotaomicron*, which alone contains 261 carbohydrate-digesting enzymes known as glycoside hydrolases and polysaccharide lyases, begs the question of how this immense diversity evolved. The *Nature* study provides a novel explanation: human gut flora acquiring new genes from microbes living *outside* the gut, presumably through the phenomenon of horizontal gene transfer. In particular, the researchers showed that genes coding for porphyranases, agarases, and associated proteins needed to degrade marine vegetation were transferred to the gut bacterium isolated from Japanese individuals, *Bacteroides plebeius*.

The implication is that when a population eats a food like nori for long enough, the useful genes from marine bacteria residing on nori can be shunted into already-existing bacterial strains in their guts. Bacteria in our guts can therefore enlarge, elaborate upon, and compensate for deficits in our “hardwired” genetic capabilities. Through shifts in our microbiome, our entire physiology can adapt to changes and challenges in our environment and nutritional milieu. The immense plasticity of our microbiome, therefore, improves our ability to survive and remain in harmony with our natural environment.

Another example centers around the ability of our commensal flora to mitigate some of the ill effects of consuming gluten-containing grains. One reason these popular Western foods are so problematic is that they contain what is colloquially referred to as “gluten,” a mixture of addictive, hard-to-digest, and immunologically problematic proteins rich in proline also found in rye, spelt, and barley.<sup>31</sup> The primary issue with them is implicit in the word *gluten*, which means “glue” in Latin. The words *pastry* and *pasta*, in fact, derive from “wheat paste,” the original concoction of wheat flour and water that made such good plaster in ancient times. Gluten’s adhesive and difficult-to-digest



qualities come from the high levels of disulfide bonds it contains. These sturdy sulfur-based bonds, also found in human hair and vulcanized rubber, resist digestion and decomposition and give off a sulfurous odor when burned.

Wheat is a hexaploid species, the by-product of three ancestral plants becoming one, containing no less than six sets of chromosomes and 6.5 times the number of genes found in the human genome. Thus, it is capable of producing no less than 23,788 different proteins.<sup>32</sup> Clearly the monolithic term “gluten” is misleading, as any one of these proteins is capable of inciting an antigenic response, wherein the immune system identifies the protein as other and launches an innate or adaptive immune response, sometimes attacking self-structures in a case of friendly fire.

One saving grace that has ameliorated some of the effects of wheat consumption is our gut bacteria. Research reveals that a wide range of bacteria in the guts of Westerners are capable of degrading thousands of difficult, if not impossible to digest, proteins in modern wheat.<sup>33</sup> Indeed, without the help of these gluten peptide-degrading microbes, the sudden Neolithic introduction of gluten-containing grains into the human diet may have had even more catastrophic health consequences.

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## **Tending to Your Microbiome**

Cultivating practices that protect and nourish our microbiome are just as important as our efforts to reduce exposures to genotoxic chemicals and radiation that damage our genetic material. It is also incumbent upon us to understand that antibiotics, literally translating to “against life,” in the form of both pharmaceutical prescription drugs and the thousands of pervasive, man-made chemicals that kill microbial life, have devastating and perhaps irreparable consequences to beneficial microbes when used indiscriminately or unconsciously—such

as with the fluoridation and chlorination of city water or the bacteria-destroying use of the broad-spectrum, glyphosate-based herbicide Roundup on a mass scale.

Each of us is eating for one hundred trillion microorganisms with every bite we take.<sup>34</sup> Especially important is the incorporation of dietary fiber in the form of microbiota-accessible carbohydrates or prebiotics, which can be readily found in foods such as Jerusalem artichokes, onions, garlic, leeks, asparagus, green bananas, cocoa, jicama, almonds, blueberries, carrots, cassava, pumpkin, and taro.<sup>35</sup> Prebiotics are a special class of fiber that resists hydrolysis by gastric acidity and mammalian enzymes and is instead selectively fermented by the intestinal flora, augmenting the growth or activity of flora that confers a health benefit to the body.<sup>36</sup> Also important is the avoidance of microbiome-disrupting foods such as synthetic additives, colorants, and flavorings; artificial sugars; grain-fed meats; oxidized and genetically engineered vegetable oils; hybridized wheat; glyphosate-laden food crops; and processed dairy, the consumption of which has increased in parallel with the escalating prevalence of “diseases of affluence,” including metabolic syndrome, coronary artery disease, osteoporosis, and cancer.

When considered as a whole, microbiome research peels back the layers of our very essence and lays bare one gleaming, iridescent fact: we must make a conscious effort to get out of our own way to preserve and leverage our relationship with the natural world. We are not separate or superior to the environment, nor are we detached from the ecology of it. Our genetic potential is optimized in the presence of biologically appropriate nutriment that supports our mutualistic and indivisible interdependence with all the plants, animals, and microbes on Earth.

The seemingly supra-human genetic capabilities of our gut microbiome may have been the primary determinant in our

species's survivability because they allowed our species to adapt quickly to changing environments and available diets. Research is only just beginning to bring to light how profoundly the microbiome can and does extend our genetic capabilities.

## THE CONNECTION BETWEEN MOTHER AND NEWBORN

The latest research into the role of the microbiome in sustaining physiological resilience undermines germ theory *and* presents a challenge to traditional gender dynamics.

We've long known that both men and women pass on nuclear DNA in the form of chromosomes. Yet only women can pass on the DNA that is found within mitochondria, the organelles traditionally considered the energy factories of the cells.

Because we are all designed to gestate in the womb and enter the world through the birth canal, from which the neonate's microbiome is derived and established, it follows that most of our genetic information is maternal in origin. Even when the original colonization eventually changes and is superseded by environmentally acquired microbial strains in infancy, childhood, adolescence, and adulthood, the original composition and subsequent trajectory of microbial changes is a direct by-product of the mother's terrain. Like a gardener planting the seeds, tending to her plot, and provisioning the conditions for growth, the mother is the guiding force for which foliage and greenery will flourish and thrive within the baby. As such, the microbiome of the mother is the bedrock of the baby's microbiome.

The conditions surrounding gestation, therefore, are important because the maternal-to-fetal microbiome trafficking in utero, maternal diet, and mode of birth take on vastly greater importance than previously imagined.

## HONEY, PLEASE PASS THE GENOME

With scientific advances, we have reached a critical juncture where certain long-buried pearls about our physiology are being revealed, unfolding in shimmering opalescence before our eyes. The central tenet—and the one that may be most shocking—is that we are more microbe than human. Not only are we meta-organisms, with the vast majority of our genetic information being microbial in nature, but when we peel back the curtain on the “private” genetic contribution of our own cells, we find that the human genome itself is almost one-tenth retroviral in origin.<sup>37</sup>

Even our mitochondria, popularized in high school classes everywhere as the “energy powerhouses” of the cell, are alien in origin. According to the endosymbiotic theory, mitochondria were once ancient, free-floating proteobacteria that surrendered their independence by becoming subcellular organelles, leading to the evolution of eukaryotic cells that presently make up our bodies.

The distant past, therefore, is embedded within the present; our cells are enriched with billions of years of biological information, and depending on what we eat or do not eat, the information either remains latent or is activated in an expertly executed schematic. Each cell in our bodies, along with all the cells in all living creatures on the planet today, derives from a last universal common ancestor (LUCA) estimated to have lived some 3.5 to 3.8 billion years ago in the primordial ocean. This was echoed by Charles Darwin, the father of evolution, who said that “probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed.” Thích Nhất Hạnh, a Vietnamese Buddhist monk, peace activist, and global spiritual leader, articulated the same insight when he wrote these words: “If you look deeply into the palm of your hand, you will see your parents and all generations of your ancestors. All of them are alive in this moment. Each is present in your body. You are the continuation of each of these people.”<sup>38</sup>

Our degree of reconciliation with our evolutionary past—and hence our level of alignment with the molecular and energetic fabric that is the essence of who we really are—will determine our ability to cultivate health and resist illness. One of the pillars of stepping back into alliance with our authentic selves is eating the food our body expects to encounter, the sustenance it has been conditioned over the millennia to use as fuel. Hippocrates’s proclamation that “we are what we eat” was true not only in physical terms—the food we eat produces molecular building blocks from which our bodies are constructed—but also in microbial terms.

The billion-dollar question, of course, is this: What did our ancestors eat? The stereotype of the caveman revolves around a meat-heavy dietary template. Animal products were indeed important in our evolutionary past, but not in the way that you might think. A turning point in evolution for our hominid predecessors was the inclusion of high-quality, easily digestible nutrition from coastal and inland freshwater seafood, which dovetailed with the rapid expansion of gray matter in the cerebral cortex of the brain. A staple of the mid–Upper Paleolithic period, freshwater or marine sources of protein made up between 10 and 50 percent of the diet early modern humans consumed. The inclusion of this protein and fat was concurrent with the development of many hallmarks of abstract thought, such as pottery figurines, knotted textiles, burial decorations, and personal ornamentation.<sup>39</sup> Our large human brains, especially their frontal lobes, expressed capacity for executive thought, critical thinking, problem-solving, memory retention, toolmaking, language, and learning. All this may be directly attributable to the easily assimilated long-chain fatty acid in seafood known as docosahexaenoic acid (DHA), which is important for membrane-rich brain tissue.

But Paleolithic humans ate a variety of other forageable foods, too, including honey. According to Alyssa Crittenden, a behavioral ecologist and nutritional anthropologist at the University of Nevada, Las Vegas, honey was a central food for early humans. Excavated rock wall art from around the world displays likenesses of early humans climbing ladders to smoke out and collect honey

from honeycomb-filled hives. Crittenden also notes that traditional hunter-gatherer populations in Africa, Australia, Asia, and Latin America incorporate honey and bee larvae as integral parts of their diets.

The idea that honey may be a cornerstone for our species's microbial health is substantiated by a study published in the journal *PLOS ONE*, which discovered the presence of lactobacillus species in honeybees, suggesting an 80-million-year or older history of association.<sup>40</sup> In our fostering of an ancient co-evolutionary relationship with honey, it has become an integral facet of our microbial identity, where our own immune systems and microbial populations may share dependency on honey-based microbes.

Honey contains a range of beneficial microbial life-forms contributed by bees and the plants they forage, including the lactic acid-producing bacteria lactobacilli, which support the immune systems and behavioral patterns of individual bees and the hive as a whole. When eaten raw, honey may contribute health-promoting bacterial strains to our bodies. Strains of lactic acid bacteria, for instance, can improve chronic constipation,<sup>41</sup> reduce childhood dental caries<sup>42</sup> and eczema,<sup>43</sup> reduce nosocomial (hospital-acquired) infections,<sup>44</sup> reduce infectious complications in elective liver donors,<sup>45</sup> decrease the duration of respiratory infections in the elderly,<sup>46</sup> alleviate symptoms of irritable bowel syndrome,<sup>47</sup> and reduce the incidence and severity of the life-threatening condition necrotizing enterocolitis in very low-birth-weight infants.<sup>48</sup>

Honey has also been shown to heal wounds<sup>49</sup> and burns,<sup>50</sup> reduce radiation-associated pain in cancer patients, improve cholesterol profiles,<sup>51</sup> and enhance DNA repair in residential populations chronically exposed to pesticides.<sup>52</sup> One of nature's ultimate medicinal substances, it is as effective as the mouthwash chlorhexidine in reducing plaque formation,<sup>53</sup> treats nocturnal cough better than the over-the-counter cough suppressant dextromethorphan,<sup>54</sup> has superior efficacy to standard hydrogel therapy in the treatment of venous ulcers,<sup>55</sup> and has efficacy against urinary tract infections.<sup>56</sup> It can even help

address the antibiotic-resistant infection known as methicillin-resistant *Staphylococcus aureus* (MRSA).<sup>57</sup>

Since Paleolithic times, the topography of our inner microbial soil has become completely ravaged. Most recently, the daily barrage of synthetic dietary inputs and battery of antimicrobial toxicants has plunged us into a post-industrial chemical soup. It is plausible, however, that honey could help heal these wounds and that ancestral foods infused with equally ancient symbiotic bacteria could help us recover and “travel back” in biological time to a far more stable state of health. Consuming honey and other real, microbiota-impregnated foods may be absolutely necessary for the continued healthy expression of our DNA, establishing vital anchors for the informational integrity of our species identity.

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### **The Life Bridge: Our Bodies Are Connected to Earth through Microbes**

The American herbalist Paul Schulick aptly named the interstitial layer of microbial communities within the soil and our guts a “life bridge,” which can be visualized as a bridge that connects our bodies via microbes directly to the Earth, as well as between the ancient past and the present, forming an inseparable whole. Think about ancient farming practices that use wild soil from old growth systems as a microbial inoculant in newer farming land to produce vitally nourishing food. These old-growth microbial communities, perhaps a by-product of millions of years of co-evolution, could contribute a wide range of biotransformed soil metabolites for a plant’s nutritional needs, as well as infuse the edible plants themselves with strains of bacteria, fungi, and viruses important to our own health.

When we allow our evolutionary compass to guide us home to ourselves, we naturally gravitate toward certain foods and avoid others. In the next chapter, we will explore some of the frontiers in the science of food and energy and learn how to assess new inventions, sidestep those that make us sick, and navigate toward the inputs that best align with what our bodies need and crave at a cellular level.