

Praise for *Fat for Fuel*

“Dr. Joseph Mercola has been a shining beacon of health wisdom and freedom for decades. His latest book, Fat for Fuel, is a masterpiece of cutting-edge research and practical application. This information, if applied, holds the key to sustainable weight loss and enhanced energy. More than that, this lifestyle plan can help reverse chronic illness such as heart disease, diabetes, and even cancer.”

— **Christiane Northrup, M.D.**, *New York Times* best-selling author of *Women’s Bodies, Women’s Wisdom* and *Goddesses Never Age*

“I truly believe that the concept of Mitochondrial Metabolic Therapy will have significant impact on health. As I mentioned in my book, cancer is not likely to occur in people with healthy mitochondria. Dr. Mercola has expanded this concept to a broad range of chronic diseases that involve mitochondrial dysfunction. He provides a clear rationale as well as guidelines for implementation of MMT. This book should be read by anyone interested in maintaining their health without toxic pharmaceuticals.”

— **Thomas Seyfried, Ph.D.**, author of *Cancer as a Metabolic Disease* and professor of biology at Boston College

“This remarkable book presents a truly revolutionary program that can help millions of people achieve optimal health. Dr. Mercola clearly explains the importance of mitochondria for metabolic function and carefully guides his readers with detailed practical advice for enhancing their activity. Fat for Fuel will change the way you think about nutrition and your health.”

— **Leo Galland, M.D.**, author of *The Allergy Solution*

“Dr. Mercola’s Fat for Fuel eloquently presents the leading edge of science, exploring how best to power your body. This is a life-changing text that not only provides a deep dive into why choosing fat as our primary fuel source powerfully correlates with health and disease resistance, but also delivers in terms of how the reader can easily bring about this fundamentally important change. Health, on a global scale, has suffered profoundly as a consequence of commercially influenced dietary recommendations. Mercola’s science-based refutation of this status quo provides a welcome and compassionate response, allowing readers to regain and maintain optimal health.”

— **David Perlmutter, M.D., F.A.C.N.**, board-certified neurologist and author of the #1 *New York Times* bestseller *Grain Brain* and *The Grain Brain Whole Life Plan*

“In Fat for Fuel, Dr. Mercola beautifully lays out the history—and the myths—behind the high-carbohydrate, low-fat diet that has been at the root of so much illness and death in the last half-century. Dr. Mercola is one of the few who have properly understood and embraced my long-standing belief that one’s health and lifespan is mostly determined by the proportion of fat versus sugar one burns over a lifetime. He also understands that excess protein creates another whole set of health-eroding issues. Anyone who values their health should read this book.”

— **Ron Rosedale, M.D.**

“Science has already shown that eating fat can make you thin. In this pathbreaking book, Dr. Joseph Mercola goes a critical step further, revealing that using fat as your main fuel source can heal your body at a mitochondrial level, restoring energy and well-being and even helping fight cancer and other diseases. Impeccably researched and passionately argued, Fat for Fuel dispels dangerous myths about ‘healthful’ diets, reveals truths the food industry won’t tell you about the food you eat, and starts you on a path to radically transforming your health.”

— **Mark Hyman, M.D.**, #1 *New York Times* best-selling author of *Eat Fat Get Thin* and Director of the Cleveland Clinic’s Center for Functional Medicine

“The world of nutrition is more confusing than ever. But one thing has become increasingly evident over the past decade: teaching our bodies to use fat instead of glucose as the main fuel source has immense potential to support patients suffering from some of the most devastating chronic diseases. Dr. Mercola’s Fat for Fuel will be an invaluable resource for me in two ways: personally, because I’m a cancer patient myself striving to create an environment that will keep my disease at bay, but also professionally as a nutritional therapist. Fat for Fuel will help me inform, educate, and guide my clients.”

— **Patricia Daly, dipNT, mNTOI, mBANT**

“Fat for Fuel is another fact-based, insightful book by the visionary Joseph Mercola that will not just change your life, but could literally save it. Dr. Mercola understands how food can preserve wellness or destroy it. Boldly challenging old myths about fat, diet, and healing, he gives practical, step-by-step instructions that will empower you to take control of your health whether you are sick and want to get well, or are healthy and want to stay well.”

— **Barbara Loe Fisher**, co-founder, National Vaccine Information Center

“Dr. Mercola’s lifetime of research reaches a crescendo with Fat for Fuel. Every page is a distillation of his genuine passion to optimize human health through diet.”

— **Travis Christofferson**, author of *Tripping over the Truth: How the Metabolic Theory of Cancer Is Overturning One of Medicine’s Most Entrenched Paradigms*

“Fat for Fuel is a powerhouse of practical, evidence-based information for the clinician and consumer alike. With so much conflicting information in the nutrition world, this book serves as a critical resource for every physician in training or in practice, and for every person eager to avoid the need for those doctors.”

— **Zach Bush, M.D.**, endocrinologist

“Fat for Fuel is a powerful manifesto reexamining the fat-phobic paradigm that has long dominated the thinking about health and nutrition. This is an extremely valuable guidebook for those seeking to understand and implement transformational dietary changes to boost their metabolic and cellular function. By shifting away from the idea of glucose as the optimal source of energy, Dr. Mercola shows how we can harness the benefits of fat and ketones for clean-burning fuel in the quest for optimal health.”

— **Michael Stroka, J.D., M.B.A., M.S., C.N.S., L.D.N.**, executive director,
Board for Certification of Nutrition Specialists

“In 2017, we have many chronic illness epidemics in the USA. At the center of most of those epidemics is the toxic, nutrient-depleted, dysfunctional human cell. And research is now showing us that the most important organelle in that cell contributing to most of these diseases is the mitochondria. In his book Fat for Fuel, Joe Mercola has given us a practical blueprint for how to revive our mitochondria using diet as a powerful foundation, with a few other added simple tools, such as intermittent fasting, exercise, light therapy, and some supplemental nutrients. Dr. Mercola tested the Mitochondrial Metabolic Therapy recommendations he makes in this book on himself, with many months of trials and errors and continuous glucose monitoring. He also amassed impressive scientific research from the literature to prove what he recommends on these pages. I highly endorse Fat for Fuel as the most practical do-it-yourself guide available today for people to take back control of their health and resolve chronic illnesses.”

— **W. Lee Cowden, M.D., M.D.(H)**, chairman of scientific advisory board,
Academy of Comprehensive Integrative Medicine

“Fat for Fuel is a landmark contribution from Dr. Joe Mercola. . . . Metabolism at its core consists of how our mitochondria utilize nutrients, and Dr. Mercola educates his readers on how to choose the nutrients that optimize mitochondrial function. This book will contribute greatly toward our health goals for our entire population as more and more health-care professionals wake up to this understanding of the importance of optimizing mitochondrial metabolism. Fat for Fuel brings mitochondrial function into the mainstream for the healthy benefit of everyone. Bravo!”

— J. William (Will) LaValley, M.D.

“Dr. Mercola proves once again that he is at the very forefront of natural healing and wellness. With medical science understanding more and more how mitochondrial dysfunction leads to chronic disease, Dr. Mercola provides a simple, natural healing plan with this important new book.”

— Jason Fung, M.D., nephrologist and author of
The Complete Guide to Fasting

“A revolution is growing in medicine, one that revolves around a change from seeing the cell as a membrane-bound bag of water controlled by the all-powerful DNA to a more fluid conception of the cell centered on the central role of the mitochondria. Dr. Mercola is at the forefront of this exciting revolution, and this book gives you both the theoretical basis and practical suggestions for supporting your mitochondria and regaining better health. I would encourage everyone to read this book and strongly consider following Dr. Mercola’s many helpful suggestions and guidelines.”

— Thomas Cowan, M.D.

“A book like Fat for Fuel has been a long time coming. Backed by a wealth of research, Dr. Mercola makes the definitive case that fat, not sugar, is the power source on which our bodies are meant to run, and he outlines what changes we can make in our daily lives to use fat as fuel. KU Integrative Medicine has been waiting for this book!”

— Jeanne A. Drisko, M.D., C.N.S., F.A.C.N., Director, KU Integrative Medicine, and Riordan endowed professor of orthomolecular medicine, University of Kansas Medical Center

“Dr. Mercola is one of the most brilliant minds in modern medicine, and he has achieved a true masterpiece with Fat for Fuel. Why? The book defies the status quo and reveals the truth behind everything from why fasting is a healthy habit to why you need to become a fat-burning machine. He even shocks us with the details on how iron can negatively impact mitochondrial health (you’ll be surprised). This book is a must-read if you want to optimize your body and brain while systematically eliminating a host of risk factors for chronic disease.”

— **Ben Greenfield**, BenGreenfieldFitness.com (Dr. Mercola’s favorite fitness podcast)

“Fat for Fuel is a crucial read to obtain and maintain health, especially in the modern pandemic of inflammation-driven chronic diseases. This important book teaches principles most people have not yet heard and extends its reach beyond the small group of practitioners around the world who are already utilizing these methods. Implementing the principles outlined in this book has proved life-changing for thousands and I now expect that this information will transform millions. These tools and strategies are ‘the real deal,’ and a proven answer to our current state of dis-ease. The science presented here is clear and well-documented and will change the way you think about what really brings you health and healing.”

— **Daniel Pompa, D.C.**

“Fat for Fuel comes at the perfect time. With the cost of health care soaring, we have to take responsibility for protecting our health instead of simply treating disease. Understanding the mechanisms of how we function is essential to a healthy body and brain, and modern-day revolutionary Dr. Mercola has relentlessly dug through the research to bring this latest and greatest knowledge of our bodies to the bookshelf. Not only does this page-turner highlight the need for fat in our diet, it shows us how to prepare our bodies to process and utilize it most efficiently—a key ingredient in the overall strategy to attain optimal health.”

— **Erin Elizabeth**, investigative journalist, author of *In the Lymelight*, and founder of HealthNutNews.com

“In a bold voice and in plain language, Dr. Mercola continues his role as nutrition pioneer for America and the world. This book will educate, embolden, and empower consumers to take charge of their health destiny.

Dr. Mercola, pro-health instead of pro-industry, shows us how we can bring in healthy fats and take a number of other key steps to right our own ships. This book should be a wake-up call to spur the medical and dental professions to take nutrition counseling seriously.”

— **Charlie Brown, J.D.**, Consumers for Dental Choice

“Fat for Fuel goes well beyond a book on the health benefits of eating the right types of fat to offer tremendous insights on how to power up your health by ramping up metabolism and boosting cellular energy. It is an incredible book written by a truly insightful thought leader. My hope is that this book will produce the tipping point leading to needed changes in our collective thinking about the power of nutrition as medicine. I highly recommend this book!”

— **Michael T. Murray, N.D.**, co-author of *The Encyclopedia of Natural Medicine*

“I had been playing around with low-carb and keto cooking on and off for a year but not making much progress toward my weight-loss goals. After reading Fat for Fuel I understand that I was limited by a kindergarten-level understanding of the ketogenic diet compared to what I needed to know and do in order to be successful. My father’s recent death due to Alzheimer’s has motivated me to be deadly serious about doing whatever I can to avoid this and other chronic diseases. I’ve read hundreds of nutrition books over my lifetime but this one is my favorite and the one I know will make the biggest impact on your health if you have the commitment to follow it to the letter.

Once again, an outstanding contribution from Dr. Mercola!”

— **Dr. Kendra Pearsall, N.M.D.**, founder of Enlita.com

FAT
FOR
FUEL

ALSO BY DR. JOSEPH MERCOLA

Effortless Healing

The No-Grain Diet

Take Control of Your Health

Sweet Deception

Dark Deception

The Great Bird Flu Hoax

Freedom at Your Fingertips

Generation XL

Healthy Recipes for Your Nutritional Type



FAT FOR FUEL

A Revolutionary Diet to Combat
Cancer, Boost Brain Power,
and Increase Your Energy

DR. JOSEPH MERCOLA



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*This book is dedicated
to all of our friends,
family, and loved ones
we've lost bravely
battling cancer.*

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INTRODUCTION

I have been passionate about learning about health for the last 50 years. I hope my story will prevent you from making some of the same painful and foolish mistakes I have made along my journey toward optimal health. It is my experience that it is far easier and less painful to learn from others' mistakes.

My commitment to a fitness routine started in 1968. Dr. Ken Cooper's book *Aerobics* catalyzed my interest in health, which eventually led me to enter medical school 10 years later. Sadly, like most health enthusiasts during the late '60s and early '70s, I fell in line with the low-fat, high-carb diet that has been popularized by the mass media for decades. This type of diet is the polar opposite of what I now understand as necessary to prevent chronic disease, manage cancer, and optimize health.

Seven years of medical school and family practice residency solidified my brainwashing into the conventional drug-based medical model that exists primarily to treat the symptoms of disease. Virtually none of my seven years of training ever addressed the root cause of common chronic illness. Rather, it focused on managing symptoms through the use of pharmaceutical products and medical procedures.

In 1995, my understanding made a radical leap in evolution. I met Dr. Ron Rosedale in a room with a few dozen other physicians at a meeting of the Great Lakes Academy of Medicine. Little did I realize then how fortunate I was to be one of the first physicians inspired by Dr. Rosedale's wisdom on clinical metabolic biochemistry.

Dr. Rosedale lectured for over three hours on the critical need to control high insulin levels in order to prevent nearly every chronic degenerative disease that is rampant in our modern culture, including diabetes, obesity, heart disease, cancer, arthritis, and neurodegenerative diseases.

You may have had a similar epiphany in your life when you knew you were encountering a foundational truth. In this case I knew it could impact the health of hundreds of millions of people who desperately needed help.

For the next ten years I used the principles Dr. Rosedale taught me along with other information I had gained from attending many dozens of postgraduate courses on nutrition—a subject, suffice to say, never taught in medical school—to continually refine my understanding and use of food as medicine. (Even today most medical schools fail to provide even the most rudimentary basics of nutrition.¹)

I was fortunate to have the privilege of using these principles to care for more than 25,000 patients in my clinical career. It was enormously rewarding to be able to provide solutions for most of my patients, many of whom had been seen but not successfully treated by some of the leading physicians at some of the finest institutions in the country.

It wasn't that I was any smarter than these other physicians—far from it. The difference was that I stayed disciplined, open-minded, and diligent in pursuing the truth about the underpinnings of health. My unfair advantage was elemental: I had a better understanding of how the body healed itself because I had made a decision to stay at arm's length from pharmaceutical interests. That perspective helped me focus on looking for and remedying the cause of disease rather than mitigating the symptoms.

Although I was aware of the importance of limiting refined carbs and processed foods and replacing them with healthier choices, I was relatively clueless about the importance of eating plenty of high-quality fats and activating the body's natural ability to burn fat for its primary fuel instead of glucose. I didn't realize that I still had to look further.

WE'RE LOSING THE WAR ON CANCER BECAUSE WE'VE BEEN FIGHTING THE WRONG ENEMY

Twenty years after I learned of the importance of insulin, I read Travis Christofferson's *Tripping over the Truth: How the Metabolic Theory of Cancer Is Overturning One of Medicine's Most Entrenched Paradigms*. I was struck by an epiphany similar to when I first heard Dr. Rosedale's lecture—here was something that had the potential to radically improve the health of millions.

The argument Christofferson so eloquently laid out—and that builds on what Dr. Rosedale taught me in 1995—is that cancer and nearly all other chronic diseases are caused by defective metabolic processes in your mitochondria. This is typically a result of insulin and leptin receptor resistance from too many net carbs and activation of the mTOR metabolic signaling pathway by excessive protein. We will go into great detail on these topics later on, but for now it's enough to know that this is the root of the problem for most.

This is in direct opposition to the conventional views of the roots of disease; for over a century, the widely accepted scientific dogma has been that cancer is a genetic disease that develops as a result of chromosomal damage in the nucleus of the cell. The discovery of the structure of DNA by Watson and Crick in the mid-20th century along with DNA sequencing in the 21st century has served to greatly reinforce this viewpoint.

Tragically, President Nixon's War on Cancer, which started with the signing of the National Cancer Act in 1971, has been a miserable failure. And in 2016, President Obama's moonshot to cure cancer is doomed to this same fate, despite its billion-dollar price tag. Today, in the United States alone, over 1,600 people will die from cancer.² If you look at global statistics, that number jumps to an astonishing 21,000 who pass each day from this mostly preventable disease.³ The odds are astronomically high that at some point in your life you will develop cancer or know someone who has cancer. Shockingly, the latest data from 2011 to 2013 show that nearly 40 percent of us will be diagnosed with cancer at some point during our lifetime.⁴ I have come to see

that we are losing the war against cancer because scientists are chasing a flawed paradigm: most adult cancers are not a disease of damaged DNA, but rather one of defective metabolism.

THE MIGHTY MITOCHONDRIA

Mitochondria—tiny energy factories within your cells that use a metabolic process to convert the food you eat and the air you breathe into energy—are at the core of what is causing your biological systems to go haywire in the first place, making you vulnerable to cancer and most other chronic diseases. When large numbers of mitochondria in your body stop functioning properly, it is simply impossible to stay healthy. This is an enormously empowering shift in how we approach cancer and all chronic diseases: if disease starts as a result of metabolic dysfunction, we can heal that dysfunction. How? That's what this book will show you—how to carefully choose nutrients and employ other strategies that turn on your body's innate ability to prevent and heal from disease.

In its most distilled form, the theory that drives this book is that the food choices you make every day directly impact your mitochondria. And if you make food choices that boost the health of your mitochondria, you also make it much less likely that the genetic material that's housed in your mitochondria will become damaged and trigger a chain reaction that is more likely than not to result in disease.

Another major impetus for me to write this book was seeing so many friends and colleagues, including Jerry Burnetti, die from cancer. It is no exaggeration to say that Jerry was a genius. He was one of the world's leading experts on regenerative farming, and I had the privilege of interviewing him for my website a few years ago.

Seeing the movie *The Fault in Our Stars*, a devastating romantic tragedy about two teens with cancer who find each other and fall in love despite their imminent mortality, was another catalyst for me. Though incredibly sad, it is one of my favorite movies. If you

haven't already seen it or read the book, I strongly encourage you to do so.

I believe—as do many of the experts I interviewed for this book—that tragic scenarios like Jerry's early death and the story depicted in this tearjerker film are unnecessary because more than 90 percent of cancer cases are either preventable or treatable. I had to do something to help staunch the loss of so many talented and loving people to cancer.

Since viewing the movie and reading Travis's book, I have scoured the National Library of Medicine for the latest research, which has led me to hundreds of review articles on the critical role of mitochondria and what factors play into how best to optimize their function. I have gained insights via personal interviews of many of the most respected authorities in this area.

One of these is Miriam Kalamian, Ed.M., M.S., C.N.S., a nutrition consultant, educator, and author specializing in the implementation of ketogenic therapies for people with cancer. Miriam is the go-to nutrition consultant for Dr. Thomas Seyfried, who is widely recognized as one of the leading pioneers in the metabolic theory of cancer. She has worked with hundreds of clients to adopt the food changes I outline in this book, and she has contributed invaluable insight and information that you will read in the pages to come. She played a vital role in helping me use what I've learned to put the puzzle pieces together for you.

THE EATING PROGRAM THAT CAN HEAL YOUR METABOLISM

My goal in writing this book is to present you with a clear, simple, and rational explanation based on science that will help you understand how your body works at a biological and molecular level. I will also tell you what foods to eat, practical strategies to follow, and ways to monitor your progress to help your mitochondria thrive—a program I call Mitochondrial Metabolic Therapy (MMT).

Simply put, MMT is a system of eating that will help shift your metabolism from burning glucose as your primary fuel to burning fat to fuel your body. When you make this shift, you optimize your mitochondrial function and protect your mitochondrial DNA from potential damage that could lead to disease.

At its most basic level, MMT is a high-fat, adequate-protein, low-carb diet that is built on eating the highest-quality foods available. It is quite a shift from the typical American diet—which is notorious for its excessive refined grains, sugars, and low-quality fats. As you will see, the foods that make up MMT are delicious. Luscious, even. They are satisfying, satiating, and absolutely energizing. And once you make the change to MMT, you will finally be free of hunger, cravings, and any feelings of deprivation that accompany the vast majority of eating plans, aka “diets,” out there.

MMT is about so much more than the foods you eat—it factors in *when* you eat as well, as regular periods of fasting improve mitochondrial function and accelerate the transition from burning sugar to burning fat. (I cover fasting extensively in Chapter 10, but at this point, you can rest assured that MMT does not require you to go even a whole day without eating; most of your fasting hours are spent sleeping.)

MMT is for you if you are facing one or more serious health conditions—such as cancer, type 2 diabetes, neurodegenerative disease including Alzheimer’s and other forms of dementia, or obesity—or you are passionate about optimizing your health while also slowing down the aging process.

MMT, in whole or part, is optional. And options are wonderful things to have. Perhaps you don’t fit into either the chronically ill or the passionate-about-health category right now. But should you find yourself at that point later, or desire to prevent a health crisis, you’ll know that there is a powerful healing protocol available, one that puts you in control. That is no small thing.

THIS IS EMERGING SCIENCE— BUT YOU CAN REAP THE BENEFITS NOW

Please understand that mitochondrial and metabolic health is an emerging discipline and only a handful of researchers and even fewer practicing physicians are actively involved in its study. But I firmly believe that at some point in the future, metabolic therapy will be accepted as the standard of care not only for cancer but for most chronic diseases.

Thankfully you and your family don't have to wait 10 or 20 years to reap those benefits. You can begin to improve your health, prevent needless pain and suffering, and help lower your risk of developing serious diseases like cancer by applying what we already know about mitochondrial dysfunction today.

I fully realize that much of the information in this book is not widely accepted yet by the mainstream and many will criticize it. I and others pioneering the way forward toward a more inclusive and holistic view of health and healing are very accustomed to this type of reaction when we provide evidence that there is a more rational and safer way to stay healthy.

The first time I experienced this was as a medical student in the early 1980s when I recommended improving gut microflora as a way to treat ulcers rather than using prescription drugs. I was widely criticized by all of my supervising physicians for promoting this new idea. Years later, I was vindicated when it eventually became the standard of care. Dr. Barry Marshall was the courageous family physician who had pointed me in this direction, and 25 years later in 2005, he won the Nobel Prize in Medicine.

Similarly, I was the first to publicly warn of the dangers of the anti-inflammatory drug Vioxx. One year before the drug was approved for sale in the U.S., I told my newsletter readers that this was a dangerous drug that could cause heart disease and stroke. Sure enough, four years after Vioxx was released Merck voluntarily withdrew it from the market—but not before it killed an estimated 60,000 people.⁵

There are many examples in the history of medicine where routine use of pharmaceutical products and other medical interventions is accepted as “standard of care” for a period of time before they are found to be flat-out wrong and toxic to human health.

I believe it is time to challenge widely accepted assumptions about the causes and cures for cancer. We must open our minds and reexamine the evidence by first acknowledging that science is never settled and that our current understanding of biology is rapidly evolving as more objective, impartial, and unbiased research is performed and published.

I was initially reluctant to write a book about mitochondria dysfunction and cancer because of the very real potential for the information to rapidly become outdated. I thought it was far more efficient and effective to give away the information in real time on the Internet on my website, which I started in 1997 in my off hours as a medical practitioner and which has grown into one of the most visited health sites in the world, with over 15 million unique visitors and 40 million page views a month. But my team convinced me about 10 years ago that books serve a very valuable purpose. They require the author to consolidate thoughts into a comprehensive printed resource where all the material is carefully integrated into an easy-to-follow format.

I am still concerned that the information in this book will need to be revised in the not too distant future, but it will likely be several years before I can carve out the time to fully update it. That is why I strongly encourage you to stay on top of the emerging science by subscribing to my free newsletter or doing your own searches at mercola.com, and, of course, reading from many other sources to help educate and empower yourself and your family on health care and health-related issues.

I continue to network with the leading researchers studying metabolic disease, and I actively review new studies as they are published. I will regularly post updates in my free newsletter at mercola.com, so you will be one of the first to know about new scientific developments and revised recommendations. It has been

so rewarding to see what an impact this information has already had in helping people gain awareness, empower themselves, and recapture their health without the use of potentially toxic and dangerous pharmaceutical products. I hope that this book will help millions more do the same.

PART I

**RESCUING
YOUR
METABOLISM**

CHAPTER 1

THE TRUTH ABOUT MITOCHONDRIA, FREE RADICALS, AND DIETARY FATS

Because you are reading this book, I am assuming two things about you:

- You recognize the link between the food you eat and your health.
- You have faced at least one health crisis, either your own or that of someone you love.

I'm also fairly certain that you are confused about what to eat in order to regain your health. I get it. Honestly, I don't see how you could avoid feeling at a loss here, as the food and pharmaceutical industries have effectively manipulated the conversation—and lobbied the government—to distort the truth in the quest to benefit their bottom line.

They have systematically and intentionally misled you about what is healthy and what isn't.

I spend the majority of my free waking hours reading the research and interviewing leading scientists in these areas. Even though I am trained as a family physician and have treated over 25,000 patients, I am still continuously refining and rethinking my understanding of what a healthy diet truly is.

In this chapter, I'm going to explain a few key concepts to arm you with the reasons *why* the eating plan I'll outline in the second half of this book works to restore health and ward off disease. First, I'll cover exactly what mitochondria are, and then I'll explain how fat can be either a friend or a foe depending on what type of fat it is and how it is processed—and how the nutritional guidance we've received from medical associations, doctors, mainstream media, and the government have led us astray. By the end of this chapter, I hope you'll have a clear understanding of why it's so important to take care of your mitochondria, and exactly how harmful a typical American diet is to these tiny physiological wonders.

MEET YOUR MITOCHONDRIA

Perhaps you recall hearing about mitochondria in your high school biology class or have read about mitochondrial disease on the Internet, but you are still not quite sure what mitochondria are or what function they serve. Mitochondria are so vital to your health that if you are interested in warding off and healing from disease, it is critical for you to learn more about them.

Mitochondria are tiny organelles (think of them as micro-organs) contained within nearly all your cells. One of their many critical roles is to produce energy by combining nutrients from the sugars and fats you eat with oxygen from the air you breathe.

Researchers estimate that mitochondria account for 10 percent of your body weight, with approximately 10 million billion within the cells of an average adult.¹ If that number is hard to comprehend, consider that more than 1 billion mitochondria would fit on the head of a pin.

Some cells have more mitochondria than others. For example, female germ cells, known as oocytes, have hundreds of thousands, while mature red blood cells and skin cells have few to none. Most cells, including liver cells, have somewhere between 80 and 2,000 mitochondria. The more metabolically active cells are—such as those found in the heart, brain, liver, kidneys, and muscles—the more mitochondria they have. You can imagine, then, that having healthy, well-functioning mitochondria will have a wide-ranging and powerfully positive impact on your overall health.

Mitochondria continuously generate energy molecules called adenosine triphosphate (ATP). Are you curious, as I was, to know how much ATP is actually generated? I suspect you will be surprised to learn that your mitochondria produce about 110 pounds of ATP *every day*.²

According to *Power, Sex, Suicide*, Nick Lane's excellent book on mitochondria, this enormous army of organelles is hard at work every second of the day, pumping out 10,000 times more energy, gram for gram, than the sun. Every second!

So you can appreciate that optimal mitochondrial function is key to a well-functioning metabolism. Repairing mitochondrial dysfunction offers one of the simplest and most promising new strategies for improving your health and helping prevent diseases like cancer from developing in your body in the first place.

THE IMPORTANT ROLE OF FREE RADICALS IN MITOCHONDRIAL ENERGY PRODUCTION

Every cell in your body needs a continuous supply of energy. Most of that energy is produced by your mitochondria through a process that involves two essential biological functions required to sustain life: breathing and eating. This process is called oxidative phosphorylation, and it is responsible for producing energy in the form of ATP.

(This process is in contrast to cancer cells, which rely more on metabolizing glucose outside of the mitochondria to produce energy in a less efficient process called glycolysis.)

ATP, the “the currency of energy,” drives essentially every biological process in your body, from the function of your brain to the beating of your heart. Your heart has more than 5,000 mitochondria per cell, for example, making it the most energy-dense tissue in your body.

During oxidative phosphorylation, your mitochondria host a complex series of chemical reactions, which can be challenging to understand even for most biochemistry students, called the Krebs cycle and the electron transport chain. Combined, these reactions use electrons liberated from the food you eat and protons contained within the cycle to produce energy and keep the process rolling. At the end of the chain, electrons react with oxygen to form water.

A percentage of electrons will leak from the electron transport chain and form what is called reactive oxygen species (ROS). ROS are molecules that contain oxygen atoms that have gained one or more unpaired electrons, making them very unstable. These highly reactive atoms form potentially destructive free radicals. You are likely familiar with the term *free radicals*. You may even believe that they are universally dangerous and supplement with antioxidants to neutralize them. (I will explain why this isn't necessarily so in just a few moments.)

Free radicals react with other molecules in what are known as oxidation reactions in order to neutralize their unstable electrical charge. Oxidation is essentially “biological rusting.” It creates a snowball effect—as molecules steal electrons from one another, each one becomes a new free radical, leaving behind a trail of biological carnage. This rapidly expanding horde of free radicals collects within the cell and degrades cell and mitochondrial membranes in a process known as lipid peroxidation. When this happens, the membranes become brittle and leaky, causing them to disintegrate.

Free radicals can also damage your DNA by disrupting replication, interfering with its maintenance activities, and altering its structure. Current research estimates that your DNA suffers a free radical attack somewhere between 10,000 and 100,000 times a day, or nearly *one assault every second*.³

All of these factors can lead to tissue degradation, which increases your risk of disease. In fact, free radicals are linked to over 60 different diseases, including:

- Alzheimer's disease
- Atherosclerosis and heart disease
- Cancer
- Cataracts
- Parkinson's disease

As you can imagine, free radicals have an enormous impact on your health, and the startling fact is that approximately 90 percent or more of the ROS in your body are produced within your mitochondria.

But it is also true that free radicals play a role in health and not just disease. Under normal physiological conditions, they actually play many very valuable roles in your body.

- They regulate many crucial cellular functions, such as the creation of melatonin and nitric oxide, and the optimization of important metabolic signaling pathways that regulate functions such as hunger, fat storage, and aging.
- They act as natural biological signals that respond to environmental stressors such as toxins and chemicals in cigarette smoke and the environment.
- They are responsible for the anticancer effects of pro-oxidative chemotherapy drugs.
- They play a role in the beneficial effects of exercise, as your body produces more free radicals when you exercise, simply due to the increase in mitochondrial energy production.

So it's not that ROS are to be avoided at all costs. It's not ROS in general that are harmful; it's ROS *in excess* that are damaging to your health. The point is you can use MMT to optimize the

generation and reduction of ROS in your cells. Think of it as the “Goldilocks phenomenon”: not too much and not too little but “just right” amounts of ROS being made by your healthy mitochondria.

Thus, if you indiscriminately suppress free radicals, you can actually run into complications with the law of unintended consequences. This is why the popular approach to reducing free radicals by loading your body with antioxidant supplements—which can neutralize too many of these free radicals—can easily backfire when they suppress these other important functions of free radicals.

One example of the adverse consequences of excessive antioxidants would be the neutralization of the desirable ROS in cancer cell mitochondria. When these free radicals build up, they cause cancer cells to self-destruct via apoptosis (automatic programmed cell death).

If you have been diagnosed with cancer, check with your licensed health care practitioner about limiting antioxidants including vitamin C, vitamin E, selenium, and especially *N*-acetylcysteine in order to avoid conferring survival advantage to the cancer cells. However, high dose IV vitamin C or oral liposomal C is used by many integrative cancer physicians to treat cancer as the vitamin C turns to hydrogen peroxide, which kills many cancer cells. If your physician does not yet know this molecular biology, perhaps you can suggest they read this chapter to become familiar with this important biological information.

THE DIETARY KEY TO LIMITING FREE RADICALS WITHOUT SUPPLEMENTS

So how can you keep the proper balance of ROS? Fortunately the answer is quite simple. Rather than suppress excessive free radicals with antioxidants, the ideal solution is to produce fewer of them in the first place.

This is why your food choices are so important: the primary benefit of eating a diet high in quality fats, low in net carbs (total

carbs minus fiber), and adequate in protein—such as MMT, the eating plan I outline in the second part of this book—is that it optimizes the capacity of your mitochondria to generate a fuel known as ketones that, in conjunction with low blood glucose levels, produces far fewer ROS and secondary free radicals than when you eat primarily carbohydrates.

In other words, carbs can be seen as a far dirtier fuel than fats. When you adopt a high-fat, low-carb diet and make the switch to burning fat and ketones for fuel instead of glucose, your mitochondria's exposure to oxidative damage drops by as much as 30 to 40 percent compared to when your primary source of fuel is sugar, as is typical in American diets today. This means that when you are “fat adapted”—that is, when you have made the transition to burning fat for fuel—your mitochondrial DNA, cell membranes, and protein can remain stronger, healthier, and more resilient.

In order to regain your body's ability to burn ketones as your primary fuel, you must focus on increasing your intake of healthy fats and decreasing your consumption of carbs in order to keep your blood glucose levels low. This is what Mitochondrial Metabolic Therapy is engineered to do.

The only catch is that when you replace carbs with fat, you must do it with care. The fats you choose must be high quality and, ideally, organic. But most importantly, they should not be industrially processed omega-6 vegetable oils, for reasons that I'll cover in just a moment.

You likely realize that espousing a high-fat diet massively contradicts the conventional nutrition guidelines and public health messages of the last half-century. Thankfully that is changing, albeit slowly. But in order to truly empower you to have the courage and knowledge to buck conventional dietary wisdom, we need to look back at how these guidelines became so prevalent. In the next section I will briefly summarize the health crisis that has occurred over the past 70 years in the United States as a direct result of recommendations to consume a low-fat diet.

Let's start at the beginning of the 20th century.

THE AMERICAN TABLE IN THE EARLY 1900s

In the late 1800s, the majority of Americans were either farmers themselves or lived in rural communities that depended on farmers for their food. There were a few commercially processed foods available: Kellogg's developed corn flakes in 1898,⁴ companies such as Heinz, Libby's, and Campbell's had been selling canned foods for decades already, and deodorized cottonseed oil—otherwise known as Wesson Oil—came on the market in 1899.⁵ But the majority of foods on American tables were whole, unprocessed, and locally grown. Interestingly, they were also organic as synthetic fertilizers and pesticides had not yet been introduced.

Cottonseed oil, before appearing in American kitchens in the familiar Wesson bottle, was a waste product of the cotton industry that was used primarily in soap and as fuel for lamps. As electricity became more available and affordable during the first decades of the 20th century, manufacturers had a glut of cottonseed oil on their hands—an ample supply in search of demand.

Cottonseed oil in its natural state is cloudy and has a red tint due to the presence of gossypol, a naturally occurring phytochemical that is toxic to animals, so manufacturers had to develop a deodorizing process to make cottonseed oil palatable as a food product.⁶ One turn-of-the-century article from *Popular Science* summed up perfectly the process of taking cottonseed oil from waste bin to table: “What was garbage in 1860 was fertilizer in 1870, cattle feed in 1880, and table food and many things else in 1890.”⁷

Cottonseed oil wasn't only unpalatable in its natural state. It came with serious issues due to the fact that it, like nearly all vegetable oils, is a polyunsaturated fatty acid (PUFA), meaning that it has multiple (which is what “poly” means) double bonds between atoms in its molecular structure (meaning the atoms are “unsaturated”). These double bonds are vulnerable to attack by free radicals, which then cause damage to the molecule. When you eat too many PUFAs, they are increasingly incorporated into your cell membranes. Because these fats are unstable, your cells become

fragile and prone to oxidation, which leads to all sorts of health problems, such as chronic inflammation and atherosclerosis.

This instability means that vegetable oils are also prone to going rancid. This made them less appealing to food manufacturers because the rise of railroads and refrigeration meant that food could be trucked long distances and sit on shelves for weeks. This is why hydrogenated fats were first heralded as a godsend: they eliminated the vulnerable double bonds and made vegetable oils shelf stable.

In 1907, the Cincinnati-based soap company Procter & Gamble was approached by Edwin Kayser, a German chemist who claimed he had developed a process for making liquid fats solid and shelf stable. The company purchased the U.S. rights to the process and began experimenting, at first in search of a way to make cheaper and more appealing-looking soap.⁸

Once hydrogenated cottonseed oil was developed, however, P&G realized it had the same luminous white look as lard, the most popular cooking fat at the time. Why not sell it as a cooking fat? In 1910, P&G applied for a patent for Crisco—hydrogenated cottonseed oil, what we know today as a trans fat—and the shift away from animal fats to industrially processed vegetable fats began in earnest.

When Procter & Gamble debuted Crisco in 1911,⁹ they introduced it to the public as “the ideal fat,” notable for its “purity” and for being “absolutely all vegetable.”¹⁰ As a result of these marketing efforts, sales jumped from 2.6 million pounds in 1912 to 60 million pounds four years later.¹¹

Where the average American consumed just under 9 pounds of industrially processed fats—from margarine and vegetable oil—a year in 1909, that number would zoom to about 20 pounds per year by 1950, 15 of them from hydrogenated oils and 5 from vegetable oils.¹² All manner of oils, including those derived from soybeans and corn, were hydrogenated and sold in the form of Crisco, margarine, and a variety of packaged, frozen, and fried foods.

As we began consuming more omega-6 vegetable oils than ever before in human history, three other technological developments

further changed the nature of the food we ate: synthetic fertilizers, food additives, and pesticides—primarily Roundup.

- **Synthetic fertilizers** were developed to help farmers produce ever higher yields of ever fewer types of crops. The use of synthetic fertilizers decimated soil microbes and their ability to mineralize the soil, which contributed to profoundly mineral deficient soils that were unable to produce nutrient-dense crops.

They also made it possible for farmers to focus on growing only one or two crops—such as corn and soy—instead of the traditional method of rotating through a large number of different crops in an effort to stave off soil depletion. This is yet another way the growing supply of vegetable oils created a demand for them.

- **Food additives** were added to the food supply at a record clip over the first half of the 20th century. By 1958, nearly 800 food additives were being used with little oversight or concern for safety. Consumer complaints from food- and drug-related symptoms grew to the point that Congress passed the Food Additives Amendment.¹³ This legislation required food manufacturers to prove the safety of any food additives before they brought their product to market.

It also created a loophole: any additive that was “generally regarded as safe” (GRAS) by the scientific community or was in widespread use in food before 1958 could be added to food products without first being approved by, or even disclosed to, the FDA. Still today, with an estimated 10,000 chemicals commonly used in the food supply, there are at least 1,000 that the FDA has never reviewed.¹⁴

Even additives that do not make the GRAS list are often exempt from scientific scrutiny, as the FDA allows companies to perform their own studies. One of the most egregious examples of an unsafe additive

that the food industry preemptively declared safe is trans fats. We now know trans fats are a prime driver of inflammation and are linked to increases in heart disease,¹⁵ insulin resistance,¹⁶ obesity,¹⁷ and Alzheimer's disease.¹⁸

It makes you wonder what else is on that list, doesn't it?

- **Glyphosate**—the main active ingredient in the toxic herbicide Roundup—is an enormous threat to your mitochondrial health. Because many vegetable oils, and the processed foods that contain them, are made out of genetically modified corn, soybeans, and canola, they are highly likely to be contaminated with this ubiquitous chemical. This is dire news, given that nearly 2 million tons of glyphosate have been dumped into American soil from 1974 to 2016.¹⁹ Worldwide, nearly 10 million tons have been applied in that same time frame.

There are two main ways glyphosate damages your mitochondria:

- The first involves manganese, a mineral that our bodies need in small amounts for healthy bones, immune function, and neutralization of free radicals.

Glyphosate binds manganese and many other important minerals in plants sprayed with Roundup, with the result that a creature that eats the plants will not get the benefit of these minerals.

Glyphosate can also bind to and deplete these minerals from your body. This is a problem because your mitochondria require manganese to convert superoxide, a potentially harmful by-product of oxygen metabolism, into water. This is a critical process that protects your mitochondria from oxidative damage. Without manganese, this mechanism is severely compromised.

- Glyphosate also interferes with ATP production by affecting your mitochondrial membranes. When coupled with the so-called inert solvents included in Roundup, the toxicity of glyphosate is magnified as much as 2,000-fold.²⁰ This makes the membrane more permeable, allowing the glyphosate to go straight to the heart of the mitochondria.

SATURATED FAT BECOMES THE ENEMY

What's interesting is that despite manufacturers' claims that refined vegetable oils were healthful, Americans experienced a massive uptick in heart disease during the first half of the 20th century. And although these oils were a new introduction to the food supply, no one thought to question their role in this new epidemic. Rather, a familiar and previously ubiquitous nutrient took the blame, mostly due to the haphazard and apparently biased research of one man.

Our decades-long mortal fear of fat was born in 1951, when an American physiology professor named Ancel Keys went to Europe in search of the root of heart disease. Keys had heard that Naples, Italy, had a low rate of cardiovascular disease, so he went to observe the eating habits of the Neapolitans.

Remember that Europe had been decimated during World War II—all manner of infrastructure had been destroyed during fighting—and for many years after peace was proclaimed, famine conditions existed. These conditions were the worst and most persistent in Greece and Italy, which had the least amount of food per capita in all of Europe, according to a 1951 survey. These were the finite and unusual circumstances that Keys waltzed into, which he perceived as long-standing tradition that he would eventually codify into “the Mediterranean Diet.”

In Naples, Keys noticed that residents dined primarily on pasta and plain pizza, accompanied by vegetables drizzled in olive oil, cheese, fruit for dessert, plenty of wine, and very little meat,

“except among the small class of rich people . . . they ate meat every day instead of every week or two,” he wrote.

Keys’s wife, a medical technologist, conducted an informal study on the Neapolitans’ serum levels of cholesterol and “found them to be very low except among members of the Rotary Club”—the class of people who could afford to eat meat. This less-than-rigorous scientific approach led Keys to deduce that avoiding meat resulted in a lower incidence of heart attacks; somehow the prevalence of cheese in the diet (also a source of saturated fat) escaped his notice, but he would soon prove himself skilled at ignoring evidence that didn’t confirm his biases.²¹

After Italy, Keys continued looking for proof that a diet high in saturated fat was associated with a high rate of cardiovascular disease, compiling data from six countries with high rates of heart disease and diets typically high in saturated fats.²² The evidence seemed compelling, logical even. For instance, men in America—who ate a diet high in saturated fat—died from cardiovascular disease at a much higher rate than men in Japan, who ate little saturated fat.

But the evidence was skewed. Keys didn’t include other facts, such as that the Japanese also ate far less sugar and processed foods; in fact, they ate far less food in general than their contemporaries. Keys also didn’t include countries that didn’t fit his mold, such as France, where consumption of saturated fat was high and cardiovascular deaths low. (Instead, this finding was later described as “the French Paradox.”) Still, his ideas gained traction as he published numerous papers and best-selling books espousing a link between saturated fats and degenerative heart disease.

Keys was also a master at ingratiating himself to people and positions of power. When President Eisenhower had a massive heart attack in 1955, Keys had the ear of Paul Dudley White, the president’s personal physician. At the following day’s news conference, White advised the public to eat less saturated fat and cholesterol to prevent heart disease—recommendations he got directly from Keys.²³

Keys also used his connections and influence to join the nutrition committee of the American Heart Association (AHA),

which, based on Keys's input, issued a report in 1961 that counseled patients with a high risk of heart disease to cut down on saturated fat.²⁴ (It's distressing to note that the AHA began its rise to prominence in 1948, the same year Procter & Gamble donated over \$1.7 million to it²⁵—making the AHA seriously indebted to the makers of Crisco.)

Nineteen sixty-one was also the year *Time* magazine put Keys on its cover wearing a white lab coat, hailing him as “the twentieth century’s most influential nutrition expert.”

In 1970, Keys went on to publish the Seven Countries Study,²⁶ which elaborated on his original research of six countries, and it was a shot heard round the world—it has now been cited in over a million other studies. Even though Keys's scientific research never proved causation, only association, between saturated fat and heart disease, he won the battle of public opinion. And we are still paying the price.

Thanks in large part to Keys, the American medical community and mainstream media began advising people to stop consuming the butter, lard, and bacon they'd been eating for centuries, replacing them with bread, pasta, margarine, low-fat dairy, and vegetable oil. It was a dietary shift that was ultimately codified by the U.S. government in the late 1970s.

HOW NUTRITIONAL GUIDELINES HAVE DECIMATED PUBLIC HEALTH

In 1977, the U.S. released the first national dietary guidelines to urge Americans to cut back on fat intake.²⁷ In a radical departure from the prevailing diet of the time, the guidelines suggested Americans eat a diet high in grains and low in fat, with industrially processed vegetable oils taking the place of most animal fats.

According to research by Zoë Harcombe, Ph.D., published in the journal *Open Heart*, there was never any scientific basis for the recommendations to cut fat from the U.S. diet.²⁸ Dr. Harcombe and colleagues examined the evidence from randomized controlled trials (RCTs)—the gold standard of scientific research—available to

the U.S. and U.K. regulatory committees at the time the guidelines were implemented. Six dietary trials involving 2,467 men were available, but there were no differences in all-cause mortality and only nonsignificant differences in heart-disease mortality resulting from the dietary interventions.

As noted in *Open Heart*, “Recommendations were made for 276 million people following secondary studies of 2467 males, which reported identical all-cause mortality. RCT evidence did not support the introduction of dietary fat guidelines.”

Despite the lack of evidence to support them, the guidelines were quite extreme, calling for Americans to reduce overall fat consumption to 30 percent of total energy intake and limit saturated fat consumption to just 10 percent of total energy. The war on fat was on, and it has prevailed to this day: even as recently as December 2015, when the U.S. Department of Agriculture (USDA) released its most recent nutritional guidelines, cautions on saturated fat were still strongly worded, with Americans advised to “consume less than 10 percent of calories per day from saturated fats.”²⁹

In all these years, that very recommendation has actually fueled the problem it aimed to treat. No one knows for sure just how many premature deaths have resulted from this low-fat diet recommendation, but my guess is that this number is easily into the hundreds of millions.

THE LOW DIETARY FAT EXPERIMENT HAS BEEN A MISERABLE FAILURE

Ever since Ancel Keys catalyzed the shift to a low-fat diet in the 1950s, Americans have dutifully reduced their intake of animal fats. The pace of the change picked up following the introduction of the USDA Dietary Guidelines in 1980 and the subsequent retooling of the food industry to produce low-fat foods, replacing healthy saturated fats like butter and lard with harmful trans fats, industrially processed vegetable oils, and lots of refined sugar. (Food manufacturers needed some way to make their products

more crave-worthy despite the absence of the luscious taste of butter and lard, so they turned to ever-increasing amounts of sugar, which appears in a myriad of processed foods.)

Yet despite adherence to these supposedly “healthy” guidelines, U.S. public health has declined precipitously, as evidenced by trends in the following areas:

- **Diabetes**

In 1978, 5.19 million Americans had been diagnosed with diabetes, according to the Centers for Disease Control. By 2013, it was 22.3 million—more than quadruple the number of people diagnosed with this deadly disease in just 35 years.³⁰

- **Obesity**

According to the National Health and Nutrition Examination Survey, from 1976 to 1980, 16.4 percent of adults were obese (defined as a BMI over 30) or extremely obese (BMI over 35). The latest numbers available at the time of this writing, from the *Journal of the American Medical Association*, put that total at more than 45.6 percent obese or extremely obese.³¹ Whereas in the 1970s only one in about six people was obese, now nearly one out of two adults are afflicted.

- **Cancer**

Obesity is a major risk factor in many cancers. In 1975, the rate of new cancer diagnoses was roughly 400 people out of every 100,000;³² the estimated number of new cases of cancer in 2016 was nearly 449 people out of every 100,000—a statistically significant increase.³³

- **Heart disease**

Heart disease is also associated with obesity. Death rates from heart disease have declined since their peak in the 1950s, although much of this is due to advances in medical treatment, not improvements in health.

The prevalence of heart disease is still high, and headed higher: In 2010, approximately 36.9 percent of Americans were living with some form of cardiovascular disease, and the rates are expected to keep rising. A study published in *Circulation*, the journal of the American Heart Association, projects that by 2030, over 40 percent of the U.S. population will be living with cardiovascular disease.³⁴

Once you understand the differences in how your body metabolizes sugars as opposed to fats, you will be able to follow the money to get a clear picture of how these flawed guidelines have contributed to this huge decline in public health.

Remember, your body is designed to run much more efficiently on fats than on sugar. By eating more sugar and nonfiber carbs, which rapidly convert to sugar, you generate far more tissue-damaging free radicals than when you are primarily burning fat for fuel. Although free radicals do confer some important health benefits, when you overconsume sugar and nonfiber carbs you tip the balance of free radicals in your body in an unhealthy direction. This imbalance then creates a cascade of tissue, protein, cell membrane, and genetic damage, paving the way for inflammation and disease.

It's not just physical health that has been hurt by the war on saturated fat. For decades now, Americans have been counseled by the government, their doctors, and the mainstream media that all they need to do to lose weight and be healthy is to eat less—particularly less saturated fat—and exercise more. The reality is that eating low-fat and high-carb foods makes it extremely difficult to lose weight.

In simple terms, when you eat carbohydrates, your pancreas secretes insulin. And the more insulin you have in your blood, the more signals your body gets to store fat. In other words, by following the present dietary advice that was officially codified by the government in 1977, we as a nation have been doing the very things that cause us to gain weight and keep it on.

So if you've gamely followed the USDA's nutritional guidelines and started loading up on bread, fat-free cereals, and skim milk while also hitting the gym a few times a week, and your excess weight not only hasn't budged but has increased, well, whose fault is that? According to all the conventional sources of nutritional guidance, the fault is yours.

The assumption is that you must not have been trying hard enough, or you weren't doing it right. Of course, this is demoralizing. One of my primary intentions in creating MMT and writing this book is to show you that you absolutely do have the power to lose weight and restore your own health.

WHAT DOES THE SCIENCE SAY?

The ubiquitous story line in the media and the governmental public health agencies hasn't evolved much past Ancel Keys's observations in the early 1950s: avoid saturated fats because they raise your LDL cholesterol, which will ultimately clog your arteries and lead to heart disease.

The problem with this recommendation is that it's based only on a hypothesis, and worse yet, that hypothesis has never been proven. In fact, numerous studies over the decades have carefully examined the supposed link between saturated fats and heart disease and found it flawed.

Six major clinical trials on saturated fat have been used to support the assumption that saturated fats cause heart disease. In reality, however, none of them actually showed that eating fewer saturated fats would prevent heart disease and lengthen your life. In fact, none of these trials showed that restricting saturated fats reduced total mortality:

- The Oslo Study (1968) found eating a diet low in saturated fats and high in polyunsaturated fats had no influence on rates of sudden death.³⁵
- The L.A. Veterans Study (1969) found no significant difference between rates of sudden death or heart attack

among men eating a mostly animal-foods diet and those eating a high-vegetable oil diet. However, more noncardiac deaths, including from cancer, were seen in the vegetable oil group.³⁶

- The Minnesota Coronary Survey (1968), a study funded by the National Institutes of Health, shows that more than four years of eating a low-saturated fat, high-PUFA diet led to no reduction in cardiovascular events, cardiovascular deaths, or total deaths.³⁷
- The Finnish Mental Hospital Study (1968) found a reduction in heart disease among men following a low-saturated fat, high-PUFA diet, but no significant reduction was seen among women.³⁸
- The London Soybean Oil Trial (1968) reported no difference in heart attack rate between men following a diet low in saturated fats and high in soybean oil and those following an ordinary diet.³⁹
- The U.S. Multiple Risk Factor Intervention Trial (1982) compared mortality rates and eating habits of over 12,000 men, and its finding that people who ate a low-saturated fat and low-cholesterol diet had a marginal reduction in coronary heart disease was widely publicized. However, their mortality from all causes was higher, although this statistic received little coverage.⁴⁰

More recently, three meta-analyses that collectively included data on hundreds of thousands of people have found that there is no difference in the risks of heart disease and stroke between people with the lowest and highest intakes of fat.^{41, 42, 43} (Meta-analysis is a statistical technique for combining the findings from a selection of independent studies.)

And some research has found that replacing saturated animal fats with industrially processed omega-6 vegetable fats is linked to an *increased* risk of death among patients with heart disease. A *British Medical Journal* study published in 2013⁴⁴ included 458 men with a history of heart problems who were divided into two

groups. One group reduced saturated fats to less than 10 percent of their energy intake and increased omega-6 fats from safflower oils to 15 percent of their energy intake. The control group continued to eat whatever they wanted. After 39 months:

- The omega-6 linoleic acid group had a 17 percent higher risk of dying from heart disease during the study period, compared with 11 percent among the control group.
- The omega-6 group also had a higher risk of all-cause mortality.

Another study published in the *British Medical Journal* in 2013⁴⁵ found that replacing saturated animal fats with industrially processed omega-6 vegetable fats is linked to an increased risk of death among patients with heart disease.

THE TRUTH ABOUT SATURATED FAT

Part of the enormous confusion about the dangers associated with saturated fats is related to their effect on LDL cholesterol, often referred to as “bad” cholesterol. But it’s important to understand that when you hear the terms *LDL* and *HDL*, they’re both referring to lipoproteins, which are simply proteins that carry cholesterol. LDL stands for low-density lipoprotein, while HDL stands for high-density lipoprotein.

HDL cholesterol is actually linked to a lower risk of heart disease, which is why measurements of total cholesterol are useless when it comes to measuring your risk. In fact, if your total cholesterol is “high” because you have a lot of HDL, it’s no indication of increased heart risks; rather, it’s likely protective.

Saturated fats have been shown to actually raise protective HDL cholesterol while also increasing LDL. The latter isn’t necessarily bad either once you understand that there are different types of LDL:

- Small, dense LDL cholesterol
- Large, fluffy LDL cholesterol

Research has confirmed that large, fluffy LDL particles do not contribute to heart disease. The small, dense LDL particles, however, are easily oxidized, which may trigger heart disease. This is because the small, dense LDL penetrates your arterial wall more easily, so it contributes to the buildup of plaque in your arteries. Synthetic trans fat also increases small, dense LDL. Saturated fat, on the other hand, increases large, fluffy—and benign—LDL.

People with high levels of small, dense LDL have triple the heart disease risk of people with high levels of large, fluffy LDL.⁴⁶ And here's another fact that might blow your mind: eating saturated fat may change the small, dense LDL in your body into the healthier large, fluffy LDL!^{47, 48} Also important, research has shown that small, dense LDL particles are increased by eating refined sugar and carbohydrates, such as bread, bagels and soda.⁴⁹ Together, refined sugar and carbs do far more harm to your body than saturated fat ever could.

Based on what we know now about saturated fats, the irony is that they are actually necessary to promote health and prevent disease. Indeed, it's now known that saturated fats provide a number of important health benefits, including the following:

- Providing building blocks for cell membranes, hormones, and hormone-like substances
- Mineral absorption, such as calcium
- Acting as carriers for important fat-soluble vitamins A, D, E, and K
- Conversion of carotene into vitamin A
- Helping lower cholesterol levels (palmitic and stearic acids)
- Acting as antiviral agent (caprylic acid)
- Optimal fuel for your brain when fats are converted to ketones

FAT FOR FUEL

- Helping you feel full and satisfied—meaning you're less likely to feel the need to snack on processed foods that may be high in flavor but low in nutrients
- Modulating genetic regulation and helping prevent cancer (butyric acid)
- Increasing your LDL levels, but this is largely an increase in large fluffy particles that are not associated with an increased risk of heart disease
- Boosting your HDL levels, which more than compensates for any increase in LDL
- Serving to fuel mitochondria and produce far fewer free radicals than carbs

The research has spelled out loud and clear that saturated fats are beneficial for human health. Most of us need to radically increase the healthy fat in our diet—this includes not only saturated fat but also monounsaturated fats (from avocados and certain nuts) and omega-3 fats—while severely limiting refined vegetable oils and even naturally occurring omega-6 fats (found in nuts and seeds).

If this sounds like a lot to remember, just hold on to this: for optimal health, eat real food—this means plenty of saturated fats and little to no refined fats, especially refined vegetable oils. Again, I will cover diet specifics in much more detail in Part II of this book.

CHAPTER 2

WHY YOU NEED MITOCHONDRIAL METABOLIC THERAPY (MMT)

The nutritional plan that I have developed—and that I outline in the second half of this book—is not for everyone. If you are merely looking for a way to upgrade your nutrition and improve your overall health with smart but quick fixes like making tweaks to the percentage of carbs, proteins, and fats you eat, and substituting nutrient-dense whole foods for foods with low nutritional value, you can easily do that by reviewing the Nutritional Plan on the right side of the home page on mercola.com or by reading my last book, *Effortless Healing*. But if you are facing serious health challenges, or if you are basically healthy now but want to *supercharge* your health, I wrote this book on MMT for you.

WHY MITOCHONDRIAL METABOLIC THERAPY?

As I've already stressed, optimally functioning mitochondria are absolutely vital to your overall health. You have between 80 and 2,000 mitochondria in nearly all of your cells and they generate around 90 percent of the energy you need to survive and stay healthy. When mitochondrial function is impaired—as it so easily is when you eat a typical American low-fat, high-carb, highly processed diet—this disrupts normal metabolic signaling, which in turn damages cellular and mitochondrial DNA or causes a defect in the ability to repair damage from other sources, such as environmental radiation.

To enable your body to prevent and fight cancer and most all major diseases, you have to take extraordinary care of your mitochondria. And the primary way to optimize, repair, and regenerate your mitochondria is to provide them with the best possible fuel. That's where Mitochondrial Metabolic Therapy comes in.

Rather than seeking to control the symptoms of chronic diseases, MMT seeks to heal the root cause of chronic disease and aging—the integrity, or lack thereof, of the mitochondria themselves.

The Difference between MMT and the Atkins and Paleo Diets

While I believe MMT is the best food plan to optimize mitochondrial function, many other popular diets are similar in some aspects to MMT—yet there are many key differences. These diets are:

- **Atkins:** A true nutritional pioneer, Dr. Robert Atkins began spreading the word in the 1970s that our carb-laden diets weren't healthy, and spread it did. His first book, *Dr. Atkins' Diet Revolution*, sold over 15 million copies, and more than 30 million Americans followed his low-carb diet plan. I use the term **low carb** very specifically, because his advice was focused more on reducing carbs than it was on burning fat.

Atkins introduced the term “ketosis” to the American public, but because of the word’s similarity to “ketoacidosis”—a potentially life-threatening condition that can occur in type 1 diabetics—he quickly backed away from emphasizing fat as a preferred source of fuel. Instead he took aim at bread and pasta as our primary dietary villains.

Atkins was very close to espousing an ideal diet. He certainly broke new ground, especially in the minds of the public. His important role in public education was indisputable. But there were a couple of major flaws in his diet plan:

Primary focus is on weight loss. The Atkins Diet became as popular as it did because it promised quick and effortless weight loss. Although shedding excess pounds can potentially benefit health in many ways, weight (especially fat) loss in and of itself is only a side effect of MMT. Although I admit that fat loss is a welcome side effect for most people, the true aim of MMT is to heal your metabolism at the cellular level and ward off the development of most common chronic diseases and premature aging—a far more ambitious goal than simply fitting into your skinny jeans.

Too much protein. Because the war on fat was in full swing, the Atkins Diet was painted as a dangerous fad, and ketosis was viewed as an aberrant and undesirable metabolic state. Despite Atkins’s advice to consume leafy green vegetables, many followers relied too heavily on protein to replace the calories that otherwise would have come from carbs, resulting in a stereotype of his followers bingeing on steak, eggs, cheese, and bacon. As I discuss in Chapter 4, a high-protein diet is even more dangerous than a high-carb diet, and the average American is already consuming far too much protein, a problem I’ve addressed with MMT.

No attention to food quality. Perhaps most importantly, Atkins did not counsel his followers to avoid low-quality foods, whether that was feedlot beef, pasteurized dairy, or refined vegetable oils. While his focus on macronutrients (which is a fancy way of referring to broad categories of food, such as carb, fat, or protein) was on the right track, the individual foods within those macronutrient categories were inherently

dangerous. As a result, the Atkins diet was pro-inflammatory and ultimately detrimental to mitochondrial health. Also, many Atkins products were highly processed bars and shakes that relied on artificial sweeteners—decidedly *not* real food.

May or may not result in a shift to fat burning. Although it was a low-carb diet, the excess protein most people consumed while following the Atkins plan was enough to keep many of them from making the metabolic switch to fat burning. This process that can take weeks, if not months, and it generally needs at least some period of careful blood glucose monitoring and ketone level checks to truly confirm that you have made the transition to burning fat. (I will walk you through this process in the chapters to come.)

- **Paleo:** Based on the eating habits of our Paleolithic ancestors, who ate primarily vegetables, fruit, nuts, roots, and meat, the Paleo diet is very clear about eliminating grains and legumes but doesn't place hard limits on high-net-carb vegetables, fruits, and sugars such as honey or coconut sugar.

The Paleo diet is wildly popular with good reason. It takes us back to the basics; it refocuses the diet on fresh, whole, unprocessed, “real” food as the foundational first step in optimizing health and addressing just about any health condition. While the standard Paleo diet can be a healthful way of eating, and is light years ahead of the standard American diet, it too has weaknesses or flaws that make it less than ideal:

Too heavy an emphasis on protein. Protein is freely substituted for carbs as being a healthy choice. The Paleo diet calls for about 38 percent protein and 39 percent fat,¹ which may actually be too much protein and not enough fat for optimal health. As you will learn later, protein levels closer to 10 percent during nutritional ketosis is far more optimal. They can increase to higher percentages, especially for those individuals still in the midst of the reproductive and athletic performance years, but those pursuing optimizing their biology would not want higher levels for extended periods.

Not enough caution regarding seafood. The Paleo diet includes lots of fish and other seafood on a regular basis, and this appears to be reasonable as docosahexaenoic acid (DHA), a

type of omega-3 fat found in fish, is clearly one of the most important and essential nutrients for your health. But there is one important caveat: as a result of industrial pollution made up of a variety of toxins, including mercury, PCBs, and dioxin, it is difficult to find seafood that is toxin free. For this reason, I only recommend seafood that is high in healthy fats while being minimally exposed to toxic contaminants. I offer specific suggestions on how to find that, as well as how to avoid being duped by deceptively marketed seafood, in Chapter 5.

Too many starches and sugars (net carbs). Even though sweet potatoes and fruits—two popular foods on the Paleo plan—are whole foods, they still raise glucose and trigger an insulin reaction, especially when you are seeking to make the transition from sugar to fat burning. This is likely to become a nonissue once you are fat adapted, which means you are able to burn fat rather than carbs as your primary fuel. A central goal of MMT is to lower blood glucose levels, and therefore insulin levels, so that insulin resistance can resolve.

In many ways, MMT can be seen as an important refinement of Paleo, taking the whole-food, no-grain foundation and building upon it by emphasizing high-quality fats, keeping nonfiber carbs to about 50 grams a day (or less), and avoiding even natural sugars such as dates (except for the sweeteners that I will cover later).

The problem here is obvious. On the one hand, your mitochondria are vital to your overall health—they generate ATP and control apoptosis (programmed cell death) as well as autophagy and mitophagy, which clear out unhealthy cells and mitochondria before they can contribute to the processes that lead to the development of chronic disease. On the other hand, your mitochondria are prime sites for ROS production *and* free radical damage because they contain two cell membranes, an inner and outer one, both of which are extremely vulnerable to damage.

The question, then, is how to manufacture ATP as efficiently as possible in order to optimize your health and longevity while

sidestepping the problems that arise from a lifetime of eating food that produces an excess of free radicals when it is metabolized.

The good news is that using ketones for energy creates significantly fewer free radicals than sugar. Because ketones simply burn far cleaner than sugar, they cause far less oxidative damage, which is one of the core reasons why a fat-burning food plan such as MMT is so powerful.

It's important to note that the biggest impact on lowering exposure to oxidative damage comes when you keep your blood glucose levels low, as evidenced by Dr. Seyfried's work to establish the Glucose Ketone Index (GKI).² This is why monitoring your blood glucose levels is an integral part of MMT (which I cover in depth in chapters 6 and 7).

ADDITIONAL BENEFITS OF MITOCHONDRIAL METABOLIC THERAPY

Beyond feeding your body a cleaner fuel and naturally limiting ROS generation, MMT provides a host of physiological benefits. When you take an objective look at them, I believe you too will see that following its guidelines is one of the best choices you can make for your health. These benefits include:

Mental Clarity

Your brain cannot function properly without healthy fats. Because your brain is 60 percent fat, eating healthy fats that build biologically responsive cellular membranes is crucial for optimal brain function. By contrast, overindulging on sugar and grains eventually leads to neural impairment and damage, in part because it blocks insulin's ability to regulate normal cellular activities.³

The connection between sugar and Alzheimer's disease was first made in 2005, when the disease was tentatively dubbed "type 3 diabetes." Previous research has also shown that people with diabetes have a twofold increased risk of developing Alzheimer's

disease. It's little wonder, then, that MMT, which will make it easy for you to transition to fat burning while also removing nearly all high-net-carb foods from your diet until you are able to burn fat as your primary fuel, will produce a noticeable boost in your mental clarity. This approach improves your brain function today and reduces your risk of dementia tomorrow.

I never could have written this book as quickly as I did without the clearheadedness MMT has provided. In fact, I have personally experienced such an uptick in creativity and cognition that I need Google Keep—a note-taking app that you can use on your computer or device—to quickly and easily capture my thoughts and ideas and then store them in a searchable way.

Freedom from Cravings

Processed food, with all its chemical additives, added sugars, and refined oils and carbohydrates, is extremely addictive. This has been demonstrated by a number of studies spanning decades of research^{4,5} and is no accident. The food industry employs teams of scientists who scheme to improve the “mouthfeel” of fake, processed food. They do this to maximize food cravings so you will continue to come back for more even when your body doesn't need nourishment.

When you burn sugar for your primary fuel, metabolic pathways are activated that cause you to crave replenishment by driving your blood sugar down after a few hours without sugar, which keeps you on a hamster wheel of hunger, cravings, and crashes.

Fat, by contrast, is naturally satiating, meaning it leaves your belly full and satisfies your desire for food. And when you make the switch to burning fat as a predominant fuel, you can access the tens of thousands of calories⁶ that are stored within your own body fat—calories that are largely unavailable to you if you are burning sugar as your primary fuel. As a result, you will find that you can go for long periods of time without even thinking about

food, let alone having to deal with specific cravings—these will disappear once your body has adapted to burning fat for fuel.

One note: If you notice that you're craving fat, most likely you haven't been taking in quite enough fat. That's one reason I love "fat bombs"—tasty treats that consist primarily of coconut oil or other healthy fats—as they are simple, delicious, and portable ways to take in a couple of teaspoons of fat. (See page 260 for online resources for numerous fat bomb recipes.)

An Anticancer Strategy

In recent years, scientists have come to realize that it's not genetic mutations that cause cancer. We now know that *mitochondrial damage happens first*.

Mitochondrial dysfunction produces reactive oxygen species, mentioned earlier, which in turn can cause DNA mutations, making the mutations an effect of abnormal respiration. The ROS then further damage the mitochondria, and thus respiration, creating a vicious cycle.

This understanding has taken decades to piece together. In 1924, Dr. Otto Warburg, who went on to win the Nobel Prize in Physiology or Medicine in 1931, made the discovery—now known as the Warburg effect—that cancer cells have a fundamentally different energy metabolism compared to healthy cells. The Warburg effect tells us that most of the mitochondria in cancer cells are dysfunctional and can't use oxygen to burn fuel efficiently—they lack the metabolic flexibility to metabolize fats. For this reason, they rely on fermenting ever-increasing amounts of glucose in their cytoplasm (instead of oxidizing it in their mitochondria), a far less efficient way of obtaining energy called lactic acid fermentation.

Thanks to the work of Dr. Peter Pedersen from Johns Hopkins, we also know that a universal characteristic of cancer cells is that they have a radically reduced number of fully functional mitochondria.

Dr. Thomas N. Seyfried, an internationally known researcher on the link between metabolism and disease and author of the 2012 landmark book *Cancer as a Metabolic Disease*, puts another nail in the coffin of the “cancer is a genetic disease” theory by explaining in his work that there are some cancers that have no genetic mutations, but still rely on fermentation rather than respiration for their energy. And that there are some known carcinogens, such as arsenic and asbestos, that do not directly cause genetic mutation. Rather, they damage the mitochondrial function of respiration, which then produces the Warburg effect and cancer.

Seyfried also elucidates that the proliferation of cancer cells disappears when the nucleus of a tumor cell is transferred to a normal cell that contains normal mitochondria. Further, the abnormal growth and metastatic behavior of breast cancer cells disappear when mitochondria from healthy cells replace the abnormal breast cancer mitochondria, despite the continued presence of the tumor nucleus.

These and many other findings indicate that cancer cannot be a genetic disease.

What all this means is that when you remove processed foods, sugar, grains, and high-net-carb fuels from your diet, you essentially stress cancer cells by depriving them of their preferred metabolic fuel.⁷

For this reason, I believe MMT is one of the most powerful cancer prevention strategies available because it optimizes your mitochondrial function, and as a result, the mitochondria are less easily damaged and the genetic mutations that can lead to cancer are radically reduced.

MMT also has enormous benefit if you are already dealing with cancer. Making the switch to burning ketone bodies will deprive cancer cells of their primary fuel, which then causes them adverse stress. At the same time, your healthy cells are given a cleaner and more ideal fuel, which lowers oxidative stress, conserves antioxidants, and optimizes mitochondrial function. The sum

effect is that healthy cells begin to thrive while cancer cells must struggle to survive.

Microbiome Changes

Recent estimates suggest your body houses some 30 trillion bacteria⁸ and about 1 quadrillion viruses (bacteriophages). In essence, we're little more than walking microbe colonies.

These organisms perform a wide variety of functions, including:

- Assisting in the digestion of food
- Regulating the enteric nervous system, which rules the digestive tract
- Orchestrating the immune response
- Helping modulate many aspects of inflammation
- Playing a large role in brain and mental health, as the gut and the brain are intricately connected

Emerging science also shows that your microbiome can be rapidly altered, for better or worse, based on factors such as diet, lifestyle, and chemical exposures, including over-the-counter medications and prescribed antibiotics, as well as those introduced into the food supply that have been widely fed to the animals we consume.

The MMT food plan up-regulates, modifies, and improves the quality of your gut microbiome. It cuts out known microbiome disruptors such as various sugars, processed foods, and artificial sweeteners.

Weight Loss without Deprivation

When your body burns glucose as its primary fuel, your ability to access and burn body fat is inhibited. With an ever-present supply of carbs, your liver down-regulates the entire fat-burning process

because you are not regularly cycling between feast-and-famine modes. Excess glucose is also stored as fat—unlike ketones, which are excreted through the urine if they aren't taken up by cells.

Fat cells produce their own hormones, including leptin. This may seem like a good thing, but when you consistently consume too much sugar and store more fat, your leptin levels rise and the leptin receptors become less sensitive and eventually more resistant to healthy levels of leptin. For this reason, when you burn glucose as your primary fuel, your fat cells trap you in a vicious cycle of storing more fat and becoming less and less adept at burning the fat you already have.

In this way, hormones and the communication between them play an important role in both weight control *and* your urge to eat, and even what you crave. And those hormones are determined by the foods you eat. As Dr. Rosedale puts it, “You eat today to control the hormones that will tell your cells what to eat tomorrow.”⁹

Which is precisely how MMT works. It uses food intake to modulate the levels of your hormones—including leptin and insulin—that influence your weight, thereby directing your body to *burn* fat, not *store* it. It also removes the sources of sugars from your diet, which helps free you from that vicious cycle. As a result, your body will release its hold on your excess weight. And it does this *without* the stereotypical hunger pangs and cravings that accompany most weight-loss diets.

Greatly Improved Energy

MMT improves the mitochondria you already have and stimulates the creation of new mitochondria. Since mitochondria are the primary sources of energy production in your body, MMT also produces a palpable uptick in energy.

Because your body will produce fewer destructive ROS as it metabolizes ketone bodies instead of sugar, you will have to spend less cellular energy on mopping up rogue free radicals—this also contributes to the net energy gain MMT can provide.

Increased Insulin Sensitivity

Any meal or snack high in net carbs typically generates a rapid rise in blood glucose. To compensate for this, your pancreas secretes insulin into your bloodstream, which in turn lowers your blood sugar to keep it in normal ranges because excess glucose is toxic to your cells. Insulin is also very efficient at lowering blood sugar by inhibiting the production of glucose by your liver (a process known as gluconeogenesis).

Unfortunately, if you consume a diet consistently high in sugar and grains, your blood glucose levels will be correspondingly high, and over time your insulin receptors become “desensitized” to insulin, requiring more and more insulin to get the job done. This is referred to as insulin resistance. Approximately 45 percent of Americans now have some degree of insulin resistance, and over time this number is expected to rise.

Because MMT does not include foods that your body can easily convert to glucose—such as grains, sugars, and high-net-carb foods—it keeps your blood glucose levels low, which in turn keeps your insulin levels low. Lowering glucose and insulin gives your insulin receptors a chance to regain their sensitivity.

Reducing Inflammation

Sugar fans the flames of inflammation in your body, as it is a dirty fuel that was never intended to be our primary fuel. Using sugar for energy produces 30 to 40 percent more ROS than burning fat.

Omega-6 oils, particularly those that are heavily refined and easily oxidized, tend to be highly inflammatory. In MMT, you will limit your consumption of these bad fats and get most of what you need from oil-rich foods containing healthier oils. Increasing your consumption of omega-3 fats will improve the ratio of omega-6 to omega-3 fats, which you will learn is important to cellular health.

Saturated fats, on the other hand, are not oxidized as easily as oils because they don’t have double bonds that can be damaged through oxidation. MMT prioritizes getting your fats

from healthful sources of saturated and monounsaturated fats and significantly reduces your omega-6 oil consumption. It's no surprise, then, that research shows that low-carb diets tend to reduce levels of systemic inflammation.¹⁰

Self-Eating: Autophagy and Mitophagy

The term *autophagy* means “self-eating,” and refers to the processes by which your body cleans out accumulated debris, including toxins, and recycles damaged cell components. Autophagy occurs within your mitochondria. When the entire mitochondria is digested and removed, the process is called mitophagy.

Both these processes are incredibly important contributors to your health—in fact, the 2016 Nobel Prize in Medicine went to Yoshinori Ohsumi, a researcher who discovered the mechanisms that drive autophagy.¹¹

When autophagy and mitophagy are inhibited through poor diet, excess ROS, and high levels of inflammation, the damaged mitochondria linger in the cell, emitting pro-inflammatory molecules and generally accelerating the aging process. So autophagy and mitophagy play an important role in controlling the amount of inflammation in your body and help slow down the aging process.

These processes are largely controlled by the mechanistic (formerly known as mammalian) target of rapamycin (mTOR)—a primary metabolic regulatory pathway that I cover more extensively in Chapter 3. When mTOR is activated, it fuels growth and regeneration, and its activity can enhance cellular maintenance and repair. MMT suppresses the inhibition (down-regulation) of this mTOR pathway, and as a result, stimulates autophagy and mitophagy.

Mitochondrial Biogenesis (The Creation of New Mitochondria)

Biogenesis is the process by which new healthy mitochondria can be duplicated. When it comes to maintaining optimal biological functioning and good health, the more healthy mitochondria you have, the better off you will be.

Research has shown that shifting to a fat-burning diet spurs mitochondrial biogenesis—at least in a rodent model.¹² On a fat-burning diet, mitochondria are not kept busy fighting off free radicals (since fat burning creates far fewer harmful reactive oxygen species than burning sugar). The beneficial effect is that mitochondria now have more energy to focus on the processes involved in creating more—and healthier—mitochondria. In a sense, your mitochondria become supercharged!

THE INFLUENCE OF KETONES

When I say that you “burn fat” on MMT, what I really mean is that you burn ketones. Ketones are also referred to as *ketone bodies*, an old-school biochemistry term. The terms *ketones* and *ketone bodies* are interchangeable and often used in place of each other. In this book, I’ll stick with *ketones*.

Ketones are water-soluble energy molecules that are made by mitochondria in your liver from dietary or stored fats and are used as an alternative fuel to glucose. Because they are water soluble, ketones don’t need carrier proteins to travel in the blood stream; they pass easily through your cell membranes and even cross the blood-brain barrier.¹³

In fact, ketones are a brilliant biological adaptation that provides a critically important fuel for your body and brain during times of food scarcity. Without ketones, you wouldn’t be able to live more than a few weeks without food. It was previously thought that the brain only used sugar for fuel, and many health professionals and organizations are still espousing this outdated notion today, but the late George Cahill disproved that 50 years

ago.¹⁴ The truth is that your body is exquisitely wired to fuel your brain because your brain consumes up to 20 percent of your total caloric intake. The ability of your brain to transition to ketone metabolism extends the survival of a fasting human from a few weeks to over a month. The longest recorded human fast was a year and 17 days—only the efficiency of ketones would allow such a remarkable feat.

Ketones are also an important component of MMT, as their presence indicates that you are burning fat as your primary fuel instead of glucose.

There are three different types of ketones, including:

- Acetoacetate, which is a precursor to the other two forms of ketones and which is excreted in urine
- Beta-hydroxybutyrate (BHB), the most abundant ketone, which circulates in the blood and is used for energy
- Acetone, which is exhaled through your breath

Ketones—Villains or Heroes?

Sadly, to this day there is serious confusion in the public and even among most medical professionals about ketones. This confusion is regarding the difference between nutritional ketosis and diabetic ketoacidosis. Although they both share part of one word, *keto-*, they are two entirely different metabolic states.

Nutritional ketosis is the state you achieve when you enter a fat-burning state. It is an exceptionally healthy way to create the conditions your body needs to stay healthy and age well. In nutritional ketosis, blood ketone levels are typically between 0.5 and 3 mmol/liter and rarely exceed 6 to 8 mmol/liter. Blood glucose levels also lowered to healthy levels of 70 mg/dl or less.

On the other extreme, diabetic ketoacidosis is a life-threatening symptom of uncontrolled diabetes and can be fatal if not properly treated. In contrast, ketone levels in diabetic ketoacidosis

are typically over 20 mmol/liter. The true danger of diabetic ketoacidosis is that glucose levels are also very high, at least 250 mg/dl, although they can even exceed 400 mg/dl! This results in a severe metabolic acidosis and secondary severe dehydration that require intensive medical management.

Ketoacidosis occurs in type 1 diabetes because insulin levels are very low. Because you need insulin to suppress glucose production in the liver, it continues to make glucose even when you aren't eating. High glucose should turn off ketone production, but again, the lack of insulin means there is no signal to stop making ketones. Since there's plenty of glucose available, the ketones are not used up by the brain as fuel. They pile up and cause a metabolic acidosis.

By contrast, in nutritional ketosis, unless you have been fasting for a long time, there is still enough insulin present to suppress liver glucose production. Glucose levels drop as you lower your carb intake and the brain burns off the ketones you make, so high levels never occur.

So, it is the simultaneous metabolic effect of very high ketones, very high glucose, and dehydration that causes the life-threatening metabolic issues associated with diabetic ketoacidosis. This condition can't exist in nutritional ketosis, but that's still where many conventional doctors are stuck in their outdated thinking.

Dr. Atkins was the first physician to introduce ketosis to the public as a desirable effect of lowering carbohydrates in the diet, but the term "nutritional ketosis" had not yet been coined. Because of this confusion, as well as the demonization of fats, he encountered resistance to using the term in his books, which is why he ended up emphasizing the low-carb facet of his diet rather than its fat-burning benefits.

Research since then (Dr. Atkins died in 2004) has clarified the difference in the impacts between unhealthy fats and healthy fats. Thankfully in the 21st century there have been reams of published studies supporting the metabolic benefits of nutritional ketosis. These, coupled with the testimonials of those experiencing these benefits, are starting to lessen the confusion on this issue, allowing many more health care practitioners and even conventional

doctors—heretofore AWOL on nutritional matters—open to the use of this diet intervention.

Why Do We Even Make Ketones?

Ketones weren't discovered until the late 1800s when they made an undignified debut in the urine of patients with uncontrolled diabetes (as diabetic ketoacidosis).¹⁵ Within a few decades researchers had also learned that there was a positive aspect of ketone production.

Whenever your supply of carbohydrates from food is low or nonexistent, even after just a couple of days or so, your body is able to convert fat to ketones. This metabolic flexibility is an important reason why the human race has been able to survive; it helps us adapt to a wide variety of food sources.

In addition to allowing us to survive periods of food scarcity, ketones provide many powerful health benefits:

- When your cells burn ketones for fuel, far fewer ROS are produced than when you burn glucose. In essence, ketones are a much “cleaner” energy source than glucose, meaning that they result in far less mitochondrial damage than occurs when glucose is used as fuel.
- If you switch to burning fats (including ketones), you decrease the amount of sugar available to cancer cells. You also reduce the amount of ROS your cells are exposed to, making it less likely that cancer will form in the first place.
- The most abundant ketone, beta-hydroxybutyrate (BHB), carries out a variety of signaling functions that can ultimately affect gene expression.¹⁶
- Ketones play an important role in reducing inflammation by reducing, or down-regulating, pro-inflammatory cytokines and increasing, or up-regulating, anti-inflammatory cytokines.¹⁷

- Ketones share a close structural similarity to branched-chain amino acids (BCAAs) and your body prefers them over BCAAs. That gives ketones a profoundly powerful protein-sparing effect, allowing you to consume lower quantities of protein while retaining or even building your muscle mass.¹⁸ Additionally, BCAAs are a potent stimulus of the mTOR molecular signaling pathway, a very important metabolic pathway that is often overactive in disease states, including cancer. So when you maintain nutritional ketosis you also inhibit mTOR, and reduced activity here is associated with improvements in health span and longevity.¹⁹ (However, mTOR has a positive role, especially in the young, as a potent stimulator of muscle protein synthesis. Many competitive athletes and bodybuilders seek to activate this pathway at the expense of the longevity-enhancing benefits of inhibiting mTOR.)²⁰
- Studies suggest that ketones provide important protective benefits for brain cells that are exposed to hydrogen peroxide—a common presence in the brains of people with neurodegenerative diseases such as dementia and Alzheimer’s disease.²¹ Hydrogen peroxide converts to the dangerous hydroxyl free radical when your iron levels are high, as we will discuss in Chapter 4. So you will get more benefit from ketones when your iron levels are optimized.
- Ketones up-regulate (increase) mitochondrial biogenesis in your brain²²—meaning that they help your body improve its capacity to produce more energy by increasing the number of mitochondria.
- Anecdotal reports suggest that in some people, fasting or transitioning to a low-carb diet produces feelings of mild euphoria, suggesting that ketones play a role in promoting the experience of well-being.²³

Despite these benefits, simply producing enough ketones to officially be in nutritional ketosis is not the main goal of MMT. Eating a supremely healthful diet that keeps your body in a fat-burning state is the ultimate goal. This is why you won't hear me refer to MMT as a "ketogenic diet"—a term often used to describe similar high-fat, low-carb diets—because that phrase implies that the whole purpose of the diet is to have as many ketones around as possible. That is not the case. As I have mentioned, the end goals of MMT are to optimize your mitochondria, reduce free radical damage, and address the root of disease. Ketones are a means to these, not an end.

Improved Quality of Life and Prolonged Survival In a Case of Pediatric Brain Cancer

Miriam Kalamian has the most extensive experience of any clinician out there in applying the principles of MMT to the treatment of cancer. She helped edit most of this book, and I asked her to share her son's story, which catalyzed her drive to empower as many cancer patients as possible.

When my precious son, Raffi, was four years old, we discovered that he had a brain tumor. Stunned, my husband and I immediately agreed to start the standard of care: 14 months of weekly treatments with a combination of chemotherapy drugs. When that failed, Raffi's options were limited to other therapies with even less of a chance of response. Over the next year and a half, he endured high-risk surgeries, increasing hydrocephalus, and the side effects of the drugs he received through a clinical trial. Again and again, we experienced the disappointment of failed therapies, and it became clear that our young son was losing his hard-fought battle.

Now, at just seven years of age, his team was shuffling him into palliative care. The story could have ended there, except that one night as I was investigating one of the many drugs my son was receiving, I stumbled on Dr. Thomas Seyfried's groundbreaking research advancing his theory that cancer is a primarily a metabolic disease that can be managed with diet therapy. Could we manage Raffi's relentless disease without toxic drugs?

FAT FOR FUEL

As thrilling as this possibility was to imagine, there were many challenges to overcome: First, I had no training in nutrition. Another broader issue was that there was no real precedent for the use of a high-fat, low-carb diet as a therapy for cancer. On the plus side, a team at Johns Hopkins with extensive experience in using this diet for treatment-resistant pediatric epilepsy had just published a new edition of a how-to book including “speculation” that a ketogenic diet might benefit those with brain cancer.

Then, on the Charlie Foundation website, I found some compassionate and keto-savvy parents willing to answer my many questions. Still, I never could have gone down this path without the encouragement of Raffi’s local oncologist and pediatrician. Their support allowed us to overcome the intimidation and obstacles put in our path by his team of highly ranked specialists.

In the spring of 2007, my husband and I moved Raffi to a ketogenic diet armed with only this tiny toolkit. Following the model used in the epilepsy world, I chose to start him with a fast. It was a rough first day, mentally and physically, but thankfully kids are very metabolically flexible, much more so than most adults, and it wasn’t long before Raffi was humming along on ketones and fats. And in fact, this seemingly harsh start was no rougher than the many days Raffi had spent dealing with the GI side effects of his drug therapies.

Amazingly, Raffi’s symptoms began to improve almost immediately. He had more energy, could think more clearly, and even regained some of the vision that the tumor had robbed from him. We knew we were on the right track! It took some time and tweaking to get to a good place with this new way of eating, but we were generously rewarded for our efforts. Just three short months after starting the diet, Raffi’s newest MRI scan clearly showed some shrinkage of the tumor mass.

This hit me like a ton of bricks: Why wasn’t everyone given this life-changing information? A ketogenic diet is nothing more than a different mix of familiar foods, so why was there such pushback from the conventional medical and nutrition communities?

Raffi’s success drove my desire to help others learn about this dietary option (as an adjunct to, not a substitute for, standard care). Within a few weeks, I had enrolled in a graduate program in nutrition, excited by the belief that I could then share what I

was learning with people who were willing to modify their diet in exchange for a better quality of life—and perhaps even a longer life.

Raffi ultimately succumbed to his disease, but I never felt that the diet was a failure. During most of the six years he spent on a ketogenic diet, our family was devoted to enjoying the moment, which included an awesome five months spent camping on the Baja peninsula, “chillaxing” in the sun instead of being tied to the oncology clinic. These tangible results, along with the sense of empowerment and control the diet gave us in those years, continue to drive my passion to help others. The fact that I’m honoring Raffi with the work I do is a wonderful bonus.

I officially began my practice in 2010, and since that time I’ve guided hundreds of people with cancer through the transition to a therapeutic diet. Although many of these people experience what their oncologist views as “an amazing response to treatment,” the diet remains woefully underutilized and mostly dismissed by a world that prides itself in sticking to “evidence-based” therapies even as millions die of this devastating disease. I truly believe in this diet, and that’s why I was excited to add my insights and experiences to a book that offers such a clear path to better health.

WHAT TO EAT ON MMT: THE CLEANEST, MOST EFFICIENT FUEL FOR YOUR BODY

As I covered in Chapter 1, one of the greatest powers of MMT is that you can use it to avoid overproduction of ROS in your cells. MMT achieves this balance in three primary ways: the food you eat (which I'll outline in just a moment), when you eat it (which I will cover in Chapter 10), and keeping tabs on your iron levels (which I covered in Chapter 4).

In this chapter I'll discuss the three major categories of foods—carbs, protein, and fats—called “macronutrients” and provide examples of specific foods that work best on MMT within each of category.

Use this chapter to start reorienting your thinking on what to eat and to make grocery lists. You can begin incorporating more of these foods now, even before you've officially started MMT,

thereby giving your palate some time to adjust. Although all the foods on this list are delicious in themselves and when used in recipes, it can be a process to wean yourself off processed foods and high-carb staples such as bread and pasta. Let this chapter inspire you to start making different food choices right away.

CARBOHYDRATES

The most efficient way to train your body to use fat for fuel and reduce your exposure to free radical damage is to limit the number of net carbs you get from your diet.

Limiting net carbs is a crucial part of MMT not just because glucose is a “dirty” fuel that produces an excess of ROS, but also because excessive net carbohydrate consumption suppresses fat burning. Notice that I say “net carbs”: that’s total carbs minus fiber. Thus MMT is not a low-*total*-carb diet—because fiber is an important carb that actually converts to beneficial short-chain fats in your intestine. Rather, this is a low-*net*-carb diet.

If you look at the nutrition facts label on a processed food package, it will list total carbs—that figure is not what I’m talking about. You need to also look at the fiber content and subtract that from the total carbs. This is important to understand, or else you may end up feeling that your choices are too limited to keep to your MMT food plan.

By dramatically reducing the number of net-fiber carbs that you eat, you will need to fill the calorie void with other types of foods. On MMT, you will replace those nonfiber carb calories (from foods such as sweets, sugary beverages, breads, pasta, crackers, chips, and fries) with organic vegetables and healthy fats. This will transition your body into primarily burning fat for fuel while radically reducing your risk for most chronic diseases.

In general, the high volume of vegetables, together with the nuts and seeds you eat while following MMT (which I’ll cover just a few pages from now), will provide you with more daily fiber than the average American typically eats.

The vegetables you want to prioritize are the low-carb kinds. Think celery, greens, and cauliflower (relatively few carbs) versus carrots, sweet potatoes, and potatoes (relatively high carbs). Although sweet potatoes, for example, are whole foods and have many nutritional benefits in terms of vitamins and minerals, they are simply too high in carbohydrates—which, remember, your body converts into glucose—to comply with MMT. Particularly when you start on the program, the number of carbs in a sweet potato can prevent you from making the shift to fat burning.

The same is true for fruit, which typically contains natural sugars that are then converted to glucose once you eat them. (However, there are a handful of fruits that have low levels of naturally occurring sugars, which you can eat in small amounts with careful monitoring—I cover those in just a moment.) The less fruit you eat, particularly when you first start following MMT, the easier it will be for you to transition to burning fat.

Here are the veggies and fruits that are part of MMT.

MMT-Friendly Vegetables

- Asparagus
- Avocados
- Broccoli
- Brussels sprouts
- Cabbage
- Cauliflower
- Celery
- Cucumbers
- Kale
- Mushrooms
- Salad greens
- Sauté greens

FAT FOR FUEL

- Spinach
- Zucchini

After you are fat adapted, you can add back limited amounts of these foods:

- Eggplant
- Garlic
- Onions
- Parsnips
- Peppers
- Rutabaga
- Tomatoes
- Winter squash (very limited amounts)

MMT-Friendly Fruits

- Berries (a small handful, in lieu of a serving of vegetables)
- Grapefruit (a few sections, also instead of a serving of vegetables)

The reason these vegetables and fruits make the list is that they are low in carbs and high in fiber. However, fiber is such an important component of health that I recommend you go beyond food sources and take it as a supplement.

Fiber is a crucial component of MMT for four primary reasons:

- Fiber is used as food for your beneficial bacteria, and a healthy microbiome is essential to optimizing your health. (For a deeper dive into how and why to nurture your gut microbiome, refer to my previous book *Effortless Healing*.)

- The insoluble fiber you consume is passed through your body undigested while the soluble fiber is converted to short-chain fatty acids that nourish your healthy gut bacteria, are used as fuel by your cells, and serve as important biological signaling molecules.
- Fiber acts as an antinutrient—it reduces absorption of carbohydrates, meaning it reduces glucose and insulin peaks.¹
- Insoluble fiber also forms a latticework in your intestine, and the soluble fiber plugs the holes. Together they form a barrier that helps protect your liver.

I've been interested in the health benefits of fiber for a long time—so much so that my classmates nicknamed me “Dr. Fiber” when I was in medical school in the '70s. Today, I still hold firm to my belief in the benefits of dietary fiber as long as most of it is coming from high-quality (preferably organic) vegetables and low-net-carb grains. (Fortunately, I lost the nickname Dr. Fiber.)

Fiber undoubtedly contributes to overall good health and longevity, and can have a positive impact on lowering your risk of disease by feeding and promoting the proliferation of healthy gut bacteria. In recent years it's become crystal clear that in order to be truly healthy, you need a healthy gut.

When your beneficial gut bacteria are fueled by plenty of fiber, they produce compounds that help regulate your immune function and even improve brain health. For starters, these compounds help increase the number of regulatory T cells—specialized immune system cells that help prevent autoimmune responses and more. Regulatory T cells are also involved in the formation of other specialized blood cells in your body via a process called hematopoiesis.

When fiber is lacking, these beneficial bacteria starve, which can send your health into a downward spiral. This has a negative impact not only on your immune system and the development of autoimmune diseases, but also in your gut. There, it causes the breakdown of the protective gut barrier, which can lead to

leaky gut syndrome. People with this disorder often suffer from widespread inflammation and inflammatory diseases.

Researchers have also found that a diet high in fiber is associated with a lower risk of premature death from *any* cause, likely because it helps reduce your risk of a number of life-threatening chronic diseases, including type 2 diabetes, heart disease, stroke, and cancer.

Studies have also linked a high-fiber diet to beneficial reductions in cholesterol and blood pressure, improved insulin sensitivity, and reduced inflammation—all of which can influence your mortality risk. There are two types of fiber:

- **Soluble fiber**, like that found in cucumbers, berries, beans, and nuts, forms a gel-like mass in the gut, helping *slow down* your digestion. This leaves you feeling fuller for a longer period of time and is one reason why fiber may help with fat loss. It also slows glucose uptake, resulting in lower net insulin levels. This type of fiber ferments in the gut and is responsible for maintaining the health of your microbiome.
- **Insoluble fiber**, found in foods like dark-green leafy vegetables, green beans, and celery, does not break down during digestion. It has many benefits, and two of the most important are its ability to bind to toxins, aiding in their elimination, and its ability to stabilize the pH in your intestines, creating an inhospitable environment for potentially harmful microbes. Insoluble fiber helps speed the transit of waste products, helping you maintain regular bowel movements. It is also a powerful stool normalizer, and if you are constipated it will soften your stools by drawing water into the colon, which adds bulk. If you have loose stools it will make them more solid by absorbing excess water. Insoluble fiber also scrubs the lining of your colon. There's a sweet spot here: enough scrubbing to remove toxins and waste but not so much that you're scrubbing away the protective mucosal lining. Another fact to note is

that this type of fiber can bind to and remove minerals and medications, so if you're taking a fiber supplement, timing is important. It's best to allow an hour or so on either side of taking a soluble fiber supplement.

Many whole foods, especially vegetables, fruits, nuts, and seeds, naturally contain *both* soluble and insoluble fiber. I recommend consuming a minimum of 35 grams of fiber and ideally 50 grams or more from whole foods a day, but you could easily double or even triple that amount. My personal consumption is about two and half times that, 75 grams per day.

If you fall short of the recommended 35 grams, or meet that total but want to consume greater amounts so you can experience more of its benefits, I recommend supplementing with organic psyllium seeds (there is more information about how to do this in Appendix B). This is a relatively inexpensive and easy way to add more soluble fiber. I personally take one tablespoon three times a day. Just make sure that the psyllium is organic. Avoid nonorganic psyllium like the plague as it is loaded with pesticides. Taking organic psyllium powder is also helpful in counteracting the loose stools that many experience when taking MCT oil (which I cover in the next section). For additional fiber I also take two to three tablespoons of chia seeds daily. Additionally I soak one tablespoon of flax seeds overnight and blend those into my smoothie. It is important to note that if your gut is not used to these amounts of fiber, you will want to gradually increase to those levels, as they can cause gas and bloating and even constipation until your microbiome readjusts.

THREE OF THE SAFEST SUGAR ALTERNATIVES

Turning down the volume on your sweet tooth and avoiding nearly all sugars—natural and artificial—is a crucial piece of your success on MMT. I know how daunting a task like this can be. But there's good news: Once you have made the switch to fat burning, your cravings for sugar will almost magically disappear. You will

no longer feel that “need” for dessert after every meal, nor will you be driven to have a sugary snack in the mid-afternoon to ward off an energy crash.

1. **Sugar alcohols** have “ol” at the end of their name—these include erythritol, xylitol, sorbitol, maltitol, mannitol, and glycerol. They’re not as sweet as sugar, and they do contain fewer calories, but they’re not calorie free. So don’t get confused by the “sugar free” label on foods containing these sweeteners. As with all foods, you need to carefully read the food labels for calorie and carbohydrate content, regardless of any claims that the food is sugar free or low sugar.

Erythritol is by far the darling of the keto world, replacing xylitol in most recipes. It’s the most tolerable and, unlike xylitol, there’s no fermentation in the gut and I haven’t seen any evidence—yet—of disruption in the microbiome. However, I strongly suggest that you limit its use so you do not become dependent on it.

One reason sugar alcohols provide fewer calories than sugar is that they’re not completely absorbed into your body. Instead, most sugar alcohols are fermented in the gut. Because of this, eating too many foods containing sugar alcohols can lead to abdominal gas and diarrhea. It’s also worth noting that maltitol, a commonly used sugar alcohol, spikes blood sugar almost as much as a high-net-carb new potato. Xylitol and erythritol, in comparison, do not have a great effect on your blood sugar, so from that perspective may be a better choice in small quantities if you feel the need to sweeten.

In summary, some sugar alcohols are a far superior alternative to highly refined sugar, fructose, or artificial sweeteners if they are consumed in moderation. Of the various sugar alcohols, xylitol and erythritol are two of the best. In their pure state, the potential

side effects are minimal, and xylitol actually comes with some benefits such as fighting tooth decay. All in all, I would say that xylitol is reasonably safe, and potentially even a mildly beneficial sweetener. (As a side note, xylitol is toxic to dogs and some other animals, so be sure to keep it out of reach of your family pets.)

2. **Stevia** is a highly sweet herb derived from the leaf of the South American stevia plant. It is sold as a liquid and as a powder and is completely safe in its natural form. It can be used to sweeten most dishes and drinks, although be careful with it—because it’s so sweet, a little goes a long way. Keep in mind that the same cannot be said for Truvia, which makes use of only certain active ingredients of stevia and not the entire plant. Usually it’s the *synergistic* effect of all the agents in the plant that provides the overall health effect, which oftentimes includes “built-in protection” against potentially damaging effects. Truvia *may* turn out to be a very good substitute to sugar, but I’d have to see more details before giving it an enthusiastic thumbs-up, as there’s just not enough evidence to prove its safety.
3. **Lo han kuo** is another natural sweetener similar to stevia, but it’s a bit more expensive and harder to find. In China, the lo han fruit has been used as a sweetener for centuries, and it’s about 200 times sweeter than sugar. It received FDA GRAS (generally regarded as safe) status in 2009.

FATS

There are no two ways about it: MMT is a high-fat diet. To promote your shift to fat burning, you want to get the majority of your calories from fat. But you must choose your fats wisely.

It’s imperative that you choose healthy fats (which I’ll go over in just a moment) and eliminate *all* industrially processed

fats—including vegetable oils such as canola, peanut, cottonseed, corn, and soy—as well as all trans fats, such as those found in commercial salad dressings, peanut butter, most mayonnaise, and anything processed or packaged. It's important that you read the ingredients, not just the label: if you see “hydrogenated fat” listed in the ingredients, that food contains trans fats, even if they're at a level below what needs to be reported on the label.

As I covered in detail in Chapter 1, refined oils are deadly for a wide variety of reasons: they throw your omega-6 to omega-3 ratio out of balance, they are highly susceptible to oxidation (which kicks off a storm of free radical damage within your mitochondria), they carry high levels of pesticides because most vegetable oils are extracted from genetically modified glyphosate-soaked plants, and they become even more volatile and harmful when they are subjected to heat.

If you decide to personally adopt MMT, which I sincerely hope you will do, but you replace your current high-carb calories with calories from industrially processed fats, you will not enjoy any benefits from this diet. Instead, you'll be creating even more harm to your mitochondria and overall health.

Here are the sources of fat that burn clean and help heal your mitochondria (and since many sources of high-quality fats also come packaged with protein, there are several more—such as grass-fed beef and pastured eggs—listed in the protein section).

- Organic, grass-fed butter and ghee
- Coconut milk
- Chicken fat
- Duck fat
- Coconut oil
- MCT oil
- Avocado oil
- Extra virgin olive oil

Coconut and MCT Oil

Coconut oil has been a dietary and beauty staple for millennia. It fights all kinds of microbes, from viruses to bacteria to protozoa, many of which can be harmful, and is a fabulous source of high-quality fat.

Around 50 percent of the fat in coconut oil is lauric acid, which is rarely found in nature. In fact, coconut oil has a greater proportion of lauric acid than any other food. Your body converts lauric acid into monolaurin, a monoglyceride (a single fat attached to a glycerol molecule, unlike three fats which would be a triglyceride) that can actually destroy many lipid-coated viruses such as HIV, herpes, influenza, measles, gram-negative bacteria, and protozoa such as *Giardia lamblia*.

For a quick hunger buster or energy boost, you could simply eat a spoonful of coconut oil. You can also add coconut oil to your tea or coffee in lieu of a sweetener. Coconut also helps improve absorption of fat-soluble vitamins, so taking a spoonful of coconut oil along with your daily vitamins may help boost their effectiveness.

If you want to heighten the benefits of MMT, I also recommend adding MCT oil to your daily plan.

MCT oil is coconut oil's more concentrated cousin. Derived from coconut oil, most commercially-available MCT consists of equal amounts of caprylic acid (C8, a fatty acid with 8 carbon atoms in its molecular structure) and capric acid (C10, a 10-carbon fatty acid).

Normally, when you eat a fatty food, it is broken down in the small intestine primarily through the action of bile salts and lipase, a pancreatic enzyme. But medium-chain triglycerides are able to bypass this process; they diffuse across the intestinal membrane and go directly to your liver via the hepatic portal. Once there, especially if you are in nutritional ketosis, or burning fat for fuel, they are quickly converted into ketones, which are then released back into your bloodstream and are transported throughout your body, including to your brain, to be used as a clean-burning fuel.

FAT FOR FUEL

For this reason, MCT oil is a great way to take in some extra fat, as it is odorless and tasteless and is therefore easy to consume straight off the spoon. Its rapid conversion to energy can help you stay on the MMT plan in those moments where your hunger is high and appropriate food is scarce.

The only hitch is that this efficiency does come with a small cost. Your liver may not be able to process that much fat quickly, and so may dump some of it back into your intestines, where it can cause stomach upset and loose stools. You can consume MCT oil every day, but you must start slowly and build up your dosage over time so you can increase your tolerance to it. (For this reason, MCT oil can help also ease constipation, but don't overdo it just to get that effect.)

Start with one teaspoon once a day, preferably combined with food, and if you don't experience loose stools or other GI symptoms, gradually work your way up. Some people use up to a tablespoon or two with each meal, but most only need a tablespoon or two per day. If at any point you develop digestive upset, go back to your previous dose and stay there for a few days. Increasing your fiber intake can also help ward off MCT oil-induced diarrhea and bloating. Aim to eat approximately 25 grams of fiber for every tablespoon of MCT oil.

My personal preference, even though it is more expensive, is straight C8 (caprylic acid), as it converts to ketones far more rapidly and efficiently than do the other versions of MCT oil, most of which contain close to a 50:50 combination of C8 and C10 (capric acid) fats. It may be easier on your digestion as well. Whatever MCT oil you buy, be sure to store it away from sunlight in an opaque bottle that limits light exposure.

Although MCT is not usually used as a cooking oil, you can still use it in some recipes; just avoid heating it over 320 degrees. For example, you can substitute it for part of the oil that you would use to make mayonnaise or a salad dressing, blend it with vegetables to make a sauce, or add it to smoothies or soups. You can also add it to coffee or tea along with another fat like ghee; blend it well and enjoy it for an energy boost.

There's just one thing to keep in mind: because MCT oil is so readily converted to fuel, and that fuel can be utilized by your brain and heart, if you take it at night you may be too hyperalert to sleep. That said, if you are following the whole MMT program, you will be avoiding all food for a minimum of three hours before sleep (as I will outline in Chapter 10), so this effect should not be an issue.

Caution: Individuals with liver cancer, elevated liver enzymes, extensive liver metastases, or liver disease *should not* use MCT oil. However, they can still use coconut oil.

Avocados

Avocados are one of the healthiest foods you can eat. Personally, I eat one to three almost every day. They are an excellent source of healthy monounsaturated fat—a type your body can easily burn for energy—and vitamins and antioxidants. These super fruits have numerous other benefits:

- **Weight loss.** According to research published in *Nutrition Journal*, those who ate half an avocado with their standard lunch reported being 40 percent less hungry three hours after their meal and 28 percent less hungry at the five-hour mark compared to those who did not eat avocado with lunch. The study also found that avocados appear helpful for regulating blood sugar.²
- **Nutrient rich.** Avocados provide close to 20 essential health-boosting nutrients, including potassium, vitamin E, B vitamins, and folic acid. Potassium plays an important role in heart function, skeletal health, digestion, and muscular function, and is essential for the proper function of all cells, tissues, and organs in your body.³ Despite the fact that it is available in many foods, only 2 percent of U.S. adults get the recommended daily amount.⁴ This is particularly troubling

because potassium offsets the hypertensive effects of sodium. Imbalance in your sodium-potassium ratio can not only lead to high blood pressure, but may also contribute to a number of *other* diseases, including heart disease and stroke.

About two and a half avocados provide the daily recommended amount of about 4,700 milligrams (mg) of potassium a day. Additionally, an average avocado contains about 40 mg of magnesium, which is about 10 percent of the recommended daily value.

Magnesium is another mineral that is important to balance with calcium. By some estimates, up to 80 percent of Americans are not getting enough magnesium and may be deficient. If you suffer from unexplained fatigue or weakness, abnormal heart rhythms, or even muscle spasms and eye twitches, low levels of magnesium could be to blame.

Better still, avocados are one of few foods that contain significant levels of both vitamins C and E⁵ and are high in fiber, with about 4.6 grams in half an avocado. So when you eat avocados, you're really providing your body with a comprehensive package of nutrition.

- **Nutrient absorption boosting.** Because they are so rich in healthy fats, avocados help your body absorb fat-soluble nutrients from other foods. One study published in *The Journal of Nutrition* found that consuming a whole fresh avocado with either an orange-colored tomato sauce or raw carrots significantly enhanced absorption of the carotenoids and conversion of them into an active form of vitamin A.⁶ A 2005 study similarly found that adding avocado to salad allowed the volunteers to absorb *three to five times* more carotenoid antioxidant molecules, which help protect your body against free radical damage.⁷

- **Cancer fighting.** Avocatin B, a type of fat found in avocados, has been found to combat acute myeloid leukemia, which is a particularly rare and deadly form of cancer. The avocado fat was able to wipe out the leukemia stem cells while leaving healthy cells unharmed.⁸ Avocados are also rich in cancer-fighting carotenoids, which are most plentiful in the dark-green portion of the flesh that's closest to the skin.

I even take avocados with me when I travel, making sure to take really hard ones, as they will ripen perfectly during the trip without getting crushed in my bag. You can use any type of rigid container, but I like to transport them in a rigid cardboard tube to prevent them from being squashed in my checked luggage.

Avocados have been rated as one of the safest commercial crops in terms of pesticide application, and their thick skin protects the inner fruit from pesticides. So there's no real need to spend extra money on organic avocados. I've even had my own team test avocados from a variety of growers in different countries, sold in several major grocery stores, and they all tested free and clear of harmful chemicals.

To preserve the area with the greatest concentration of antioxidants, you basically want to peel the avocado with your hands, as you would a banana:

- First, cut the avocado lengthwise, around the seed
- Holding each half, twist them in opposite directions to separate them from the seed
- Remove the seed
- Cut each half, lengthwise
- Next, using a teaspoon or your thumb and index finger, simply peel the skin off each piece

One note: If you have a latex allergy, you may have a cross-reaction to avocados. Also, if you suffer from seasonal allergies, you may notice a sensitivity to avocados when the pollen count

is high. You may want to take periodic breaks from daily avocado consumption so you don't develop an allergy or sensitivity to them.

Despite all these benefits, avocados do have one serious drawback: They can be expensive, particularly if you don't live in a state where they are grown. To offset some of their cost, purchase them when they are on sale—choose ones that are green and rock hard. You can keep them in the fridge for up to three weeks; simply take them out two days before you want to eat them to allow them to ripen and soften.

Olives and Olive Oil

Olives are a wonder of nature that are easy to take for granted, yet deserve special attention. One hundred grams (3.5 ounces) of olive oil has nearly 100 grams of fat: monounsaturated (77 grams), polyunsaturated (8.4 grams), and saturated (13.5 grams). Olives are a great, satiating snack, salty and satisfying, and a wonderful addition to salads. They are a healthful way to add more fat to your diet. Olives, olive oil, and the compounds they contain have been linked to the following health benefits:

- **Antioxidant powerhouse.** Olives contain high quantities of several different antioxidants, including phenols (hydroxytyrosol, tyrosol), polyphenols (oleuropein glucoside), and oleuropein, which is only found in olives. The antioxidant properties of olives have been shown to be stronger than those of vitamin E.
- **Heart protection.** Most of the fat in olives and olive oil is oleic acid, a monounsaturated fat known for lowering your risk of heart disease by decreasing LDL cholesterol and blood pressure. Oleuropein, an antioxidant component of olives, also reduces the oxidation of LDL cholesterol in your body and may lower markers of oxidative stress.
- **Anticancer activity.** The antioxidant and anti-inflammatory properties in olives, as well as other anticancer

compounds, make them useful for cancer prevention. For instance, compounds in olives and olive oil have been found to activate the tumor suppressor gene and apoptotic gene, which induces programmed cell death.⁹

- **Anti-aging benefits.** Tyrosol, a phenol found in extra virgin olive oil, has been found to increase life span and resistance to stress in roundworms.¹⁰ Oleuropein, hydroxytyrosol (another antioxidant), and squalene in olives may also help protect your skin against the radiation in ultraviolet (UV) light; oleuropein in particular has been found to act as a skin protector and has direct antioxidant action on your skin.¹¹
- **Bone health.** Consumption of olive oil and olives has been shown to prevent the loss of bone mass in animal studies of age-related osteoporosis. In a study of 127 elderly men, consumption of a Mediterranean diet enriched with virgin olive oil for two years was associated with increased bone-building proteins, which suggests olives may have protective effects on bone.¹² Phenolic compounds in extra virgin olive oil have also been found to stimulate human osteoblastic cell proliferation¹³ (osteoblasts are bone-forming cells).

It's relatively easy to find high-quality olives (look for those with the pits intact and sold in a jar, not a can), but this isn't the case for olive oil. According to the U.S. Pharmacopeial Convention's Food Fraud Database,¹⁴ olive oil is commonly and deliberately diluted with less expensive and inferior quality oils, including hazelnut, soybean, corn, sunflower, palm, sesame, grape seed, and frequently inferior, non-human-grade olive oils, as they more easily evade fraud detection measures. Deceptively, these other oils will not be listed on the label, nor will most people be able to discern that their olive oil is not pure.

In 2016, *60 Minutes* did an exposé on the Italian olive oil industry and exposed that it has been corrupted by the Mafia. They are adding large amounts of cheap omega-6 vegetable oils, typically

sunflower oils, and generating over \$16 billion in sales a year as a result of the substitution. If at all possible, taste the oil before you buy it. While this won't necessarily be a guarantee of quality (especially if you're not skilled at picking out all the potentially subtle taste differences), it can help you to pick out the freshest-tasting oil possible. And if you open a bottle at home and find that it tastes rancid or "bad," return it to the store for a refund.

When you need an oil to cook with, coconut oil, *not* olive oil, is the ideal choice, because it is the only one that is stable enough to resist heat-induced damage. Extra virgin olive oil is excellent when used for cold dishes, but cooking with it is virtually guaranteed to damage this sensitive oil, as high temperatures can further degrade its molecular structure and create free radicals. However, it is important to understand that high-heat cooking with *any* oil, even coconut oil, will damage it. I personally use an induction burner to fry foods that allows me to cook foods as low as 100 degrees Fahrenheit, although I typically cook at 140 to 150.

Apart from its large amount of unsaturated fats that make it very prone to oxidative damage, extra virgin olive oil has a significant drawback even when used cold: it's still extremely perishable. It contains chlorophyll, which accelerates decomposition and makes the oil go rancid quite quickly.

PROTEIN

In nature, nearly all animal protein sources are also sources of a significant amount of fat. In order to help you meet your daily fat allotment without exceeding your daily protein totals, avoid any low-fat dairy products or "lean" meats. Instead, seek to make the majority of your sources of protein high-fat options—chicken thighs with the skin on versus skinless chicken breast, for example.

As I outline in Chapter 9, you want to keep your protein intake at any given meal to 12 to 15 grams for women and 15 to 20 grams for men (assuming three meals per day). However, if you are immune compromised or recovering from surgery/illness or have higher physical activity demands, you will need about 25 percent more.

When I first learned of therapeutic high-fat diets, I simply didn't understand that anyone could fulfill their daily protein needs without overreliance on animal products—most of which have come from animals that have been raised on feedlots, which are degrading to the environment, the animals' quality of life, and the nutrient content of the meat they produce. (To be clear, I advocate eating certain animal products, but only those from pasture-raised animals that have no added hormones or antibiotics—look for the “American Grassfed” certification from the American Grassfed Association [AGA], which was just announced at the time of this writing.) Now I know better. Nuts and seeds are excellent sources of protein, with an average of 4 to 8 grams per $\frac{1}{4}$ cup, and most vegetables contain 1 to 2 grams of protein per ounce. With a target of 45 to 55 grams of protein in a day, plant sources can easily meet your protein needs.

Seafood

Seafood is the ideal source of the omega-3 fats EPA and DHA, but especially DHA, which is the single most important fat for your biological health. It is the only major fat that is not burned for fuel but integrated directly into your cellular and mitochondrial membranes.

As levels of pollutants in the water (including mercury) have increased, you have to be very choosy about which types of seafood you decide to eat. Among the least contaminated fish, and the highest in healthy omega-3 fat, are Alaskan and sockeye salmon. Neither is allowed to be farmed and they are therefore always wild caught. The risk of sockeye accumulating high amounts of mercury and other toxins is minimal given its short life span. Additionally, bioaccumulation of toxins is reduced because neither of these species of salmon feeds on smaller, highly contaminated fish.

The closer a fish is to the bottom of the food chain, the less contamination it will likely have accumulated in its lifetime, so other safe choices include small fish like sardines, anchovies,

mackerel, and herring. Sardines are one of the most concentrated sources of omega-3 fats, with one serving containing more than 50 percent of your recommended daily value, making them one of the best dietary sources of animal-based omega-3s.¹⁵ Just be sure to get your sardines in water, not olive oil, as nearly all the olive oil used to pack this fish is not fit for human consumption.

Avoid Farmed Fish

Although farmed salmon is more plentiful and cheaper than wild Alaskan salmon, I strongly discourage consumption of farmed salmon due to its inferior nutritional profile, environmental drawbacks, added dyes, and other potential health hazards.

Most important, it is almost 5 times higher in omega-6 fat, and the typical American already gets 10 to 20 times more omega-6 oils than they need. Overall, farmed salmon can contain anywhere from 14.5 to 34 percent fat, whereas wild salmon contains only 5 to 7 percent fat. Because many toxins accumulate most readily in fat, farmed salmon contains far more toxins than wild.

Farmed fish are also subject to many of the same issues as concentrated animal feeding operation (CAFO) beef and pork: namely, high antibiotic and pesticide use and GMO feed. Unfortunately, recent investigations by Oceana—an international organization focused on protecting our oceans created by a group of foundations including the Pew Charitable Trusts—have shown that as much as 80 percent of the fish marked as “wild” may actually be farmed, and that includes salmon. In restaurants, 90 to 95 percent of salmon is farmed, yet is often listed on the menu as “wild.”¹⁶

Given these inaccurate representations, how can you tell whether your salmon fillet is wild or farmed? For one thing, the flesh of the salmon will give you a clue. Wild sockeye salmon is bright red, courtesy of its natural accumulation of astaxanthin, a powerful antioxidant. Sockeye salmon actually has one of the highest concentrations of natural astaxanthin found in any food.

Wild salmon is also very lean, so the fat marks—those white stripes you see in the meat—are quite thin. If a fish is pale pink (or dyed red) with wide fat marks, the salmon is likely farmed. Avoid Atlantic salmon, as these fish are almost always farmed.

Get Savvy about “Fake” Seafood

The seafood industry is rife with fraud. As Larry Olmsted points out in his excellent—if alarming—book *Real Food/Fake Food*, the vast majority of seafood sold in America isn’t what it claims to be. As I mentioned, fish that is labeled wild is actually farmed. Or Chinese shrimp—which has consistently tested as being contaminated with harmful chemicals and is typically raised by what are essentially slave laborers—is passed off as coming from a different country. And restaurants often pass one fish off as another. For instance, red snapper is almost never actual red snapper: it’ll be an inexpensive farmed fish like tilapia, probably imported from Southeast Asia, and probably farmed under dubious conditions.

“You could go out for a week and order red snapper every day and there’s a good chance you’re never going to get it,” Olmsted told me when I interviewed him for my website.

A report by the ocean conservation group Oceana revealed that over 30 percent of shrimp products sold in U.S. grocery stores and restaurants are misrepresented.^{17, 18} Fifteen percent were mislabeled in regard to production method (farm raised or wild caught) or species.

The ramifications of this frequent misrepresentation and mislabeling can be more serious than simply overpaying for an inferior product. In an earlier test published in 2013, Oceana discovered that 84 percent of white tuna sampled from U.S. retail outlets was actually escolar—a fish that can cause severe digestive problems (earning it the nickname “Ex-Lax fish”).¹⁹

So how can you make sure you’re actually getting what you’re paying for? Here are a few strategies for buying seafood that is actually what it is purported to be:

- Buy your fish from a trusted local fishmonger or, surprisingly, a big-box retailer. This class of megastore has a lot of leverage in the industry and studies have shown that their labeling is highly accurate.
- When buying fish from grocery stores, look for third-party labels that verify quality, such as the Marine

Stewardship Council (its logo features the letters MSC and a blue checkmark in the shape of a fish). MSC has auditors who certify where the fish came from and how it got to you. Other labels that signify improved sustainability are Whole Foods Market Responsibly Farmed, Global Aquaculture Alliance Best Practices, Fishwise, and Seafood Safe.

- Look for Alaskan fish. Since Alaska doesn't permit aquaculture, all Alaskan fish is wild caught. The Alaskan fishing industry has some of the cleanest water and the best-maintained and most sustainable fisheries. To verify authenticity, look for the state of Alaska's "Wild Alaska Pure" logo. This is one of the more reliable ones, and it's a particularly good sign to look for if you're buying canned Alaskan salmon, which is less expensive than salmon steaks.
- *The Atlantic*²⁰ suggests buying your seafood from a member of the Better Seafood Bureau.²¹ This trade organization reports fraud found along the seafood supply chain.
- You're also less likely to get scammed if you seek out seafood that has not been imported, as domestic fisheries tend to follow the rules for seafood labeling. Many coastal areas have seafood markets dedicated to fresh, high-quality seafood that is brought in daily. Here you can talk to the owner directly, who should be able to give you details about where the seafood came from.
- If you are going to eat shrimp, look for wild-caught shrimp from the Gulf of Mexico and a third-party certification that indicates the shrimp is from where it says it's from. Keep in mind that a minimum price per pound for shrimp is typically in excess of \$18. If you see a deal that seems too good to be true, it almost certainly is.

- Last but not least, when possible, purchase the whole fish, as it's far more difficult to misrepresent the fish species when it's not cut up and filleted.

If you are a seafood lover and eating more types of fish and shellfish is important to you, use this list, compiled by the Natural Resources Defense Council, to select the least contaminated types.²²

Least Mercury (Recommended)

- Anchovy
- Butterfish
- Catfish
- Clam
- Crab (domestic)
- Crawfish
- Croaker (Atlantic)
- Flounder
- Haddock (Atlantic)
- Hake
- Herring
- Jacksmelt (Silverside)
- Mackerel (North Atlantic, chub)
- Mullet
- Oyster
- Plaice
- Pollock
- Salmon (canned)
- Salmon (wild)
- Sardine

FAT FOR FUEL

- Scallop
- Shrimp
- Sole (Pacific)
- Squid (calamari)
- Tilapia (not farmed; hard to find)
- Trout (freshwater)
- Whitefish
- Whiting

Moderate (Consume Moderately)

- Bass (saltwater, striped, black)
- Buffalo fish
- Carp
- Cod (Alaskan)
- Lobster
- Mahi mahi
- Monkfish
- Perch (freshwater)
- Sheepshead
- Skate
- Snapper
- Tilefish (Atlantic)
- Tuna (canned chunk light, skipjack)

High Mercury (Avoid)

- Croaker (white Pacific)
- Halibut (Atlantic, Pacific)
- Mackerel (Spanish, Gulf)
- Perch (ocean)

- Sablefish
- Sea bass (Chilean)
- Tuna (albacore, yellowfin)

Highest Mercury (Never Eat)

- Bluefish
- Grouper
- Mackerel (king)
- Marlin
- Orange roughy
- Shark
- Swordfish
- Tuna (bigeye, ahi)

Finally, no matter what type of fish you're considering, look for varieties that have received the Marine Stewardship Council certification, which assures that every component of the manufacturing process—from how the raw materials are harvested to how the product is manufactured—has been scrutinized by MSC and independently audited to ensure it meets sustainable standards.

DAIRY

Dairy can be classified as either high fat or high protein or a combination of both—while on MMT, you want to stick to the high-fat options. Some dairy products, such as milk and cottage cheese, are high in lactose (milk sugar), which is made up of a molecule of glucose bonded to a molecule of galactose. Once it's digested, the glucose will raise blood glucose levels. So limit your dairy consumption to the forms that are on the “high-fat dairy” list just below. And just as with your meat and eggs, you want to choose dairy that comes from grass-fed and organically raised

cows—as with beef, look for the brand-new “American Grassfed” certification from the AGA. When available, raw dairy is preferable to pasteurized dairy. Even high-fat dairy contains some protein, so be sure to count those grams in your daily protein totals.

High-Fat Dairy (Okay in Moderation)

- Butter (12 grams of fat per tablespoon; minimal protein)
- Ghee (13 grams of fat per tablespoon; no protein)
- Heavy whipping cream (5 to 6 grams of fat per tablespoon; minimal protein)
- Cream cheese (4 to 5 grams of fat per tablespoon; some protein)
- Sour cream (2 to 3 grams of fat per tablespoon; some protein)
- Parmesan cheese (1.4 grams of fat per tablespoon; high protein—use all cheeses mainly as a condiment)
- Cheddar cheese (9 grams of fat per ounce; high protein)
- Brie cheese (8 grams of fat per ounce; high protein)

High-Protein Dairy (Avoid)

- Milk
- Cottage cheese
- Ricotta
- Yogurt
- Kefir

Note: High-fat dairy contains estrogen metabolites that may play a role in hormone-sensitive cancers, such as breast, uterine, ovarian, and prostate. Use dairy sparingly, if at all, if you have this type of cancer. Unless it is organic, it is likely contaminated with Roundup, hormones, antibiotics, and even worse, antibiotic-resistant bacteria.

EGGS

Despite the bad rap they've gotten from public health organizations and most mainstream media in the last decades, eggs are one of the healthiest foods you can eat, offering fantastic nutritional bang for your buck.

Many people, unfortunately, have been scared away from this healthy food source because eggs contain cholesterol, but it's becoming common knowledge that dietary cholesterol from natural sources poses no threat to your health (and may actually be beneficial). In 2015 the U.S. Dietary Guidelines removed the dietary cholesterol limit and added egg yolks to the list of suggested sources of protein. The long-overdue change came at the advice of the Dietary Guidelines Advisory Committee, which finally acknowledged what the science shows: that "cholesterol is not considered a nutrient of concern for overconsumption."²³

Eggs provide the eight essential amino acids that your body requires to synthesize protein and that must be obtained through your diet because your body can't manufacture these amino acids on its own. Choose only true free-range organic eggs, also referred to as pasture raised, which come from hens that roam freely outdoors on an organic pasture where they can forage for their natural diet of seeds, worms, insects, and green plants.

It's important to remember that eggs have seven grams of protein, so you need to carefully integrate them into your diet to avoid consuming an excessive amount of protein that will in turn stimulate mTOR.

Tests have confirmed that pasture-raised eggs contain superior nutrients. Compared to eggs from CAFO chickens, they have:

- Two-thirds more vitamin A
- Three times more vitamin E
- Twice the omega-3 fatty acids
- Seven times more beta carotene

FAT FOR FUEL

For a wide variety of reasons many people are very sensitive to chicken eggs but do very well on duck, quail, or goose eggs. If you're going to consume eggs regularly, it would be wise to broaden your variety and not just rely on chicken eggs. Also, be aware that raw eggs contain high levels of avidin, a protein that binds to the B vitamin biotin, and can lower biotin availability. So if you eat a lot of raw eggs, you may need to take a biotin supplement.

How you prepare your eggs also matters. Ideally, eat them raw or as close to raw as possible in order to keep the nutrients intact. Your risk of getting salmonella from eggs is always exceedingly slim. It may be slimmer still with pasture raised.

If you cannot eat them raw, poaching or soft-boiling (drizzling with MCT oil) is the next best option. Scrambled or fried eggs are the worst because the high heat oxidizes the cholesterol in the eggs, and could pose a problem if you are struggling with high cholesterol levels. Heating eggs also alters the chemical composition of the egg protein, which can then lead to allergic reactions or sensitivities. Eggs do contain a small amount of carbs, which should be counted in your daily carb totals.

NUTS AND SEEDS

Nuts and seeds are to the plant world what eggs are to the animal world, and are some of the most nutrient-dense foods on the planet. It's important to choose nuts that are organic, raw, and not irradiated, roasted in toxic oil, pasteurized, or coated in sugar or flavorings. Organic varieties are also free of antimicrobials and pesticides. Make sure they smell fresh and not musty, spoiled, stale, or rancid. These problems can also indicate the presence of fungal mycotoxins that are known to be damaging to your liver.

You should limit your overall intake of nuts to a few ounces a day and seeds to a few tablespoons per day to avoid overdosing on omega-6 fats. The best choices of nuts in your MMT plan are raw,

organic macadamia nuts and pecans because they have the lowest amounts of carbs and protein and the highest amounts of fat. If you want to include other nuts, please confirm that they will not create an imbalance in your omega-6-to-omega-3 ratio.

Roasted nuts are tasty, but high heat is known to damage nutrients in nuts, including decreasing the availability of beneficial fats and amino acids.²⁴

If you prefer to eat nuts and seeds roasted, roast them yourself so you can control temperature and time. For instance, raw pumpkin seeds can be sprinkled with Himalayan or other natural salt and then roasted on a low-heat setting in your oven for about 15 to 20 minutes—no more than 170 degrees Fahrenheit. This should minimize any heat-related damage.

A note of caution: Although nuts and seeds are excellent sources of nutrients and deserve a place in your MMT protocol, it is vital that you don't overeat them because they are also rich natural sources of omega-6 fats.

Omega-6 fats are essential to humans, but the reality is that you need *very little* of them in your diet. A major problem with processed oils high in omega-6 fats is that the oils are degraded during the refining process, so even naturally occurring omega-6 fats such as those that are in most nuts and seeds are unhealthy when consumed in excess because of their potential to be pro-inflammatory.

For example, when you eat too much of the most common omega-6 fatty acid, linoleic acid, unstable fatty acids get integrated into and disrupt your cardiolipin—a major lipid component of mitochondrial membranes. When mitochondrial cell membranes are compromised, mitochondrial metabolism and energy production is seriously impaired.²⁵ And please don't confuse linoleic with *linolenic*, as the latter is actually exactly what cardiolipin needs.

Thankfully, you can reduce the amount of linoleic acid that is integrated into your cardiolipin by substituting foods high in linoleic acid with omega-3 fats and the monounsaturated

omega-9 fat oleic acid found in olive oil and many nuts, especially macadamia nuts, which are quite low in omega-6 fatty acids.

Linoleic acid's pro-inflammatory effect is not limited to mitochondrial membranes. In a 2013 study, excess linoleic acid appeared to exert a pro-inflammatory effect on cartilage. In patients with osteoarthritis, the presence of linoleic acid in the cartilage stimulated an inflammatory response, while oleic acid (monounsaturated) and palmitic acid (saturated) appeared to protect against cartilage destruction. This suggests that there may be a link between consuming high levels of linoleic acid and cartilage damage that leads to osteoarthritis.²⁶ For this and other reasons, take care not to exceed the recommended daily serving size of the seeds and nuts listed in this section.

The nuts and seeds I recommend for MMT include:

- Almonds (albeit in very limited amounts, as they are high in protein)
- Black cumin seeds
- Black sesame seeds
- Brazil nuts
- Raw cacao powder, nibs, and butter
- Chia seeds
- Flax seeds
- Macadamia nuts
- Pecans
- Psyllium seed husks
- Pumpkin seeds
- Sunflower seeds

For more information about these choices, including their nutrition and how to eat them, refer to Appendix B.

All other nuts not on this list are simply too high in protein for me to recommend using them. This is why they are not listed and should not be eaten on a regular basis.

It's important to look for nuts that are organic and raw, not irradiated, pasteurized, or coated in sugar. To avoid nuts that have been treated with antimicrobials and pesticides, choose organic varieties.

ABOUT THE AUTHOR

Dr. Mercola is a true visionary who champions freedom of thought and of choice on all matters related to health. He has empowered millions of people around the world to take control of their health and has led the charge to implement much-needed changes to our current health-care system.

As a board-certified family physician for over three decades, Dr. Mercola treated many thousands of people at his wellness center where he focused on addressing the root cause of disease and encouraging patients to view food as medicine. In 1997, he founded his website, Mercola.com, which has become the most visited natural health website in the world and made him one of the leading teachers of health. A three-time *New York Times* best-selling author, Dr. Mercola has appeared on CNN, Fox News, ABC News, *Today*, CBS's *Washington Unplugged*, and *The Dr. Oz Show*.

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