Microbiome
All Diseases Begin in the Gut
(Short Guide To Fixing Your Gut)

\[ V \ O \ M \ E \]

Author: Naveen Jain | Viome
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Introduction

Do any of the following issues hold true for you or a loved one?
Have you considered these solutions?

**Issue: Despite my dieting, I can’t maintain my weight.**
**Solution:** No one diet is right for everyone.

**Issue: I can’t focus during the day.**
**Solution:** Your brain uses more energy than any other tissue in your body. In order for your brain to work, you need to eat a combination of foods that will optimize your body’s energy production and enhance your focus.

**Issue: I feel bloated after almost every meal.**
**Solution:** If you aren’t eating the right foods for your microbiome, you can feel the consequences. Viome identifies the ideal diet to help your gut thrive.

**Issue: I don’t have the energy to do the things I love.**
**Solution:** The food you eat gets processed into energy. When you eat the foods that are right for your microbiome and biochemistry, this process becomes efficient—resulting in maximal energy.

**Issue: I have trouble falling asleep and staying asleep.**
**Solution:** Your microbiome affects your biological clock. An analysis of your microbiome will provide the needed information to help you maintain it at its most healthy functioning level, which may improve your sleep.

For many people, the issues are widespread, and may feel inescapable. While so many of us and our loved ones, colleagues, and acquaintances struggle with these issues, for most, the given solutions are unfamiliar. The solutions use words such as “microbiome” and suggest connections that we haven’t encountered before. From reading these solutions, you might be left wondering:

- What’s a “microbiome”?
- What’s the relationship between my “microbiome” and my health?
- How can I harness my “microbiome” to optimize my health and well-being?

In this book, you’ll find detailed answers to these questions. You’re embarking on an in-depth learning journey to arrive at a destination tailor-made for your body’s particular requirements for achieving lifelong health and wellness.

When it comes to your well-being, there’s no time like the present. So let’s get this journey going—starting with the microbiome.
A Breakthrough Discovery: The Human Microbiome

To solve the problem of chronic disease, scientists have begun to turn to an army of surprising allies: bacteria and other microorganisms.

New technologies used by microbiologists to study tiny organisms—bacteria, viruses, archaea, fungi and more—have quietly ushered in a new era of medicine. While these communities have been fussy and difficult to study for centuries, the past few decades have been an era of change. Viome, an innovative tech wellness company, uses a technique called meta-transcriptomics. This has given the scientists at Viome the ability to take a sample of your microbes and get a comprehensive list of which kinds are there and also what they are doing (See sidebar).

Microorganisms have scientific names that are important for distinguishing and

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<th>FAMILY</th>
<th>GENUS</th>
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<td>B. bifidum</td>
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Bacteria Composition and Function

Scientists care about two main things when they analyze a bacterial sample from the human body: composition and function. Composition answers the question “Who’s there?”, yielding a list of all the different bacterial types present and their proportions—like an attendance list. Function answers the question “What are they doing?” This gives scientists a report of all of the genes that the bacteria are expressing and what these genes do. The expressed genes are called transcripts. Some of the transcripts, for example, show that the bacteria are breaking down certain foods, while others show that they are making beneficial substances such as butyrate. Butyrate has a host of beneficial effects: maintaining our gut lining, helping with insulin sensitivity, suppressing inflammation, and even controlling our human gene expression.
What Are Those Tiny Things?

Antony van Leeuwenhoek,¹ the man credited with the invention of the microscope, provided one of the first descriptions of bacteria in 1683. Upon looking through his microscope, he reported: “I then most always saw, with great wonder . . . there were many very little living animalcules, very prettily a-moving.”

Microorganisms, or “microbes” for short, include bacteria as well as viruses, fungi, and bacteria-like critters called archaea (pronounced “ar-KEE-uh”). They’re all living, except for viruses, which have to latch onto a host cell in order to replicate.

Communities of these microbes exist everywhere on Earth—from the surface of a table to the interior of a volcano, to the skin of your forearm. Each microbe has a set of genes that can serve as an identity card. With new technologies, like those offered by Viome, scientists can take a swab from the environment or your body, and find out the names of all the microbes that live there.

classifying them. The last three categories—genus, species, and strain—are most frequently used when naming an organism.

When scientists began using metagenomics to study different sites on the human body in a systematic way, they discovered something remarkable: humans have an invisible coating of microorganisms—a complex mix of bacteria, viruses, archaea, and fungi—where bacteria are the most abundant. These tiny creatures live in communities all over the surface of the body, and in some locations inside the body, too.

You may be used to hearing stories about bacteria and other microbes as little villains. You don’t have to look far to find a news story of a dangerous Listeria outbreak or food contaminated with E.coli. It’s true that some microorganisms are harmful—these are called “pathogens.” It took early scientists a lot of painstaking work to discover which microorganisms were causing various diseases like cholera and smallpox, which killed millions of our ancestors.

But it turns out that pathogens make up only a tiny minority of microorganisms. In fact, judging all microbes by the reputation of pathogens is like reading a news story about a serial killer and generalizing to all of humankind. Around one trillion² different species of bacteria are found on Earth, according to the latest scientific estimates—and among the species found clinging to humans, the vast majority are either harmless or are active contributors to health.

As you can imagine, no one has ever sat down and actually counted the number
of microorganisms that live on an average human. But scientists’ best estimate puts the total number of bacterial cells in and on your body at around 40 trillion—more than the number of human cells. There are probably 1.3 bacterial cells for every one of your human cells.

Researchers named the entire collection of microbes living in and on the human body the “microbiome.” The microbiome forms a living layer over your skin and parts of the inside of your body, including the lungs and the digestive tract, from your mouth down to your colon.

The Human Microbiome

Bacteria and other microorganisms live all over the body, with the highest concentration inside the colon.
One key discovery about the microbiome was that it is not the same all over the body. Just as some people love the action of the city while others are more suited to the solitude of rural living, different microorganisms like to live in different ‘niches’ on the body. This means different sets typically colonize each site—for example, the skin of the forearm tends to host species of bacteria that thrive in a dry, oxygen-rich environment, while the colon hosts species that prefer to live in a warm, moist environment with little to no oxygen.

Another key discovery is that while your DNA is very much the same as that of other humans, your microbiome is not. Any two humans share 99% the same DNA. In contrast, two humans share about 5% the same microbial DNA. What this means: each person’s microbiome is incredibly unique. This discovery has significant implications that we’ll discuss in detail later in the book. First, let’s learn about what the microbiome does.

A Codependent Relationship

The more scientists learn about these microorganisms and what they are doing, the more we realize they are not just an accessory; they are a vital part of what it means to be a fully-functioning human. We are not discrete packages of human genes. We are bundles of both human and bacterial genes, constantly interacting and evolving. We are super-organisms.

Microorganisms have been around for much, much longer than humans on the evolutionary timeline, making us humans mere tourists in a vast, ancient microbial world. Rob Knight, a microbial ecologist and researcher at UC San Diego, wrote in his book Follow Your Gut⁴ “The emerging facts about this tiny world serve as a rebuke to our egos.” We are in a codependent relationship with the microorganisms of our microbiomes. There’s an elegant symbiosis happening.

Gut Microbiota As The Body’s Engine

Of all the places on the body, the highest numbers of bacteria and other microorganisms are found in the digestive tract, also known as the “gut.” The colon has the greatest numbers of microbes, with hundreds of different species working together and competing with each other for food and real estate.

Microbes live in communities all along the digestive tract, starting at the mouth and continuing through to the bottom end of your colon. Differences in pH and oxygen mean conditions vary in different parts of the gut, and these affect the microbes that live there.

Each person’s microbiome is unique, although all humans have some species of bacteria and other microorganisms in common at each site.
So, for example, some of the microbes that live in the mouth, where there’s constant exposure to oxygen, can’t survive in the folds of the small intestine where little or no oxygen is available.

Scientists know the gut microbiota of a child changes its composition from infancy through toddlerhood and beyond. By the time a child turns three, their microbiota already seem to approximate the microbiota of an adult. So even though a child of three years may not be able to understand the punchline of a joke or swing from the monkey bars, they might have a gut microbiome that has achieved a level of stability beyond their years. Data indicate that the gut microbiome continues to shift throughout life, but not on the same scale as in early childhood.

Enormous variation exists in the kinds of microorganisms in the gut—even different bacterial species from the same genus can differ in important ways. Imagine an army of little gnomes dressed in white, all with the name Lactobacillus; now imagine some of them have yellow belts and others have green belts. And of those with the white suits and yellow belts, some have pink hats. Only some of the pink-hatted gnomes have black straps on their hats, and some of those with black straps have gold buckles. And so on. Each differently-dressed category of gnome is a community within itself, with special patterns of behavior and things it likes. These are like bacteria: they exist in groups that share the same name and basic structure, but differ in crucial ways.

The many microorganisms in the colon aren’t just there to have fun. They carry out important work. Despite the chaos of hundreds of different species living and multiplying and dying on a daily basis, these bacteria are interacting with different body systems—the nervous, immune, and endocrine systems. They are doing two major jobs that are especially critical for maintaining your health: transforming what you eat and collaborating with your immune system.

### Transforming What You Eat

Whatever you consume—be it an apple or a bag of Doritos—enters your body and is shunted down the tubes of the digestive tract. As the food travels through your gut, digestive processes successively break it down into parts that your body can more easily absorb. But you’re not just eating for yourself—you’re eating for your trillions of microorganisms, too. The activities of microbes in the gut play starring roles in the process of digestion. They make vitamins, such as B12 and K, that your body can’t make on its own. And while many components of food are absorbed higher up in the digestive tract (that is, in the small intestine), particular kinds of fiber called non-digestible carbohydrates make it down to the colon intact.

These non-digestible carbohydrates are special. They’re called non-digestible because—you guessed it—your body can’t break them down. So what’s a body to do? Here’s where gut microorganisms come in. When non-digestible carbohydrates reach the vast community of microorganisms in the colon, these microbes work to break them down. (In fact, some have started to call these carbs “microbiota-accessible carbohydrates, or MACs.)

As bacteria break down this kind of fiber, they produce many different products. The molecules produced in this manner are called “metabolites”—and like the ultimate recycling plant, the body takes some of these bacterial
Hi John! Welcome to Viome. My name is Vie.

I am here to guide you on your wellness journey.

The more I learn about you, the more precise and helpful I will be.

First we'll set up your phone and account. This process will take about 10 minutes. Are you ready?

Periodically, I will update you on your stats, our insights, and send you convenient reminders. Is it ok if I send you these notifications?

It would be helpful if you shared...
end products and puts them to use. In particular, metabolites called short-chain fatty acids (SCFAs), which are produced when bacteria are given the opportunity to ferment MACs, feed the cells of the colon and have other important health effects (and not just in the gut). These are by far the most studied metabolites.

Bacteria produce thousands of other kinds of metabolites. These molecules can travel all around your body and perform both beneficial and detrimental functions. One molecule called trimethylamine N-oxide (TMAO), for example, is produced by the gut microbes when you eat foods like egg yolks and red meat.

While the link between cardiovascular disease and red meat is well established, the latest research show that it’s the increase in TMAO in our blood, rather than just the ingestion of the red meat, that’s associated with a higher risk of disease. Because your personal set of microbes is responsible for making TMAO in your gut, this risk factor is dependent on your personal microbiome. In a later chapter, we’ll take a deep dive into the implications of the unique nature of your microbiome and how Viome can help you harness your personal microbiome to avoid disease and achieve greater wellness.

Collaborating With Your Immune System

The inner surface of the small and large intestines (also called the gut barrier) has a difficult task. It must facilitate the uptake of nutrients, water, and electrolytes, while keeping out clever pathogens. It can be especially vulnerable because it consists of only a single layer of cells.

The gut has its own immune system (called the gut-associated lymphoid tissue, or GALT), which is an important part of the body’s overall immune system. The GALT has to constantly keep the peace with foreign materials that enter the gut. It needs to make your body tolerate molecules of food and other substances that are harmless, while declaring all-out war on any pathogens it encounters. That is, you need your immune system to be reactive, but not too reactive. Disruption of this finely-tuned system leads to either infections or inflammation.

Here’s where the microorganisms come in: they play a role in not only keeping out the pathogens, but also in teaching the body which ones are the pathogens in the first place. They do this by exchanging signals in a constant to-and-fro with the GALT. Basically, keeping the gut environment in a steady state depends on a codependent relationship between commensal microbes and the immune system in the intestine. These interactions can have effects all throughout the body.

From the two job descriptions above—transforming food to give the body what it needs and keeping the peace with foreign substances while fending off intruders—it’s clear that gut microbes are essential for keeping you in good health. Yet the gut microbiota has even more superpowers that scientists are actively studying.
You want your immune system to be constantly active in order to keep harmful substances at bay—but how active? To remain healthy, the immune cell activity must be just the right level: too high means the body starts attacking its own healthy tissues, and too low means the immune system might fail to eliminate harmful invaders. In either of these cases, tissue injury can occur, resulting in inflammation. Excess inflammation in particular areas or throughout the body can lead to a long list of chronic diseases, from cardiovascular disease (systemic or whole-body inflammation) to ulcerative colitis (inflammation at a particular body site—in this case, the large intestine).
Other Superpowers of the Gut Microbiota

Influencing Brain and Behavior

You already know your gut and brain communicate. How else to explain the sudden onset of gut troubles when you get some bad news or you realize your wallet is missing? Scientists have been studying this “gut-brain axis” for decades. They know that the digestive tract (including the gut-based enteric nervous system) and the brain (part of the central nervous system) send messages back and forth constantly. What’s new about this gut-brain connection in recent years, however, is information about the role of the gut microorganisms in this two-way communication channel.

How much can behavior really be controlled by microbes? So far the evidence comes mainly from germ-free mice. Studies have shown the presence or absence of certain microbes can, in effect, change a mouse’s personality—how often it takes risks, how much it explores, and what it does in a challenging situation. But, of course, humans are a little more behaviorally complex than mice.

New evidence shows gut microbes can indeed play a role in the way the brain functions in humans. Some of this evidence comes from studies that show how antibiotics and probiotics, which target the gut, can affect the brain. Here are some examples:

Antibiotics: Doctors have reported cases of people who receive a course of antibiotics and experience a drastic behavior change; this condition, called “antibiotic-induced psychosis,” goes away when the antibiotics are stopped. It is well known that antibiotics can drastically change the microbiome.

Probiotics: A recent study found women who consumed a probiotic fermented milk (via functional magnetic resonance imaging, or fMRI) showed differences of activity in the regions of their brains that processed emotions and sensations.

Of course, we’d like to know how to control a huge range of human behaviors—from anxiety-induced nail biting, to eating an entire box of cookies, or even the repetitive movements made by children with autism. In the future, modulating the gut microbiome, with the help of wellness services like those provided by Viome, will be one way to help us control these unwanted behaviors.

Interventional studies in this area are difficult, however, because scientists can’t ethically carry out experiments where they try to manipulate the behavior of humans. More data need to be collected on how gut microbiota correlate with individual emotions, behaviors, and personality traits in people’s everyday lives. Then, the data might get scientists closer to knowing how adding or removing particular species of intestinal microbes could influence brain function or behavior.
Influencing Your Longevity

Compared to middle-aged people, those who live past the age of 90 have different patterns of gut microbiota composition. Here’s the million-dollar question: are these microbes part of the reason these individuals live longer than most?

In humans, scientists are actively exploring this. But interestingly, for a type of worm called C. elegans, scientists have found certain bacteria influence how long the creatures live. Scientists found 12 different versions of the bacteria E. coli that increased how long the worms survived, and even delayed the growth of age-related tumors in these worms. This is a tantalizing clue that understanding more about our gut microbes could help us know how to increase our lifespans.

Caring for Your Engine

Let’s say you get a new car today—a car that you want to keep in great condition for ten years. You know you can’t just drive it everywhere for ten years straight and hope for the best without looking under the hood. It’s critical that you do preventative maintenance.

The maintenance has to be focused on the right part of the car, though. No matter how much attention you lavish on the trunk latch in those ten years—oiling it, replacing it, singing lullabies to it—the car will not run any better. More money and attention need to be focused on the engine, the key part of the system upon which every other part of the car relies.

We can think of your gut microbiome as your body’s engine. To keep your body running well over the long term, it’s critical to keep your gut microbiota in good condition. It’s beginning to dawn on scientists and medical professionals that by maintaining or changing our gut microbes, we will be able to change the course of chronic diseases—treating them, and especially preventing them in the first place. As a result, optimal gut health becomes a number one priority. Viome is a cutting-edge wellness company already providing groundbreaking individualized analysis and personalized recommendations to people today.

Engine Trouble

What happens when your body’s engine breaks down? Scientists have repeatedly observed, all over the world and in different age groups, that people with chronic diseases like Crohn’s disease, type 2 diabetes, celiac disease, and others have distinct patterns of microbes in their guts that differ from healthy people. Sometimes the people with the disease have proportionally more of one species, and sometimes they have less. But in all cases, the disrupted or disease-associated microbiota is called “dysbiosis.”
Other Superpowers of the Gut Microbiota

Engine Trouble Cont.

Scientists define “dysbiosis” as a disruption of the complex gut microbial community. There is an almost infinite number of ways the gut microbial community can be disrupted and thus dysbiosis could look very different, depending on the disease and many other factors. Dysbiosis is best understood as a label of “abnormal” without being too specific—like pass/fail on a test. A gut microbiota that is dysbiotic is one that’s measurably different from others that qualify as normal.

Clearly, (see chart on following page) the diseases linked to the gut microbiota are not all digestive diseases; some of them are diseases with effects throughout the body (i.e., systemic), and some are even brain-related conditions. This isn’t surprising, considering the close relationship of the gut microbiota with the immune system (described above) and, in turn, the immune system’s role in many chronic disease processes.

Again, microorganisms that cause disease are nothing new. The game-changer is that many of the conditions in the above list may not be caused by the presence of a single kind of pathogenic bacteria. Instead, they could be caused by the absence of certain beneficial bacteria or just the wrong proportional mix of bacteria.

These reactions and interactions are enormously complex. So how will we figure them out? Scientists are currently developing computer analysis techniques that will help them figure out the patterns of gut microbiota development that signal disease.

Even better, the patterns that signal the changes in gut microbiota that may foretell a sickness long before its symptoms appear. Artificial intelligence (AI) systems are a key part of this process. Given a massive amount of data, the AI systems will find the patterns that exist and help scientists zero in on the complicated balance of factors that cause disease.

Applying gut monitoring and AI, as does Viome, could have a profound impact on health care as we know it. Finding the patterns that predict the future emergence of disease leaves open the exciting possibility of making a course correction long before illness manifests—something that would make a massive difference to the epidemic of chronic diseases happening worldwide.

Now that you know what the microbiome is, what it does, and how it has been linked to longevity and chronic disease, it’s time for that promised analysis of the individualized nature of your microbiome and the implications of that individuality.
Conditions Associated with Microbiota Dysbiosis

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<tr>
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<tr>
<td>Crohn’s disease</td>
<td>Allergy</td>
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<td>Type 2 diabetes</td>
<td>Cardiovascular disease</td>
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<td>Non-alcoholic fatty liver disease</td>
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<td>Obesity</td>
<td>Alcoholic liver disease</td>
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<td>Depression</td>
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<td>Depression</td>
<td>Ankylosing spondylitis</td>
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<td>Colorectal cancer</td>
<td>Myalgic encephalomyelitis/chronic fatigue syndrome</td>
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<tr>
<td>Celiac disease</td>
<td>Hepatic encephalopathy</td>
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<tr>
<td>Parkinson’s disease</td>
<td>Cirrhosis</td>
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<tr>
<td>Autism spectrum disorder</td>
<td>Severe acute malnutrition</td>
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<tr>
<td>Systemic lupus erythematosus</td>
<td>Necrotizing enterocolitis</td>
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Conditions for which a gut microbiota dysbiosis has been noted. In some cases, gut microbiota may have a role in causing the disease.
Forging Your Unique Gut Microbiome

In order to know how to keep your gut microbiota (your body’s engine) in good condition, we have to know the things that can modify it.

Imagine a crowd of 2,200 European adults—they each filled out a detailed questionnaire and had their gut bacteria analyzed in the largest observational study of gut microbiota ever conducted. From this, and from similar studies, scientists have gained a wealth of information on the factors that correlate with gut microbiota composition and, thus, contribute to the highly individualized nature of each person’s gut microbiome.

In several large cohorts that have been studied around the world, each person is found to have a different collection of gut microbes. That’s not surprising. But what stands out are two factors that overwhelmingly seem to predict the microbes found in each person’s gut: medications and diet. In these studies, what people were putting into their mouths had the most predictive power with regard to the set of bugs in their guts.

Other factors that contribute to the composition of your highly individualized gut microbiome include early-life conditions, your environment, your sleep, your fitness, and your stress. Before jumping into the two most predictive factors—medications and diet—let’s look at the other factors that influence you microbiome.

Early-Life Conditions

While most of us can’t relive our birth, it’s worth knowing for the sake of the next generation, that early life can be a hugely important time in determining the gut microbiome’s influence on future health.

Before birth, children’s guts are more-or-less sterile. (See sidebar below.) When a newborn baby enters the world, it’s a big moment for the parents, but it’s an even bigger moment for the bacteria and other microorganisms present at the event—they have a life-or-death stake in the matter. If they want to survive, they have to colonize the surfaces of the new little human. These trillions of friends are desperate to be friends for life.

In a normal vaginal birth, the baby is coated with its first layer of microbes during its journey through the birth canal. But if delivered by Caesarean section (C-section), the baby appears to get a different set of microbes, one that more closely represents the microbes found in the hospital and on adults’ skin.

These very different initial sets of bacteria could influence the child’s health down the line. Although by adulthood, the gut microbiota seems to reveal...
no hint of whether a person was born vaginally or by C-section, there might still be long-lasting effects on health. Scientists are hard at work trying to figure out whether the increased risk of allergies, such as allergic rhinoconjunctivitis, and asthma in children born by C-section has to do with the microbes that colonize them at birth. (After all, these differences are present at an important time for immune system development.) One well-known pilot study explored a “microbial restoration procedure” for infants delivered by C-section; the infants’ mouths, faces, and bodies were swabbed with vaginal fluids from the mother in the first two minutes after birth. This procedure gave the babies microbiomes that more closely represented their vaginally-born counterparts. These babies need to be tracked for a longer period of time, so that the long-term health benefits of the procedure can be determined.

Early diet also has an impact on which gut microbes proliferate. Infants who are breastfed have a very different set of gut microbes than those who are formula-fed. Breast milk, it turns out, contains specific sugars (called human milk oligosaccharides) that have no hope of being digested by the baby. The scientists that discovered this thought it strange: why would a food that’s tailor-made for an infant have components that it can’t digest? The answer came when looking at the baby’s gut microbiota. It turns out these sugars are the favorite food of certain species of microbes living in the baby’s digestive tract. So, while the baby doesn’t digest these sugars, the microbes eat up the sugars and use them to produce compounds that support the baby’s health. This elegant system shows how microbes and food work together for the best health of the baby.

Environmental Influence

The microbes that live in your intestines might seem very removed from the world outside your body—but scientists have found that these microbes are influenced by the outside world more than previously imagined. Here are some of the things in the environment outside your body that can change your gut microbiota composition:

CONT. ON NEXT PAGE
Location:
Your geographical location on Earth might make a difference in the microbes living in your gut. Studies show some healthy people in different countries—say, China versus Sweden—have distinct patterns of gut bacteria.

Farms:
If you grew up on a farm, you might have a different set of microbes from your urban-raised counterparts, and these microbes could possibly lower your risk of asthma, hay fever, and allergic sensitization later in life. One recent study even compared two different rural communities; in the community that made use of more traditional farming practices (as opposed to using modern tractors and equipment), the children were exposed to different microbes in house dust that appeared to protect against asthmatic reactions. This ties into the “hygiene hypothesis,” which proposes that a lack of exposure to microorganisms (including infectious ones) in early life increases the risk of allergic diseases by interfering with the normal ‘education’ or development of the immune system.

siblings:
The number of siblings in your household correlates surprisingly well with some species of gut bacteria and with a lower risk of immune-related diseases later on. Siblings may not be so keen on sharing their toys, but they most certainly share their microbes.

Dogs:
When you come home from taking your dog for a walk, you likely take off your shoes and wash your hands at some point; but not the doggy’s paws. The same paws that were moments before in contact with rotting leaves and trash on the sidewalk are now walking around your kitchen. Several researchers have tackled the topic of furry pets: they looked at whether the microorganisms they bring into a house on a regular basis affect the gut microbiota of the people living there. And the answer, for dogs, is yes. Those with a dog in the house have a different identifiable set of microbes in their guts than those not living with dogs.
The Influence of Sleep and Fitness

Sleep is another lifestyle factor that appears related to gut microbiota composition. Some studies have shown that when you’re sleep-deprived or when you mess with your circadian rhythms (as in situations of jet lag), your gut microbes shift. Interestingly, this shift may not be metabolically neutral—it may shift in a direction that predisposes you to obesity.

Gut microbes also track with what you do “on the track.” That is, people with higher cardiorespiratory fitness (as measured by peak oxygen uptake) have higher levels of beneficial short chain fatty acids made by their microbes. Higher cardiorespiratory fitness also correlates with the presence of particular microbes not found in less fit and sedentary people. Not only that, but elite athletes often have a very distinct species in their guts. More research will be able to illuminate whether the health benefits of exercise are in part attributable to how exercise changes the intestinal microbial community.

The Influence of Stress

Chronic stress is very bad for health, that much we already know. The acute kind of stress you experience when you’re stuck in a bad traffic jam or lose your keys is not the problem—those kinds of stresses go away almost immediately when the situation resolves itself. But studies show chronic stress arising from early-life or long-term adversity predisposes individuals to a wide range of diseases.

Could gut microbes be responsible for the connection between chronic stress and poor health? Controlled studies in animals give clues that this might be the case; one study in mice showed that stress in early life caused physiological changes that led to gut microbiota dysbiosis; then, this dysbiotic gut microbiota was transferred to other mice and was sufficient to cause anxiety-like behaviors in the new mice.

Fecal Transplant—Another Influencer?

Scientists have found that simply transferring a fecal sample from one person to another has a very low chance of ultimately changing the composition of the gut microbiome. For one, it’s hard to make the treatment ‘stick,’ since the recipient’s gut microbial community can be quite resilient.

On the other hand, fecal microbiota transplantation (FMT for short) is an important emerging medical treatment. So far, scientists only have evidence that it works reliably in one case: treatment of the diarrheal nightmare called recurrent Clostridium difficile (C. difficile) infection. In this condition, people (often after antibiotic treatment) get a GI tract infection caused by a powerful bacterium called C. difficile; despite targeted antibiotic treatment, the symptoms may come back again and again. But if the person with recurrent C. difficile infection receives FMT from a healthy donor, they’re cured 90% of the time. FMT may turn out to have applications to other conditions—ulcerative colitis is a hot topic of investigation, for example—but the procedure will probably be replaced one day with safer tailor-made cocktails of microbes created in a laboratory.
To summarize, your microbiome is unique to you. These factors—early-life conditions, your environment, your sleep, your fitness, and your stress—contribute to the highly individualized nature of your (and everyone’s) gut microbiome.

Now it’s time to examine medications and diet—the two dominant influences on the composition of your microbiome.

You Are What You Feed Your Microbes

It’s true that one of the main jobs of your microbes is to influence the nutrition you get from your food, but the reverse is also true: your nutritional intake influences the community of microbes living in your gut. What you eat can rapidly change the gut microbiota composition\(^{14}\) and adjust the major categories of bacteria in the gut. Let’s say you’re consuming a vegan diet without any animal products. If you tested your gut microbiota, you’d probably find you had a high proportion of Prevotella and other bacteria that metabolize plant-based dietary fiber. Then one day, you switch to a diet of all animal products—a ketogenic-like diet of fatty meats, eggs, and cheeses—and tested again, you’d see a shift toward fewer Prevotella and more Bacteroides.\(^{15}\)

Another example of how great an influence your diet has on the composition of your microbiome focuses on fiber. One finding that crops up again and again in the scientific literature is that a higher intake of non-digestible fiber—found in all kinds of plant-based foods, from lentils to cucumbers to potatoes—correlates with a more diverse gut microbiota. Some have proposed that the lack of fiber in the typical Western diet (as compared to diets in other parts of the world and diets of the past) leads to a diminished community of gut microbes.

Several dietary components have a special status as microbiota modulators: namely, probiotics and prebiotics.

Probiotics, Fermented Food, and Prebiotics

You may not be aware of it, but you consume bacteria all the time—they’re all over your food and drinks, from your morning latte to your after-dinner snack. Probiotics, some fermented foods, and prebiotics all contain live microorganisms that influence the composition of your gut microbiome.

Probiotics: An international group of scientific experts has defined probiotics\(^{16}\) as “live microorganisms that, when administered in adequate amounts, confer a health benefit on the host.” Essentially, these are a special class of bacteria that scientists have linked to better health by influencing the composition of the gut microbiome. They can come in the form of pills, powders, or tasty foods and drinks like yogurt and kombucha.

Probiotics are one possible way to change the composition of your gut, but if you test your gut before and after taking probiotics, you might not find a trace of them in your sample. That’s because probiotics may not necessarily Colonize your gut even though they influence its composition.
**Fermented foods**: A common misconception is that probiotics and fermented foods are the same thing, but in reality some important differences exist. A fermented food is one that has been transformed by microorganisms; the substrates could include anything from milk (made into yogurt) to meat (made into a dry fermented sausage) to vegetables or beans. Only some fermented foods contain live microbes at the time you consume them; others (like chocolate and coffee) go through processes that kill the microbes after they have done their fermentation work. We cannot measure the exact amount of live microorganisms in fermented foods such as unpasteurized sauerkraut. Their live microorganisms exist in a wild and unmeasured mix. So, while the consumption of such fermented foods certainly influences the composition of your microbiome—as does the consumption of any food—the extent of the influence isn’t consistent.

**Prebiotics**: The newest official definition, published in 2017, states that a prebiotic is simply “a substrate that is selectively utilized by host microorganisms conferring a health benefit.” This inclusive definition means that the category is going to expand beyond inulin, FOS, and GOS—the three substances traditionally classified as prebiotics. Any substance that improves your health through the way it’s metabolized by microbes will be considered a prebiotic. This might equally include substances that are used by the microbes in your mouth or your skin, or anywhere else you have a microbiome.

The primary takeaway is that probiotics, some fermented foods, and prebiotics all influence the composition of your gut microbiome. Each person’s particular consumption of these is yet another reason that gut microbiomes are so unique.
The Influence of Medications

Antibiotics

As mentioned above, we’ve come a long way in understanding how pathogens cause disease. But as great as our progress has been when it comes to infectious diseases, a big problem has remained: even if we know precisely which bacteria are causing a disease, modern medicine is at a loss when it comes to selectively killing specific bacteria. We’ve mostly used antibiotics to successfully kill the unwanted microbes that cause disease. Antibiotics are poisons that are essentially more harmful to bacterial cells than they are to our human cells. Different antibiotics kill bacteria in different ways; some (broad-spectrum antibiotics) succeed in killing a wide range of bugs while others (narrow-spectrum antibiotics) kill a smaller group of species that have something in common. Even the narrow-spectrum antibiotics kill off many more microbes than they need to in order to quash the pathogens; this has led some scientists to liken the ingestion of antibiotics to “carpet bombing” the gut. As you might have guessed, scientists have documented that antibiotics, even as they cure infections, kill off many of the beneficial microorganisms living in the gut. Sometimes the gut microbial community fails to bounce back even years after a course of antibiotics.

Make no mistake: antibiotics are absolutely necessary in some cases and can be life-saving on these occasions. It’s better to remain alive even if you end up killing many beneficial microorganisms. It is well-known that antibiotics are vastly over-prescribed, with between a quarter and a half of all antibiotic prescriptions in US hospital settings deemed unnecessary or inappropriate. Furthermore, they are also not effective against infections caused by viruses such as the common cold, even though physicians commonly prescribe antibiotics for this condition.

One well-known physician, Dr. Martin Blaser, argues there’s a mass extinction of gut bacterial species going on in the Western world, largely due to rampant use of antibiotics. You might not think you take antibiotics very often, but consider this typical scenario: a child takes a course of antibiotics at three years old to address an ear infection. Then they take two more courses by the time they are ten years old, each time because their parents were excessively worried about a cold that lasted too long. In young adulthood, they get a wisdom tooth removed and take antibiotics to prevent an infection. Then, on a vacation, they come down with a severe stomach ailment that persists for weeks after they return home; they’re on antibiotics for an extended period of time afterward.

The net effect of a situation like this, according to Dr. Blaser, is a gut microbiome with severely depleted diversity and some species that are permanently gone; this might be one of the factors predisposing a person to chronic disease.

Granted, different people probably have different degrees of this antibiotic-induced extinction since everyone has a different gut bacterial diversity to begin with. The final effect could depend on whether your gut
microbiota before antibiotic treatment had the biodiversity of a healthy rainforest or a barren desert. Only by testing your gut microbiota before and after antibiotic treatment would you know what effect it had on your microbial diversity. No matter the exact nature of the antibiotic’s effect, the point is that your particular ingestion of antibiotics directly affects the composition of your particular gut microbiome.

**Other Medications**

Several other medications have documented effects on gut microbiota composition—including the common diabetes drug metformin, drugs called proton-pump inhibitors that reduce gastric acid production, and drugs for inflammatory bowel disease. To the surprise of scientists and doctors, it appears that the way these drugs change the gut microbiota might even play a key role in how they work.

The list of these microbiota-modulating medications is growing—and it appears that some drugs on the market that had a previously unknown mechanisms of action actually have their therapeutic effect by affecting the gut microbiome. Knowledge about drug interactions with gut microbiota will hugely expand in the years ahead, perhaps making it possible to further personalize medications for maximum benefit.

In summary, scientists are finding more and more links between the composition of individuals’ particular gut microbiomes and their levels of health, chronic disease, and aging. On top of this, the composition of people’s gut microbiomes is surprisingly individual. Factors that influence this individuality—and that can be tweaked to change the composition of your microbiome—include your early-life conditions, environment, sleep, fitness, and stress. What you put in your mouth, such as diet and medication, are the two most influential factors in establishing and then modifying the particular composition of your gut microbiome. With this foundational understanding of your gut microbiome, you are now equipped for the next phase of the journey: learning how to harness your particular gut microbiome to achieve optimized health and wellbeing.
Getting Personal with Diet and Lifestyle

Each person has a unique combination of microorganisms in their gut. These microorganisms affect how you metabolize food, so foods that are healthy for me might not be healthy for you.

Naveen Jain, Founder and CEO of Viome

When your mother or grandfather advised, “Eat your veggies,” “Keep calm and carry on,” or “Get to bed early,” they probably weren’t thinking about all of the molecular mechanisms that affect the gut microbiota and health outcomes. But these simple acts are beginning to bear out in state-of-the-art science, such as that done by Viome, and their health benefits appear to come from the way they modify your gut microbiota.

Most of us already know there’s a link between diet and health. But this link may feel distant, stuck in the pages of an eighth-grade health textbook—it’s hard to observe for ourselves because in most cases we don’t see the immediate effects of what we’ve eaten. That is, healthy individuals fortunately don’t immediately acquire diabetes after they eat a single deep-fried Mars Bar at the fair.

But microbiome science shows that gut microbes react incredibly quickly to a change in diet—after 24 hours of a dietary shift, scientists can see a corresponding shift in microbiota composition. The microbes are inside you now, waiting expectantly for your next bite. And they’re also pretty effective managers of your health. So by thinking of the trillions of tiny mouths waiting for your next meal, the diet and health connection becomes a whole lot clearer. It’s almost impossible not to become concerned about giving those microbes what they need to support your health.
But the things you need aren’t the same as the things your neighbor or your partner needs. Your gut microbiota has been shaped by all the things you’ve done, and eaten in all the moments before you sat down to read this e-book—from how you were birthed, to what kind of milk, breast or formula, you drank as an infant, to whether you have have a pet dog, to how much sleep and exercise you’ve been getting lately, to everything you’ve been ingesting—food, drink, and medication—for the last day, week, month, and years, and to your level of chronic stress. All of these factors are unique to you. For this reason, your unique set of gut microbes needs a unique set of recommendations so that they can help you.

Furthermore, of all the things that affect gut microbiota composition, as detailed in the previous chapter, only some of them are within your control at any given time. Diet, exercise, and sleep—you probably do have a choice in these. On the other hand, you may long for the solitude and rich microbial exposures of rural living, but you might live and be employed in a large city. You need recommendations that will work for you; by taking charge of the factors you can indeed control, you can potentially make all the difference to your long-term health.

General recommendations for lifestyle and diet just don’t cut it anymore. From dietary guidelines to daily physical activity targets, broad recommendations for the general public are meant to apply to everyone, despite the enormous differences in each person’s genes and microbiota. They’re certainly useful as rough estimates—for instance, the emphasis on fruits and vegetables is definitely warranted given the overwhelming data to support it in nutritional science. But given our knowledge about the uniqueness of everyone’s gut microbiota, these general guidelines fall short of being able to provide the best guidance for you as an individual. They’re about as much help as a Ford instruction manual for keeping a Honda engine in good working order for the long haul.

Dr. Jeffrey Bland, the “Father of Functional Medicine,” in his 1998 book Biochemical Individuality, points out, “There is no such thing as an average person, we are all genetically and biologically unique.” Dr. Bland proceeds to explain the fascinating amount of diversity that exists from human to human, including diversity in the shape of our heart, the shape of our liver, the shape of our hands, the rate at which we excrete various fatty acids and amino acids, our natural enzyme production, and many other elements that display an extreme amount of individuality. So, while we human beings share 99% of our DNA, tremendous diversity exists between us—and this is before even mentioning the monumental diversity of our microbiomes. When we throw our highly unique microbiomes into the mix, the call for customized health plans and diets becomes even more urgent.

And yet, despite the plethora of evidence showing the enormous amount of biochemical individuality that exists from human to human, we still see a deluge of diet books published each year (particularly close to swimsuit season and close to the New Year) that promise to be the de facto final solution for everything from fat loss, to health, to banishing acne, to beating cravings and beyond. Simply put: most diets simply involve a “one-size-fits-all” approach that paints an entire population with a broad nutritional brush without taking into consideration genetics, personal health history, individual nutrient, vitamin, and minerals needs, and, as you’ve just learned, the individuality of one’s microbiome.
A telling example of how general, one-size-fits-all dietary advice is not good for everyone is the wild variation in blood sugar response that can occur when subjects in controlled dietary studies eat foods like cookies, bananas, sushi, and whole-grain bread. The latest research on this newly-observed phenomenon, detailed in Robb Wolf’s book Wired to Eat, suggests that each person’s capacity to extract energy from foods differs dramatically because the interactions among the person’s genes, microbiome, diet, environment, and lifestyle are so infinitely complex. The findings also suggest that common measurements of the sugar content of foods, such as the glycemic index, may be relatively useless when compared to looking at individualized blood sugar responses to foods.

Food4Me, a recent six-month study funded by the European Union, investigated 1,500 participants in seven European countries. The participants were divided randomly into two groups. In one group participants were given personalized dietary advice based on their molecular data. In a second group participants were told to follow general dietary prescriptions, such as eating lots of fruits and vegetables, lean meats, and whole grains. Those who were in the personalized diet cohort fared far better than those in the one-size-fits-all diet group, making the researchers confident that personalized diets are the way forward.

To conclude: get personal with your food intake. Generic recommendations can either be dangerous or else not optimally advantageous to your specific body and its needs.
If there were a master list of bacteria that constituted a “healthy” set of gut microbes for all people, the task for determining a “best diet” would be easier. But there is no set list correlated with health across the board, and even if there were, it’s not clear that the path for getting there via food intake would be the same for everyone. We all start from different places and have to get to different destinations.

To help your gut bacteria help you, it’s necessary to give it individual attention. How can this be done?

Viome to the Rescue

When it comes to balancing your microbiome to maximize your health, food comes first. However, as you’ve already gathered, there is no such thing as a food that works for every single person. What’s healthy for your friend or spouse may not be healthy for you, and what’s healthy for you today may not be healthy for you six months from now. That’s because you not only have different gut bacteria, but your gut bacteria fluctuate and change with each day, week, month, and year of your life—depending on all those influencing factors given in the previous chapter.

For this reason, to optimize the composition of your particular gut microbiome, you need to know its current composition—a list of the bacteria, viruses, fungi (including yeasts), archaea, bacteriophages, and parasites—and use that to determine what dietary and lifestyle changes you need to make. You need to be able to check in on your gut’s microbiome composition at regular intervals to see how it’s fluctuating, so you can make further adjustments. You also need to know what all of these microbes are currently doing, it’s important that they are carrying out the functions that will keep you healthy and not the ones that are harmful.

Traditionally, most gut microbiome tests rely on a technology called 16S sequencing. This technique sequences only a fraction of the DNA in the bacteria. This results in an incomplete view of the specific types of bacteria - the genus level only. This is problematic because it makes connections between microbes and health almost impossible to uncover, as the microbes within a single genus (e.g., Bacillus) can include both species that have beneficial effects and those that have harmful effects. Optimal health is associated with diversity at the species level, and without knowing these species you’ll be in the dark. The only way to fully understand your gut microbiome is by procuring the detailed species and strain names; the majority of 16S gut microbiome tests cannot identify these accurately, even if they claim otherwise.

On top of this, 16S gut microbiome tests are unable to identify nonbacterial microorganisms: viruses (including bacteriophages), fungi (including yeasts), archaea, and parasites. Gut microbiome testing using 16S sequencing does not have the sensitivity to reveal all of the other nonbacterial microorganisms that play an important role in the health of your microbiome. They also don’t give any clue as to what all of the organisms are doing in your gut. With a 16S gut microbiome test you simply won’t be supplied the level of information you need to work with to optimize your particular gut microbiome. So what do you do?

This is where Viome flies in to your rescue. Viome offers a new form of complete gut microbiome analysis. Viome uses technology
that was born at the prestigious Los Alamos National Lab and was initially designed for national security. Viome uses this technology to perform an in-depth gut analysis, and then uses artificial intelligence to evaluate this complex microbial data. They then deliver this information in a wellness service – via home-testing kits and an app tool. Let’s take a look at the level of analysis Viome’s tests provide, so you can understand exactly how game changing their testing is for your health.

Viome’s Gut Microbiome Composition

Viome developed a proprietary technology that offers an ultra-high level resolution analysis to identify and quantify all of the living microorganisms in your particular gut—bacteria, viruses (including bacteriophages), archaia, fungi (including yeasts), parasites, and more—at the species and strain levels. This technology works because every living organism produces RNA molecules from its DNA. Viome’s technology sequences the RNA in your stool sample to identify and quantify all the living microorganisms in your stool (thus, in your gut). This is the highest resolution of a person’s gut microbiome available.

But even this detailed list of all microbes in your gut is only one part of the information—it’s a little like having a list of names of children in a class and their report cards, without actually meeting them and seeing what they’re up to. Ideally, a gut microbiome test would give you so much more than the names of the microbes living inside of you. Don’t worry—Viome does give you so much more!

Diet and health are not one-size-fits-all. You are unique, and so is your gut health. Viome takes the guesswork out of the equation, so you get a personalized map that helps you fix your gut so you can lose weight and maintain your health and wellness.
Viome Gut Microbiome Gene Expression

After identifying your gut’s composition, Viome goes on to understand how your microorganisms function. Measuring the functions of the microbes—what their genes tell them to do—is hugely important, as scientists have begun to suggest that the function of the microbiome is more important that the composition to health and disease outcomes. To understand this better, let’s say your gut microbes were at a job interview. Would you want to hire them based on their resume alone, or would you prefer to see what they could do on the job? The latter gives you much more certainty about their performance. Similarly, the functional information you get from a gut microbiome test can go a step beyond information about what the microbes can do in a hypothetical sense: it can tell you what genes they are actually expressing. This kind of analysis, called metatranscriptomics, gives you a much more realistic picture of what is happening in your gut and how the microbes are affecting you. This kind of test also shows whether human RNA is present; and if so, it may indicate a breakdown of your gut lining.
Metabolic Intelligence
Metabolomics is another valuable test that Viome administers. Hundreds of molecules in human blood are produced by the gut microbiota as they carry out their daily activities. And many of these molecules have biochemical roles that make them key players in optimal health. The molecules end up concentrated in different parts of your body; both your urine and blood are good places to measure them, as each one will yield a different collection of molecules that will give insights into what is happening in your body and microbiome. Once your sample is taken, the molecules are separated by a procedure called liquid chromatography, a special technique that measures their mass, allowing the laboratory technicians to identify the different molecules. By knowing the concentrations of these biochemicals, it may be possible to fine-tune your metabolism for better outcomes.

**Viome’s Metabolic Flexibility**

At the same time, it’s important to correlate the activities of your microbiome at any given moment with how they’re affecting your own body; that way, you know not just what your microbes are doing, but how you’re reacting to these activities. “Metabolic flexibility” refers to the specific way an individual’s body produces and processes energy. What this means is that everyone’s body, like a fingerprint, processes and digests carbohydrates, proteins, and fats differently, much of this depending on their unique microbiome. Viome measures your body’s particular response to a nutritional challenge to determine how quickly you regain your balance and how you metabolize the different macronutrients. As explained by Naveen Jain, Viome’s founder and CEO, “We look at the biochemical activity of the trillions of microbes in your gut and your metabolic activity to determine the unique way your body processes food.”

**Customized and Continuing Recommendations**

Using these analyses, Viome recommends to you your optimal diet along with other
customized diet recommendations that do the following:

- Identify the ideal ratio of proteins, carbohydrates, and fats for your diet
- Identify foods that are most compatible with your metabolism
- Recommend a diet to help you achieve and maintain a healthy weight
- Recommend a diet that will increase your energy, focus, and wellbeing
- Optimize your digestion and absorption
- Introduce beneficial (but missing) bacteria with probiotics

The result? You can fine-tune the function of your gut microbiome to minimize production of harmful metabolites and maximize the production of beneficial ones, so that you experience increased energy and general well-being, all while reaching and maintaining a healthy weight. Chronic inflammation is also addressed, and beneficial bacteria are restored. And by truly—and scientifically—understanding the inner workings of your gut microbiome, Viome’s proprietary technology helps maintain overall wellness.

The AI-driven personal wellness champion, Vie, that accompanies Viome gives you simple analyses and makes customized suggestions of foods for you to “indulge”, “enjoy,” “minimize,” and “avoid” based on your personal analysis. Shortly, Vie will also give you personalized wellness tips daily and track your evolving status as you do future tests. It will even give recipes based on your personal nutritional recommendations. Restaurants aren’t off-limits either, as the app will recommend what is best to order when you eat out.
Viome’s GPS for Your Gut

When you’re driving, your GPS gets you where you need to go. But a critical part of the way it works is that it goes step by step. It knows where you are at one moment and tells you the very next step. Then it waits to see how you respond and gives you only the next step. Importantly, the GPS doesn’t get ahead of you; if it tried to cram in four steps at once, you’d probably end up very lost and confused. You need to proceed in a constant dialogue, with constant re-calibration of the instructions based on where you are.

A well-known microbiome scientist has said that in the future we’ll each need a “microbial GPS” to navigate us through our lives in good health. So in the same way as a real GPS, a microbial GPS is more than just giving you advice that fits your microbiome. This GPS will also involve personalization of diet and lifestyle for optimizing your wellness. It would be like a GPS that knows what car you drive and if you need an oil change or new tires. What suits you one week might not suit you the next. Taking a single “snapshot” of the gut and applying the findings is not enough to get you where you want to go. Rather, personalization is about regularly measuring and making micro-adjustments over time. This is exactly what Viome offers: your personal microbial GPS so that you can live in good health.

Excerpted from Kiera Carter’s article “Fix Your Gut” in Marie Claire (July 2017)
Mapping a Disease-Free Future

Modern medicine knows well how to treat illness when it occurs. We live in an era where we have access to complex surgeries (pain-free, thanks to advances in anesthesiology). We have drugs of every shape and color. Yet, comparatively, we know so little about how to prevent disease.

Prevention has been a sticking point in health research because of one basic point about human nature: we don’t know what we’ve got ‘til it’s gone. Most of us don’t give illness prevention much thought because with our busy lives we don’t dwell on how close we are to losing what we have. If we can climb 1,000 steps today, we think we can climb 1,000 steps tomorrow and on any day we choose. But for most of us, the day will come when we can no longer climb 1,000 steps—or even 50; when we can no longer open a jar or get up out of a deep armchair.

But we’re entering a new era. With modern technologies and analyses, everything we do—from eating a grilled cheese sandwich to taking ibuprofen to hitting the gym for 30 minutes—is a data point that can help us and others know how to prevent major diseases. Through the ability to track the minutiae of many people’s lives, including their gut microbiota, we can leverage this data into powerful tools for prevention. Using Viome’s computational tools that can understand the complex data, we may zero in on the signs of disease before the disease occurs.

Prevention is becoming possible, but it’s not advisable to do it haphazardly. Are you taking supplements? Are you going on a “detox” regimen every few months? These might work for you, but for others they may not make any difference. The data Viome provides can guide you toward the best techniques for your own body and circumstances, the goal is to allow you to balance the best quality of life with the best chances of preventing illness.

“Chronic diseases don’t happen overnight, it happens over time,” concludes Naveen Jain, Viome’s founder and CEO. “There is no doubt in my mind that with a proper personalized diet, we’ll be able to create a world where chronic illness is a matter of choice, not luck.”

It’s common to monitor a child’s height and weight with notches on the wall, starting from the first few days of life and continuing through grade school until they reach adult height. In the future, a child’s gut microbes may be an even more important measurement to track. From a sample coming from the baby’s diaper at three months, does it look like they might get asthma later on? At one year, does the gut microbiota still show evidence that they were born by C-section? Did a course of antibiotics at age three leave any lasting compositional changes in their gut microbiota? Through Viome’s continuing analysis of gut microbiota, we’ll have the potential to answer these questions and more—keeping careful tabs on the child’s ongoing health and preventing the diseases that might have cropped up had they taken a different course.

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Mapping a Disease-Free Future

Monitoring Your Gut Health

In the past decade, we’ve come a long way in monitoring our bodies. We now have myriad ways to track how many steps we take in a day, how many calories we consume, how many heartbeats we experience. Carbs, grams of fat, minutes of sleep. These technologies have been enormously effective in increasing people’s awareness of their bodies and their health.

The future holds an even more promising era where we can track something even more crucial: the invisible world inside of us—the organ we never knew existed and the traces of its activity. And now, with Viome’s wellness service, we can continually monitor our gut data. This is important because, as discussed in this book, changes in the gut are changes in your wellness.

Imagine a million Americans—say, everyone in the city of San Francisco—who lived their lives as they normally live them. And several times a year, these people sent in their samples to Viome for a “gut check.” In idle moments on their smartphones, these people played games that answered questions about their lives: what they ate, whom they lived with, what medications they took. The bank of data on these people grew over time.

And by combining the trillions of data points into a huge network and applying artificial intelligence, computers could identify patterns between these peoples’ lifestyles, gut measurements, and health. Then, every one of these Americans could leverage these tiny details gathered from themselves and others into a precise set of recommendations for their personal health and wellbeing—more precise and personalized than any doctor could ever give. Through their personal contribution combined with those of many others, each and every person would have information literally at their fingertips that could save them from a lifetime of chronic illness.

This is the vision of an empowered future of illness prevention. This is Viome’s vision of living better, longer. Reach out and touch this future—it’s now. It’s Viome and you.

With Viome, you get individualized results to customize nutrition that works for you, so you can to optimize your microbiome. When you take control of your gut health, you have the power to heal. Viome is the most powerful tool available to manage your microbiome.

The best part is that Viome is now offering you complete Gut Intelligence and Metabolic Intelligence tests each year with a stream of personalized recommendations for less than the cost of a cup of coffee per day.

Fixing your gut health has never been easier, more precise, or more customized. With Viome, you gain the needed personalized information and tools to fix your gut, optimize your wellness, and maximize your performance.

What’s better than that?


