Forever Strong™

Forever Strong™

A New, Science-Based Strategy for Aging Well

DR. GABRIELLE LYON

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Dedicated to my best friend and mentor
of a lifetime, Dr. Donald Layman

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PART THREE: TAKE ACTION: LET LOOSE THE LYON'S ROAR

Forever Strong

By highlighting muscle as your target for better health, you can create positive momentum focused on what you have ***to gain*** instead of what you need ***to lose***.

Introduction

What you are about to read has the power to transform your life. My goal with this book—and with all my work in Muscle-Centric Medicine®—is to overthrow conventional wisdom on the foundation of good health. I want to help you get to the root of where your body's strength lies so you can take swift and effective steps to feel stronger, look better, and add years to your life.

You've already heard that you need to eat right, exercise, and lower your stress level to live longer, right? So why does it feel so difficult to make even the most basic commitments to a healthy life? I believe good health starts with the most important muscle of all: your mind. After I completed med school, I spent two years in psychiatry to study what makes people the best versions of themselves. The thinking patterns and brain pathology I studied have since become invaluable to my work helping patients get well and reach their full potential. And yet, after my transition to family medicine, patients came to me in the prime of their lives already showing signs of type 2 diabetes, cardiovascular disease, and obesity. Still, there seemed to be no room to talk about prevention besides generic recommendations—with limited impact. The chance to provide nutritional counseling as part of my residency, which focused on obesity and weight management, granted me another

window into the painful consequences of damaging lifestyle patterns. So many patients felt trapped on a hamster wheel of frustration. I felt just as frustrated by the limits of mainstream medicine.

After my residency, I attended Washington University for a combined research and medical fellowship in geriatrics and nutritional sciences. I engaged with next-level nutrition research in the lab of Dr. Sam Klein, who is known for studying the clinical and metabolic aspects of obesity and type 2 diabetes. For two years, I ran an obesity clinic, sitting week after week with the struggling participants. I witnessed the pain of people trying, unsuccessfully, to lose weight, and it kept haunting me: Why, with all our scientific insights, are we still chasing obesity?

The question felt especially urgent when I attended to my clinical responsibilities as a geriatric fellow providing advanced aging care. Daily, I witnessed the devastation wrought by dementia on patients and their families. The ramifications of that focus for the aging population pained me, but working with these two patient populations helped me connect the dots. This combination of duties revealed to me the before-and-after consequences of nutrition and exercise choices made by individuals who'd been left floundering by flawed recommendations. I also had an even bigger revelation when I discovered that the one thing that both these groups had in common wasn't a "weight problem" but a muscle problem.

One study I worked on examined the connections between body weight and brain function and found a correlation between a wider waistline and lower brain volume. The working premise was that obesity causes insulin resistance in the brain—a sort of "type 3 diabetes" of cerebral matter—that could lead to dementia. Our research showed that people with obesity often had impaired overall cognitive responses, such as impulse control, task switching, and other mental

challenges.[1] I became very invested in the study's participants, especially Betsy, a mother of three in her early fifties, who had always put her family and others first. Betsy had spent decades struggling to lose the same fifteen or twenty pounds she'd been carrying since her first pregnancy. But she shouldn't have been advised to focus on the weight she had to lose. The real threat lay with what she had failed to build. Imaging her brain revealed her future—the pictures I saw looked like those of someone with Alzheimer's. I knew what was in store for her within the next few decades, and it crushed me. I felt that I, along with the mainstream medical community and society, had failed her. To me, she represented dozens of patients I had seen in the same position. Then it hit me.

These people had one thing in common: low muscle mass or some impairment in their muscle. They all lacked the strength to perform certain basic movements (like those listed in chapter 8), and they had low physical tone along with blood markers that indicated unhealthy muscle. Their issue wasn't body fat, I realized; it was a lack of sufficient healthy muscle tissue.

We, in medicine and in society, have long been telling people to lose weight. But by focusing on fat, Betsy, like so many, had failed to get healthy, no matter how hard she tried. I realized that we had gotten the narrative all wrong, and the consequences for countless individual lives would be devastating.

Desperate to repair what I felt was the medical community's biggest failure, Muscle-Centric Medicine® became my mission. I am so grateful for the chance to share with you the groundbreaking science that has the power to revolutionize our pursuit of longevity for extraordinary health at any age.

Do you struggle with constant cravings, low energy, blood-sugar issues, and confusion about what to eat, how to exercise, and why? If so, you are in good company. When I was younger, I obsessed about food and my body weight. I felt hungry all the time and couldn't seem to curb my appetite. I cycled through an array of fad diets, everything from season-determined macrobiotic to all-organic, sprouted, and vegetarian. Back then, before I knew better, my meals were heavily skewed toward an unbalanced diet of carbs often considered healthy, with whole grains like brown rice, barley, millet, oats, and corn. I ate locally grown vegetables, beans and bean products (like tofu, miso, and tempeh), and sea vegetables (like seaweed, nori, and agar). I was chasing after increased energy, health, and athletic performance, but all my careful planning was rooted in misinformation.

I spent hours of each day on food acquisition, obsessing over every tiny detail to get it "right." I avoided parties or brought my own snacks. I exercised for, easily, fourteen hours a week. My focus on food and exercise was unhealthy largely because I thought meeting a baseline of wellness required a diet and training program demanding that much effort. While my intentions were good, this behavior, grounded in my flawed understanding of health, devastated my body and my mind.

After two years, I found myself exhausted and malnourished. Simply put, I had been unintentionally starving myself of the nutrients I needed. Finally, my body's response to growing deficiencies was to start binge eating. Over time, I developed an incredibly disordered relationship with food that stemmed from my inability to regulate hunger. Although I prioritized whole foods, I had completely missed the mark on protein—just like so many other people I've encountered over the years. I was keeping an intense exercise regimen of one hour of cardio plus one hour of weight training daily. Undereating protein left my body starved for extra fuel. All the carbs I ate at that time kept me

hungry and at the mercy of constant blood-sugar peaks and crashes. Once I added high-quality, strategically consumed protein to my diet, my suffering began to ease. Finally, I had regained control of my hunger. Proper nutrition helped my body recover from my workouts and supported new growth so I could finally see the results of the effort I'd been putting in. Muscle started forming, and my whole body changed. So did my outlook and eventually my life. Instead of subtracting foods and activities from my life, I started adding.

My struggles with regulating my physiology had left me hungry—not just for food but for understanding too. As I began following discussions about carbohydrates, fats, and proteins, I quickly learned how charged and layered with confusion nutrition can be. Nearly every person I met seemed to have their own beliefs about food science, some personal struggle with nutrition, and an overall fraught long-term relationship with eating that had outlasted any romantic relationship they'd ever been in.

Seeking answers in academia, I noticed that many of my classmates had come to study nutrition out of their own frustrations with food and diet. How had nutrition become such a touchy subject? Why did people eat the foods they ate? Why did some people struggle with weight and food obsession for a lifetime with so little progress?

These initial questions led me to a life spent treating people just like you. Now I'm here to share all I've learned. My greatest desire is to help you find the freedom you've been seeking, just as I did all those years ago.

THE LYON PROTOCOL WORKS

Promoting muscle health is the driving force behind the Lyon Protocol (see more on page 161)—the combination of nutrition and training instructions with operating procedures that will grant you the

power to make real, lasting improvements to your body composition and overall health. Muscle-Centric Medicine® and its protein-forward, strength-training-focused lifestyle will change everything. My patients' incredible successes demonstrate just how well these lasting, long-term strategies work.

Within one month of adopting my program and shifting your understanding and your approach from fat-focused to muscle-centric, you will likely gain muscle, lose body fat, and have more energy. Once I teach you how to build a protein-forward nutrition plan, to center your training with a focus on healthy muscle tissue, and to establish mindset guidelines for execution and consistency, you will begin to feel better immediately. And then, farther down the road, you will benefit from improved quality of life and increased longevity.

Time and again, I've observed how quickly my patients' energy levels improve, cravings dissolve, and anxieties ease. Most important, after the Lyon Protocol becomes a part of their routine, they almost immediately develop a sense of inner freedom. My practice has shown me that **once my patients prioritize skeletal muscle as an organ, they gain a whole new sense of wellness**.

My goal is to help you achieve extraordinary health. While maintaining muscle mass demands different strategies for each age group and activity level, your ability to survive and thrive—no matter your age—is directly related to muscle tissue health. Muscle-Centric Medicine®, which recognizes muscle as the organ of longevity, is the future of health. Here's your chance to change your life and rewrite your future.

LOOKING AHEAD

In the coming pages, I will shed light on how we became so blinded to some of the key nutritional realities that have interfered with more widespread health. We will examine the questionable science behind

commonly accepted nutritional principles and the deeply misleading "wisdom" that leads so many to poor health outcomes. I will break down the hard-and-fast biological numbers that determine the value of different macro- and micronutrients and will explain what, when, and how to eat and train for maximum health.

Together we'll talk through how you can use your own metrics (including waist circumference, blood triglycerides, high-density lipoproteins, and fasting blood sugar) to take simple, concrete steps to optimize your metabolism, manage your weight, and correct your body composition—energizing your muscles to burn excess calories naturally while protecting your body from inflammation and disease.

YES, THIS BOOK IS FOR YOU

Does any of this sound familiar?

1 Have you followed every program, purchased every diet book, and purposefully and thoughtfully completed every plan, only to find weight loss impossible?

2 Are you highly motivated and creative and a wiz at obtaining information—so much information that you have no idea what to do?

3 Have you been cycling through various juice cleanses, stockpiling enough supplements to open a pharmacy?

4 Did you wake up one day to find yourself wondering, *What happened to my body? What happened to my health?* Did you turn forty and—two kids and a high-stress career later—hardly recognize the person staring back at you in the mirror?

5 Do you suffer from emotional eating? Are you continually backsliding instead of reaching your health goals?

6 Do you struggle to change an unhealthy body composition? ("I'm just big-boned" or "I have a slow metabolism." "Exercise and weight training just don't make a difference for me.")

7 Have you watched your parents age and become immobile and felt helpless to protect them or provide them with a better strategy?

8 Are you fretting about the laundry list of conditions your doctor says you're at risk for, including obesity, osteoporosis, GI problems, poor cognitive function, diabetes, cancer, and even Alzheimer's? Do you see your own future in your parents' predicaments and know, in your gut, that there must be a better way?

9 Are you so busy managing everybody and everything in your life that you can't possibly prioritize your own health needs?

10 Are you settling, convincing yourself you're comfortable where you are, without realizing how much better you could feel?

Whether you're looking to maximize your weight loss and performance or to age well, *Forever Strong* will show you why, when, and what to execute to make real changes in your body and your life.

MINDSET RESET

ADOPTING A GROWTH MINDSET

Before we go any further, I want to lay the groundwork for understanding what I consider the "drivers" of behavior.

Step one is to deconstruct your thinking around health and wellness. Is your mental framework fixed or growth-oriented? The term "growth mindset," popularized by psychologist Dr. Carol Dweck, reminds us of our own mental flexibility and the reality that reaching our full potential takes time and effort. Our beliefs may be powerful, she explains, "but they are just something in your mind, and you can change your mind."[2] Understanding your own mind will help you embrace the new challenges of adopting a muscle-centric lifestyle. A mental framework that welcomes rigor will help you thrive while leveling up both your exercise and nutrition plans. That's because a growth-focused mental framework is the engine that drives progress.

People stuck in a fixed mindset often get caught up in essentialist notions of themselves ("I'm not an athlete"; "I don't like 'health' food"; "I'm gym-phobic"; "I've never been able to stick with a workout plan") and lose sight of their capacity for change. With a growth-mindset approach, on the other hand, we recognize that each of us has the potential to learn new skills and practice new ways of being. Effort is not the end, Dweck insists, but "your means to an end . . . that [is] learning and improving."

Imagine what is possible when we replace:

"I can't do it."

"This is too hard."

"I'm not good at this."
"I'm too old to try new things."

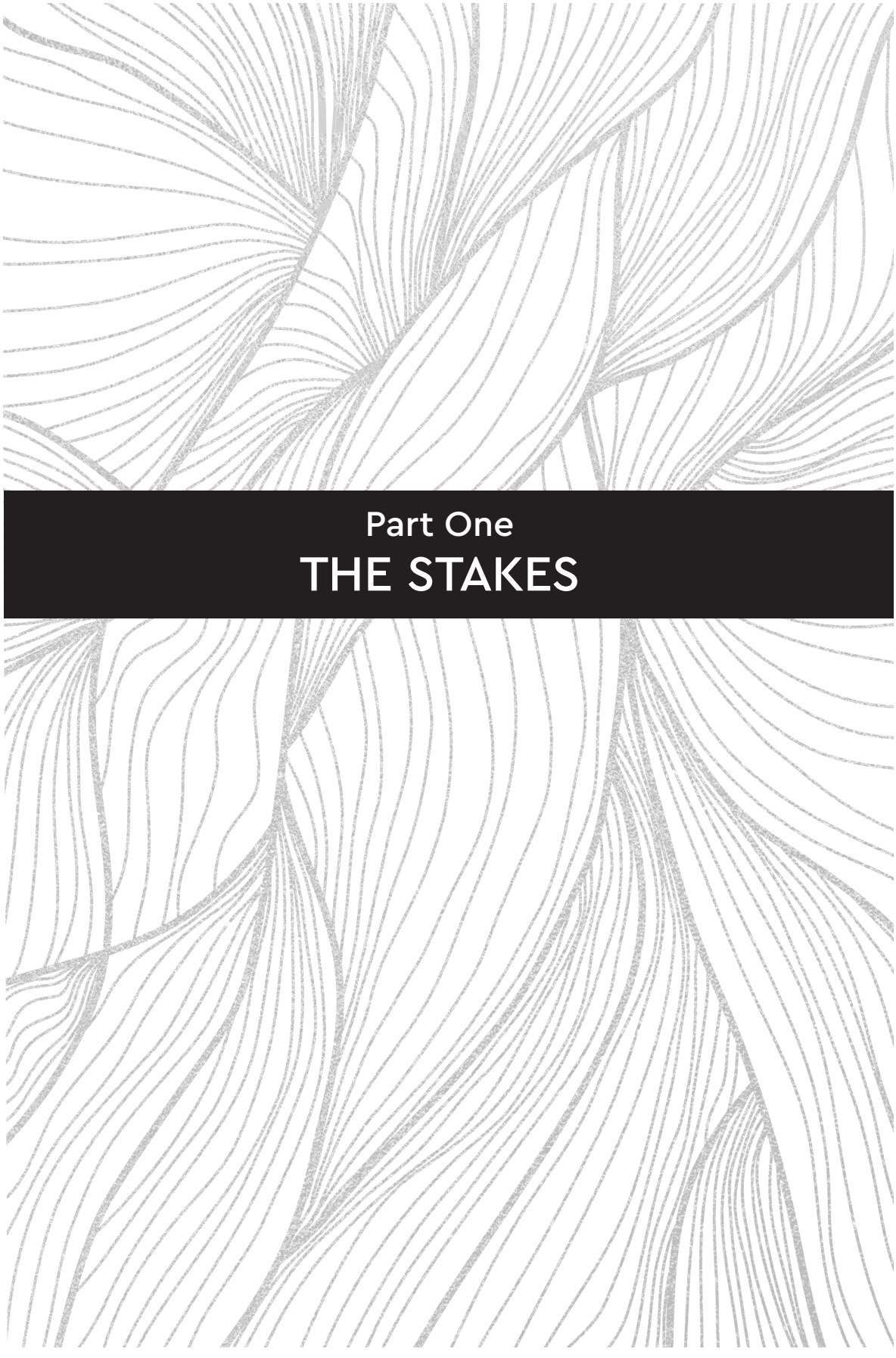
with:
"This may take some time and effort."
"I'm still learning. I'll keep trying."
"I can use a different strategy."
"This will get easier with practice."

Would you let a child struggling to tie her shoe or put on her own jacket throw out a line like "I can't do it" and quit right there? Not likely. Probably, you'd offer some words of encouragement, come up with a "bunny ears" trick for the laces or a lay-it-on-the-floor-first coat-donning strategy, and insist that she keep trying. Why do we sell ourselves short when we know full well how often in this life persistence creates possibility?

Pairing a growth mindset with internal discipline is crucial. I call this integration a growth-focused mental framework. This approach will help you look forward to learning health-improvement skills and enjoy the process—not because it is easy but precisely because it is not. Through challenge comes mental and physical refinement, and that leads to a meaningful life. It's time to recognize that having an "easy" life is a delusion laced with unmet dreams and complacency. If you choose the "easy" path, life will end up being hard; if you choose the hard path, life will wind up easy. I'm here to show you how.

"The ultimate life hack is hard work."

—Dr. Gabrielle Lyon



Part One
THE STAKES

"It's learning. It's growing. It's understanding who you are, and your capabilities, your limitations, so you can go practice and train, practice and train, and come back and try it again. The combination of daily training and practice with challenges, applying that failure-is-not-an-option mindset, leads to accelerated progress."

—Retired Navy SEAL Commander Mark Divine

1.

Shift the Fat-Focused Paradigm

After a lifetime of dieting, my patient Layla decided she'd had enough. A forty-six-year-old chef who suffered from rheumatoid arthritis that left her fatigued and in pain, Layla weighed 317 pounds when she started treatment with me. The medications she needed to keep her immune system in check kept packing on pounds and draining her energy. She was close to giving up.

Layla wasn't alone in her struggle. Obesity is wildly prevalent in the United States. At this point, more than seven out of ten of us are overweight—about 40 percent life-threateningly so! The Centers for Disease Control (CDC) estimates that addressing lifestyle factors such as poor diet, exercise frequency, tobacco smoking, and sleep quality can help to resolve the majority of heart disease, stroke, and type 2 diabetes cases. Additionally, addressing these lifestyle factors reduces risks for specific cancers by up to 40 percent.

And yet, even though we all know we need to eat better and exercise, why is it so hard to implement this change?

Seventy-five percent of Americans don't get the federally recommended weekly minimum of 150 minutes of moderate-intensity exercise

(or 75 minutes of vigorous exercise), never mind the two-plus days of full-body strength training recommended by the American College of Sports Medicine (ACSM).[1] Many factors—psychological, physiological, societal, and even religious, as I'll explain in the coming pages—can make it harder for us to get into shape. The trap of feeling exhausted, overwhelmed, and lulled into false ideas about our own abilities to change has prevented us from making the very life changes that build a foundation for long-term health and longevity. If you've reached the point where you think the best thing you can do for yourself at the end of the day is to curl up on the couch and start the binge, dive into an oversized bowl of mac and cheese, pour a large glass of wine, or indulge in a decadent dessert, I'm here to show you another way.

My first goal for Layla was to help her move the needle on the scale. To give her the boost of an early win, step one was to get her moving. She began walking on her lunch break and incorporated three additional ten-minute walks throughout the day. Next, we got Layla started with resistance exercises to assist with quality weight loss that decreased fat tissue without sacrificing muscle. (See more on those in chapter 9.)

Once we got Layla moving, we focused on her nutrition. We anchored her first and last meals with protein, and she eliminated all snacking.

Within seven months, Layla had lost nearly sixty pounds. As exciting, and rare, as that weight loss was, it wasn't even her biggest accomplishment. She was most proud of the health benefits that flowed once her body composition shifted. Her joint pain decreased, allowing her to reduce her arthritis medication. Her blood markers, such as fasting insulin, blood glucose, triglycerides, and hs-CRP, which can gauge risk of coronary artery disease, all improved.

The most inspiring part of her story, though, was realizing that her body *wanted* to get stronger. Shocked by her own success, Layla grew

less hungry and more encouraged. She could not believe how easy it was for her to feel so much better. Time and time again, I've witnessed hundreds of my patients transform by following the nutrition and exercise guidelines in the Lyon Protocol. They learn, almost immediately, that **strength is something you can build, inside and out**.

This book is your chance to find clarity in the chaos. The information I'll share on the following pages is meant to help you rise to wellness, on your own terms. Aging is going to happen, no matter what. But the following pages spell out exactly what will arm you against the setbacks to keep your body primed for health that lasts a lifetime.

FORGING A PATH FORWARD

There's no question we need a different approach to health, wellness, and longevity. Beyond the conditions already mentioned, poor muscle health also contributes to Alzheimer's, sarcopenia, osteoporosis, poor cognitive function, polycystic ovary syndrome, fatigue, poor immunity, and even cancer. And yet *all* of us have contended with the confusion and frustration of attempting to navigate the information overload of conflicting health guidelines, particularly when it comes to diet and exercise.

The result is a cycle of mental and physical stress. Contradictory advice leads many of us toward dieting and extended sessions of continuous, cardiovascular exercise that's insufficient to build or protect quality muscle. Regimens that focus on too much aerobic exercise at the expense of resistance training and don't supply sufficient fuel to power muscle growth leave people frustrated and fatigued. If you only do Zumba and skip the weight room, any pounds you lose will include both fat and muscle. Not only does this common, yet misguided, approach sap our motivation and our ability to drive change, but it also

depletes the very life-fortifying tissue (aka muscle) that we need to arm ourselves against the forces of aging and disease. Specific, well-timed resistance training (see chapter 9) doesn't just improve your body's composition, but also allows you to perform your daily activities while boosting your metabolic health.

Even my patients who *have* managed to lose weight—which is statistically hard to accomplish and sustain—are also struggling. After months of reducing calories, they wind up shedding pounds but, in the process, losing the wrong kind of weight. This is because traditional weight-loss plans that are focused solely on caloric restriction often lead to unfavorable loss of muscle mass. Then, when the weight piles back on in the form of fat, people wind up even more disheartened than before. Worst of all, each yo-yo cycle through the latest fad diet whittles away the precious muscle tissue that gets harder to gain back with each passing year.

Some of the people I treat have been flooded with plant-based perspectives that have shattered any reasonable nutritional balance and pushed them toward consuming frighteningly high levels of carbs. These folks often wind up struggling with digestive issues and chasing fatigue. (See more on this on page 59.)

The truth is that our society's obsession with fat and lack of focus on skeletal muscle—the internal engine that drives all systems—send people down the wrong path. Over the past decade, I have seen the pain caused by our failed health approaches playing out in the lives of my patients. Like most people, many of them start out with superficial ideas about skeletal muscle—they think about looks, mobility, or functional performance. Strength training can carry stigmas of vanity and "bro science." But muscle does far more essential work than improving appearance or athleticism. Instead, this dynamic tissue, which makes up about 40 percent of a person's mass, is the

keystone organ of health. Healthy muscle is imperative to a body's function. That's why, if you want to change your body—inside and out—repairing damaged muscle and building new lean muscle mass form the critical first step.

THE LIFE-CHANGING POWER OF SKELETAL MUSCLE

Skeletal muscle (the muscle that moves bones to control our locomotion) not only constructs our physical architecture but also impacts our physiological infrastructure. A grossly underestimated resource, muscle burns fat, drives metabolism, protects against disease, and so much more.

Nearly immediate improvements (measurable within two weeks) brought about by increasing muscle health include **better blood-sugar regulation, hunger control, and increased mobility.**

Longer-term benefits include **a stronger body and stronger bones, an improved blood profile including lower triglycerides, metabolism protection, increased survivability against nearly every disease, and a better mood.**

Muscle-Centric Medicine® harnesses this powerful system to **heal disease, build better body composition, boost energy, increase mobility, and combat the conditions associated with aging.**

Consider skeletal muscle as your body armor and the Lyon Protocol as your battle plan. *Forever Strong* will show you what to do and how to train your mind to *get the job done*. Nurtured through nutrition,

lifestyle, and proper exercise, healthy muscle tissue brings endless health benefits, ultimately holding the key to aging *the way you want to* rather than the ways society convinces you to accept. The better your habits, the more dialed-in your execution, the more you will be able to attain excellence in this personal sphere. Treat your muscles right, and the results will astound you. I'm here to show you how.

ALL ABOUT MUSCLE: THE ORGAN OF LONGEVITY

Building muscle is the most important safeguard for health because it is the bodily system that will allow us to live our longest, most capable, fulfilling life.

The key is metabolic health. By increasing your healthy muscle mass, you not only change your body's physical structure but also direct how your body uses both food and energy. Through training, you increase the density of muscle mitochondria—the primary energy-producing units within almost every cell of the body. This allows your body to use nutrients, such as carbohydrates and fats, and convert them into energy that can be used to power everyday activities. Training also boosts your immune function via peptides—small molecules composed of amino acids—released during muscle contraction. Key peptides can send signals in the body that help fight off germs and reduce inflammation.

On the flip side, unhealthy muscle is not only weaker but also less effective as a metabolic sink. In essence, building muscle creates something like body armor that protects you in *all* domains of health. What you do and how you live—in particular, what you eat and how you exercise—dramatically affect this organ system both immediately and over the long term. Through specific, targeted behaviors, you can literally change your destiny by empowering your muscle to run the body's energy-processing and chemical-messaging system in healthy ways.

BACK TO LIFE SCIENCE CLASS (BUT I PROMISE IT WILL BE BRIEF)

Let me take a minute now to break down for you the basics of cellular function and explain the way muscles utilize the nutrients provided through food. First, it helps to understand that the primary sugar you obtain from food is glucose—a vital nutrient that's essential for proper brain, heart, and digestive function, as well as maintaining healthy vision and skin. Research shows that glucose—not fat or protein—is the primary determinant of muscle metabolic fuel preferences.[2] The body prioritizes burning and storing glucose, over fat and protein, because if blood sugar levels remain too high for too long, glucose becomes toxic. (***Note:*** *Everything* can be toxic to the body at some amount; it just depends on the dose. One can even overdose on water!) Indeed, poor glucose clearance, as is seen in insulin resistance and diabetes, damages the tissues of the body.

Our bodies use multiple mechanisms to dispose of the excess glucose we've ingested within a maximum of two hours. We can measure the success of this process through an oral glucose tolerance test, which reveals how much time it takes our bodies to clear this sugar from the circulation. The less time it takes, the more insulin sensitive or glucose tolerant one is said to be.

I'll explain all of this in greater detail a little later, but one key health strategy I'll be teaching you is how to mitigate glucose responses by properly dosing your carbohydrates at each meal. I'll explain how detrimental reaching for carb-heavy snacks can be for both your weight-loss and metabolic-health optimization goals. Metabolic dysfunction is the leading driver of most of the diseases we face as a society. It makes for unhealthy muscle, infiltrated with fat, much like a marbled steak. This can lead to chronic fatigue, loss of strength, and insulin resistance, as well as the limitation of daily activities.

To combat these effects, we need to grow our muscles and turn them into mitochondria-manufacturing plants. Declines in muscle mass and mitochondria diminish the body's capacity to store and burn glucose, resulting in an overburdened insulin system that's working overtime to try to find places to dispose of this nutrient. The most important thing to understand right now is that **it is absolutely possible to optimize or restore proper metabolic function by building and maintaining healthy muscle**.

In addition to facilitating glucose disposal, muscle tissue also serves as one of the largest sites of fatty acid oxidation. Fatty acids can be categorized into four main groups: saturated, monounsaturated, polyunsaturated, and trans fatty acids. At rest, muscle burns fatty acids as its primary energy source.

Currently, forty million Americans are prescribed statins to lower their LDL cholesterol caused by metabolic dysfunction, while receiving virtually no guidance on optimizing metabolic health by improving muscle quality and quantity. The more healthy muscle tissue you have to process fat and glucose, the more metabolically healthy you will be, and the less you will need to rely on pharmacological interventions.

BENEFITS OF A MUSCLE-CENTRIC LIFESTYLE

- Balanced blood sugar
- Increased energy
- Mental clarity
- Decreased body fat
- Improved body composition
- Reduced cravings

Skeletal muscle also acts as an amino-acid reservoir, keeping these fundamental nutrients flowing in your body in the absence of food. This is the metabolic duty of muscle. If you become sick or injured, the body will pull amino acids from your available muscle tissue to repair and protect itself. Multiple studies have shown that the healthier your muscles, the greater your survivability when things go wrong. In fact, a person's ability to survive cachexia, a wasting disease often associated with cancer, is directly related to total muscle mass.

THE METABOLIC POWER OF MUSCLE

By highlighting muscle as your target for better health, you can create positive momentum focused on *what you have to gain* rather than *what you need to lose*. Given the power of muscle to help stave off diseases commonly attributed to aging, we should be thinking of muscle as a new health end point.

A typical doctor's visit includes measuring vital signs such as blood pressure, pulse, and weight. But for a more accurate picture of overall health, your doctor should also be measuring your muscle mass at each annual visit, with a strength assessment and other tests. This would allow immediate feedback about the trending direction of your muscle condition, which ultimately determines so much about your overall health. Until the medical system steps up to the challenge, it's crucial that you take charge of your own longevity.

Muscle health has two major components: (1) physical and (2) metabolic. The physical involves strength and mass, while the metabolic affects insulin sensitivity, glucose regulation, fatty-acid oxidation, and mitochondria health. Often called the powerhouses of a cell, mitochondria play a critical role in converting the food we eat into energy our cells can use. Their health determines the wellness of our tissues and organs, while their dysfunction can cause life-threatening conditions.

To understand how muscle helps drive metabolism and why its effect is so important, it helps to grasp three core concepts:

1 Glucose becomes toxic to the body when too much remains in the bloodstream for too long, that is, more than two hours. (We call this disease state diabetes.)

2 Insulin is the body's main mechanism for removing glucose from the bloodstream.

3 A root cause of obesity and related diseases (including type 2 diabetes, hypertension, cardiovascular disease, and impaired fertility, among other conditions) is decreased insulin sensitivity, also known as insulin resistance.

Now, here's where exercise comes in. **Muscle contraction during both aerobic and resistance training stimulates the uptake of glucose *without* any need for insulin's assistance.** This insulin-independent uptake offers an additional effective mechanism for removing excess glucose from the blood. And check out this bonus: in response to resistance training, specifically, your body reaps the benefits of contraction-driven glucose uptake **for up to two days after your workout** because exercise improves insulin-stimulated glucose uptake. During the post-workout window, the increased density of glucose transporters present in muscle cell membranes continue their work of getting rid of excess blood glucose, still with less insulin required. Here's another benefit: the glucose that gets stored in your muscle tissue as glycogen fuels both short, intense exercise and longer endurance training. In other words, with proper nutrition, the glycogen resynthesized after your workout **gives you back the energy you need to keep training**. As you can see,

this system works on a feedback loop. Exercise not only helps manage proper blood-sugar and insulin levels, but it also primes the muscle. As exercise burns glycogen (glucose) it leaves the post-exercise muscle tissue primed for glucose uptake. Proper nutritional refueling then replenishes glycogen stores, helping your body meet its ongoing training needs, thereby powering this healthy energy cycle over the long haul. Understanding the interplay of these dynamics offers a lifelong solution.[3]

Now let's look at what happens in the opposite scenario, where the muscle is not sufficiently worked, hindering all the positive effects exercise can have on the whole system.

DROP THE BAGGAGE

Think of muscle as a suitcase. When you continue to eat the wrong foods in the wrong quantities, you overstuff your suitcase until the excess contents spill out. In this case, what spills out is glucose, fatty acids, or amino acids, and all that substrate overflows back into the bloodstream. Somehow the body must dispose of all those extras. That's when initial disease processes begin. Whether the trouble starts as obesity, diabetes, or other conditions, the underlying pathology remains the same. When muscle, your main metabolic organ, gets flooded and overwhelmed, you gain fat. This fat goes on to create low-grade inflammation. When you have unhealthy muscle, poor diet choices can create postprandial inflammation every time you eat, hurting muscle's metabolic regulation and causing a whole host of other problems.[4]

Skeletal muscle health issues often begin early in life. When we are young and seem healthy enough, we think we can get away with less-than-optimal choices—even being sedentary—because we don't see a change in clothing size. In reality, **there is no such thing as "healthy" inactive**. What we commonly think of as diseases of aging are really diseases of impaired muscle.

The information I'm providing here about the function of muscle as an organ upends completely the mainstream understanding of the relationships between food, exercise, fat, and muscle. Grasping these interactions will arm you with all you need to reprioritize muscle health in the life decisions you make. **Optimizing your muscle will optimize your life.**

FIVE WAYS TO MAKE MUSCLE MAGIC

❶ Every hour, complete 10 to 20 air squats.
❷ Stand at your desk.
❸ Get your heart rate up with a brisk walk to the bathroom or water fountain 10 times a day.
❹ Bring a resistance band to your office to get in a quick 10-rep set of bicep curls between tasks.
❺ Wear a lightly weighted vest to work to add in just a little more resistance.

BREAKING IT DOWN: INSULIN RESISTANCE

Insulin is a peptide hormone released from the pancreas to move glucose into cells. Too little insulin is deadly. Too much is also deadly. When insulin resistance leads the body to require more insulin, this creates a state that drives metabolic disease and derangement in blood lipids. A pivotal paper from Kitt Petersen demonstrated that insulin resistance in skeletal muscle, due to challenges with muscle glycogen synthesis (think of that overstuffed suitcase), can promote elevated levels of triglycerides (TG) and low-density lipoprotein (LDL) cholesterol along with low levels of high-density lipoprotein (HDL) cholesterol.[5]

The insulin resistance experienced by these individuals was *independent of changes in intra-abdominal obesity*. See what I'm getting at here? If insulin resistance shows up without extra abdominal fat appearing, fat tissue and obesity may not play a primary role in causing insulin resistance in the early stages of the metabolic syndrome!

While the liver is another critical organ in this story, the most functional way to disrupt this unhealthy progression is through building skeletal muscle. Why? Because the last time I checked, it's not possible to exercise your liver. Further, the sheer mass of muscle makes it a more effective tissue to target.

The science clearly shows that skeletal muscle is an area of initial insult that leads to insulin resistance in other areas of the body, resulting in type 2 diabetes. The authors of one of my favorite papers express this succinctly in their title, "Skeletal Muscle Insulin Resistance Is the Primary Defect in Type 2 Diabetes."[6] A decade or more before beta-cell failure in the pancreas (the linchpin of diabetes) results in elevated fasting blood-sugar levels, insulin resistance can already be detected within skeletal muscle.

Therefore, if you want to correct for the body's insulin resistance, it makes sense to focus on the largest primary site of this resistance in the body. That way, you are hitting the highest-value target. Achieving—and maintaining—proper insulin regulation requires, first, emptying the proverbial tank and, second, keeping skeletal muscle healthy.

MUSCLE AS A BLOOD-SUGAR-STABILIZING ORGAN

Not only does muscle help with preventing high blood-glucose levels, but it also helps prevent levels from dropping too low. In the absence of dietary carbohydrates, amino acids released by muscle can be used to synthesize glucose in the liver, which directly supports blood-glucose levels. This mechanism allows muscle to assist in blood-sugar stabilization.

By adjusting your protein intake and prioritizing training to meet your metabolic goals, you can mitigate the effects of aging, such as the decline of the natural steroids (i.e., anabolic hormones) like testosterone that stimulate muscle protein synthesis and muscle growth while protecting against insulin resistance. Increasing protein intake also protects your body's ability to regenerate tissue while also stimulating the nutrient-sensing capacity of muscle tissue, allowing it to use dietary protein most efficiently. All these factors support your efforts to hold on to muscle. Let's dive a little deeper into the nutrient-sensing capacity I just mentioned. It turns out muscle is remarkably malleable and responsive. We've already discussed how skeletal muscle reacts biochemically to contractile forces (i.e., exercise) in beneficial ways. It also responds directly to nutrition like no other organ. Muscle can sense the protein you eat and proceed with stimulating growth of new tissue based on the availability of sufficient and appropriate amino acids. Amino acids are the building blocks of proteins—the biomolecules that establish the physical structure of the body and facilitate all of the metabolic reactions required for life.

Don't worry! I'll explain all of this in greater detail in chapter 5, feeding you all the facts, figures, and equations to help you establish the nutrient balance that your body needs based on your current situation and your future goals.

METABOLISM: SOLVING MYSTERIES AND MISCONCEPTIONS

OK, are you ready to have your mind blown?

You might have heard that muscle plays the biggest role in using calories and elevating our metabolism while we're at rest. But don't be fooled. Although muscle does play a huge role in moving the metabolism needle, the reason is not what you might think.

Here's what you'll hear at the gym: Every 10 kg difference in lean mass translates to a difference in energy expenditure of approximately 100 kcal per day. This means that **every hard-earned pound of muscle burns only about 10 calories at rest**. Now, most people right about now are thinking, *Wait a second! All that effort just to burn a measly 10 extra calories?* The fact is that the calories you burn from simply having muscle is *not* the primary effect, despite how often this information is repeated.

We know that exercise blazes through calories, but the metabolic power is this: well-trained muscle tissue is more efficient and effective at utilizing calories. So healthy muscle tissue *does* increase your metabolism but in a different way from how you likely understood it previously. Muscle boosts metabolism by using energy for protein turnover. **The more healthy muscle you have, the greater ability your body has to stay in homeostasis or balance.**

You've doubtless heard that "calories in versus calories out" creates weight loss or gain. This metric is used to describe the major elements determining our energy expenditure, with the goal of reaching exceptional health and wellness goals. But from a muscle-centric perspective, we must reconsider the very foundation of this equation, incorporating effects from the laws of thermodynamics. Here you'll see that even this simple equation, rooted in the binary thinking we've used for decades, has blinded us to other important pieces of the puzzle.

The troubles caused by visceral obesity and the effects of aging on muscle strength are well established.[7] To debunk a pervasive myth about obesity, excess fat gets stored not just in adipose tissue but in other tissues as well—including muscle. This spells bad news in terms of actual strength (peak muscle force generation) and metabolic health, along with a multitude of other unwelcome outcomes. Beyond the devastating impairments of mobility and metabolism, intramuscular

adipose tissue (IMAT) is a significant predictor of conditions such as stroke, spinal-cord injury, diabetes, and chronic obstructive pulmonary disease (COPD).

The fates I've just outlined aren't pretty, but here's the good news. We all have within us powerful tools for improving our muscle health. You can reverse some, if not all, of the damage to your muscle. With adequate stimulus from diet and exercise, you can move the needle from sarcopenic to strong, at any age.

MYOKINE MAGIC

In the same way that your thyroid releases specific hormones that regulate your weight, energy levels, and internal temperature, muscle tissue releases small signaling proteins known as myokines that act both locally and system-wide. Skeletal muscle's ability to release these circulating hormone-like proteins **establishes muscle tissue as an endocrine organ**. In plain English, that means skeletal muscle releases substances that travel in the bloodstream and influence other cells to help regulate multiple body functions, far beyond simple locomotion. Myokines released in response to muscle contractions during exercise play a significant role in energy utilization. These proteins, which help regulate metabolism in all body tissues, also exert specific, health-boosting, anti-inflammatory effects on different tissues, while improving immune function and metabolism.[8]

If you haven't heard about the role of muscle as an endocrine organ before, that's because this relatively new concept is still foreign to many of us, including many medical professionals. Pioneering research established muscle contraction's power to influence metabolism through the stimulation, production, and release of disease-fighting cytokines.

At the same time, it opened a whole new paradigm: instituting skeletal muscle as an endocrine organ—in fact, the largest organ system

in the human body.[9] It is, perhaps, the most important organ system for combating our current health crisis, regaining exceptional health, and maximizing physical performance.

Learning about these powerful molecules dramatically transformed my own thinking about food and exercise by impressing upon me the critical function of muscle. This research showed me how important it is to eat in a way that allows the body to store less fat while using exercise as a potent tool to elicit metabolic changes. Your quality of life correlates directly with your muscle health. If your muscles are healthy, you live better.

Beyond the benefits already mentioned, new science reveals yet another major health boost provided by resistance training: increased production and release of myokines. Myokines are a collection of small proteins and peptides secreted into the bloodstream during skeletal-muscle contraction. Because they act as chemical signals that produce downstream metabolic and hormonal changes, myokines help your body metabolize glucose from your bloodstream *without* the use of insulin. This effect benefits everyone, but it can offer significant metabolic correction for insulin-resistant individuals. Actively working and taxing your muscle tissue will not only help regulate your hormones but will also make you better able to regulate your blood sugar and improve your body composition.

Myokines even improve your sense of well-being and capacity to learn. Studies have shown that working out increases blood flow to the brain, promoting the development of new brain cells while helping to clear out toxins.[10] During exercise, muscle releases two myokines called cathepsin B and irisin, which can enter the circulation and cross the blood-brain barrier, where they stimulate the production of brain-derived neurotrophic factor (BDNF). This uptick in BDNF boosts neurogenesis, or the formation of new neurons, facilitating learning and

memory.[11] Higher levels of BDNF correlate with decreased incidence of mood disorders, while aerobic-exercise-induced increases in BDNF are associated with increased volume in the hippocampus—the region of the brain that facilitates learning, memory, and spatial awareness.[12]

The takeaway is this: you'd be shocked to learn just how much muscle you still have the capacity to build—even if you're struggling with a long-term illness or feel like you've missed the boat on getting healthy—and how big a role it will play in saving your life. Read more to learn how!

If you would like to learn how to master the fundamental concepts of Muscle-Centric Medicine® and mindset, visit www.drgabriellelyon.com to learn more about our Muscle-Centric Foundations Course!