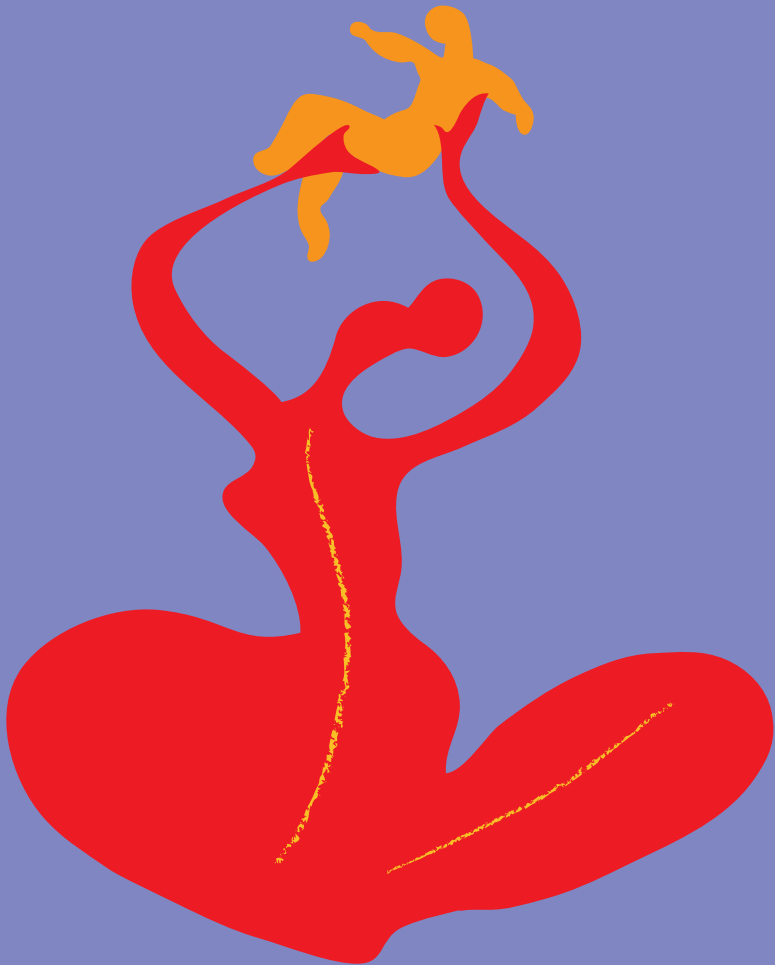


# Autism:

## Pathways to Recovery



**NRI**  
Neurological Research Institute

**Dr. Amy Yasko**

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# **Autism:**

## Pathways to Recovery

**Dr. Amy Yasko**

Ph.D., CTN, NHD, AMD, HHP, FAAIM

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It is important for me to thank and appreciate those who make a positive difference in my life. To me, this is part of paying it forward, and in that light I would like to thank those whose love, help and support have given me the strength to put together a program to help all of you.

To Missie, Jessie, and Cassie. The joy, love and support I receive from my own children inspires me and gives me the strength to help others.

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In loving memory of my parents.



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# Forward

## A Word from the Author

In most cases the forward of a book is not written by its author. However, autism is not a conventional condition and neither is my approach. So it is no surprise that the forward of this book is not following what is considered the standard norm. My program for children with autism is approached from the heart as well as the head; as a mom first then as a scientist. As a parent, I understand how debilitating it can be when your child is not well and how it makes it almost impossible to get through a day. I care about the children. I care that each and every child is given the best chance to recover. I care that the parents understand what has happened, why it has happened and what to do about it. My heart goes out to each parent; every child is precious to me and it is for this reason that I continue to share my knowledge through a program that has made a positive difference for so many.

The concept of this book was to explain the program in laymen's terms so that anyone can understand the "why" behind the symptoms. Understanding the science allows you to make specific choices for your child and their individualized pathway to recovery. This book encompasses revised and updated content contained in my previous book *The Puzzle of Autism* including information from my power point presentations and the thousands of posts that I have authored from my online discussion group over the years. The goal was to create a comprehensive and easily readable work that walks you through the protocol in a more organized fashion than in the previous book.

For those of you who are used to reading my personal comments on your test results or the email responses on the discussion group, some of the copy in the book may not read like "Dr. Amy". The book was written with the help of a professional writer in order to better clarify a point or ensure that concepts were conveyed in a manner that could be easily understood by someone without a science background. My heart and my thoughts are still with every parent who reads this book even if some of the particular words used in a sentence are not the

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exact phrases I might have chosen. What is most important to me is that you are able to comprehend the program in order to help recover your child.

Also, I find that it does help to view the same information in several different formats. Using the book, the workbook and the DVDs should provide every parent the background needed to understand and implement this program. The workbook was compiled from my posts on our discussion group by the (cyber) moms who help answer your questions on that forum. The book was written with the help of a professional writer to allow for a logical and easy to follow guide to the program. The DVDs give you my view of the program, presented in my own words. Along with the discussion group and these resources you should be able to understand and utilize this program for your child.

It has almost been a decade since I began using this approach in my personal practice. Since that time I have shifted from working one on one in order to reach more of you through the use of these resources. To date I have now worked with almost 10,000 families throughout the world. The program really does work, but it takes time and patience. It is a marathon, it is not a sprint. So take a deep breath, get out a highlighter and slowly work your way through the book and the workbook, watch the DVDs and sign onto the discussion group. Please know that I am beside you each step of the way, helping you to recover your child.

With love and hope for recovery for each and every child,  
Dr. Amy

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# **I. Foundations of a New Approach**

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# Chapter 1. Discovering the Pathways

## The Autism Epidemic

**A**utism is reaching epidemic proportions in this country and the world. To give you an idea of just how fast it's growing, the U.S. population grew by 13% during the 1990s, disabilities grew at a rate of 16%, and autism grew at a rate of 172%! According to the Autism Society, within 10 years, the annual costs associated with care for individuals with autism will be \$200–\$400 billion dollars. Today, at least one out of 150 children born in the United States will develop autism. (In certain parts of the country, those rates are estimated to be 1 out of 100. Some predict that if by the year 2020 we do not make significant changes, 1 in every 10 children will be affected by autism. That's why it's so important to understand the predisposing factors that play a role in its development. With that understanding, we can not only help to recover those who are already affected, but can also help to prevent future cases and stem the tide of this epidemic.

Most of the general public are not even aware that the condition of autism can be addressed and that it is possible to bring about a reversal of symptoms and recovery. In addition, most people are unaware of the many causative factors involved. What you'll find in this book is not merely a theory, but a program in active use today—one that has been used by thousands of families. Still, implementing these suggestions will take time and patience. *Autism: Pathways to Recovery* is your doorway into both an approach to addressing autism and a world of support. Through the foundation and action steps offered here, you'll get the grounding you need to understand the rationale for this program, as well as the basics of how to follow it. To complement this book, you can find active support, feedback, and information in my online chat room of families, available to you on my companion website, [www.holistichealth.com](http://www.holistichealth.com). In addition, my other books and DVDs offer in-depth information as well as further guidance for every step of the program.

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## **A Paradigm Shift**

Parents of children with autism desperately seek answers. But since not all practitioners possess a basic understanding of this complex condition, misinformation abounds. The valiant physicians who have come forth to work in this field are overwhelmed by the urgency of need, the severity of symptoms, and the large numbers of children flocking to their practices. Many physicians find helping older children a heightened challenge, while few feel confident in addressing the most pronounced symptoms. Both in the United States and around the world, there is an urgent need for a comprehensive approach to autism that is driven by a comprehensive understanding of the underlying factors that lead to autism. That is what I aim to provide to you in the pages of this book.

Despite all of these challenges, and while I make no guarantees, I want to assure you that there is hope, and more. This is a path that many have walked to recover their children, starting with an understanding of the individual components that go awry to create autism. The most basic principle of this program is that knowledge empowers. The more you understand about the underlying causes, the easier it becomes to address recovery and to realize why you can have real hope, based on discrete scientific principles.

## **Living with Autism**

In looking at the current rise in autism rates, we must ask, “How did we get here?” Back in the 1950s, some practitioners attributed autism to “refrigerator mothers.” In my experience, nothing could be further from the truth. Those who care for children with autism and walk the pathways to support those children in regaining health and function call upon every ounce of love, courage, persistence, and hope that they have. Indeed, many parents never knew their own inner storehouses of love and strength until they encountered this challenge. Given the day-to-day struggles that so many families with autism experience, there’s nothing more important for them than understanding that they are not alone, that there is hope, and a place to go for emotional support when they need it.

## ***Recovery Is Possible***

That’s why, along with some parents, I began my website’s online chat room ([www.holistichealth.com](http://www.holistichealth.com)) several years ago. There you will find not only new information, as the science of addressing autism continues to evolve, but also the extensive support network I referred to earlier. Emotional support is as important as scientific support for the choices that you will make on the road to recovery. While it’s never possible to make absolute promises, I want you to know that many parents have walked before you in helping their children down the pathways to health suggested in this book. The protocol you will find both here and

on my website has made a significant difference for many children with autism of all ages and degrees of severity, and word about its success has spread.

In the pages of this book, you'll first begin to familiarize yourself with the underlying scientific basis for all that I'll suggest. While it may at first seem overwhelming, a clearer picture will emerge as you proceed. What seemed incomprehensible before will begin to make sense, and as you begin to implement some suggestions and see improvements, your confidence will increase. But even more important is something I've been privileged to witness firsthand: Following through on the health recommendations suggested here can relieve symptoms and changes lives. Progress along the road to recovery is possible for any child with autism. There is no magic age or age limitation with this approach.

This book will:

- Orient you to the underlying rationale for this approach
- Familiarize you with the principles and practices I'll suggest
- Take you through the steps of the program
- Provide an easy reference to the supplements and tests used in this healing process
- Refer you to additional sources of support and information available to you in following this pathway to healing

While I won't be able to completely cover every one of the many complex issues integral both to autism and this approach, please use this book as an introductory guide. To actively use the program, it will be necessary to locate the supplemental information available in the websites, online newsletters, chat rooms, and DVDs, as well as the other sources mentioned in the additional resources section of this book.

At [www.holistichealth.com](http://www.holistichealth.com), you can connect with other interested families currently enacting the kind of supports mentioned here. In addition, you can search by keyword through the approximately 14,000 articles that I've read over the past few years to locate the scientific findings, insights, and approaches I will share with you. Also on the site you will find extensive questions and answers about every aspect of this protocol from those using it. Taken together, all of this accumulated wisdom and experience offers an explanation for many of the observed behaviors and symptoms that are associated with autism, a framework from which to help reverse many of these traits, and scientific validation for why many of the therapies I'll suggest are effective.

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## ***How I Evolved My Approach***

As a mother myself, as well as a scientist with extensive expertise in biochemistry, molecular biology, and biotechnology, I bring both a mother's heart and a unique array of insight, scientific knowledge, and clinical experience to my approach to autism and other forms of what I consider "neurological inflammation." My research and clinical experience in both allopathic and alternative medicine also enable me to take the best of both worlds and offer it to those following this approach.

To give you a comfort level as you consider this program and its underlying approach to health, let me share with you a little more about myself.

I was a co-founder and owner of a successful biotechnology company and have been a recognized expert in molecular biology in the field of DNA/RNA based diagnostics and therapeutics. For eighteen years, I served as a consultant to the medical and research community. More than twenty years ago I began isolating single-copy RNA messages from transformed cells at Strong Memorial Hospital Cancer Center at the University of Rochester. Later, while at Yale Medical Center, I worked to enhance the expression of specific eukaryotic RNAs from yeast.

### ***What Is Neurological Inflammation?***

Neurological Inflammation occurs when an inflammatory cascade releases inflammatory mediators. Neurological inflammation can be a result of the overexcitation of neurons, nerve pathways in the nervous system and brain, leading to misfiring, exhaustion, and ultimately the death of these nerves. When neurons die, chronic inflammation results, leading to poor nerve signaling and health imbalances. For example, the red swelling that surrounds a bug bite is actually the body's inflammatory process at work. A very similar process can occur in the areas surrounding our nerves, even if we can't see that internal process as clearly as we can the red bite on our skin's surface.

At St. Vincent's Hospital in New York City, I developed custom diets and used nutritional supplements and transfer factor (immune builders found in the colostrums) to improve the cure rates of non-Hodgkin's lymphoma patients, later conducting molecular research on Transfer Factor at the Medical University of South Carolina. I've spent years studying the relationship between energy transport and modes of antibiotic resistance by bacteria and have written articles and chapters in books on the subject.

After becoming a naturopath, I established an alternative healthcare practice specializing in chronic inflammation and immunological and neurological dis-

orders and attained considerable success in halting and in many cases reversing the effects of debilitating conditions, including ALS, MS, Parkinson's disease, Alzheimer's disease, Systemic Lupus Erythematosus (SLE,) Myasthenia gravis, and autism. I considered and addressed all these conditions as various forms of chronic neurological inflammation.

Over eight years ago, I found that the same integrative health principles I used in guiding adults with chronic inflammation and immunological and neurological disorders could benefit children with autism. To my surprise, recognizing autism as a form of chronic neurological inflammation opened up the use of techniques I had previously used successfully with adults. As I began to apply these principles and use these techniques, over time there was considerable improvement. With that discovery, I stepped onto a path that is more complex, more demanding—and for me, more rewarding—than any I've ever known.

Since then my focus on children with autism has drawn on every ounce of my expertise in molecular biology, biotechnology, immunology, infectious conditions, and biochemistry. The fruits of that work are offered to you through this book and all the associated services and resources of the Neurological Research Institute.

People often ask me how I came to develop these unique communication services to the autistic community. To me, it's really been a natural evolution of my personal practice. As more and more children recovered on my program, I got wonderful feedback from the families I served. Yet I was faced with a dilemma: the rates of autism continued to rise. There was mounting need, yet the standard treatment approaches were not able to help the growing multitude of children. While many integrative approaches achieved some measure of success, there were still many children left untreated, as well as many others who attained only a partial recovery.

Meanwhile, over time, word of my successful treatment approach spread in the community of parents of children with autism. My personal practice soon grew a five-year waiting list. Clearly, this was an untenable wait for parents eager to recover their children. Due to the size of the epidemic, I knew that other capable doctors had been forced to close their practices to new patients. I was now fast approaching that same limit.

This combination of circumstances inspired me to try a totally different approach that would allow me to reach out and serve more families.

I decided to expand the number of children the program could reach by:

- Sharing the program through books, DVDs, and talks
- Answering questions through the discussion group



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Instead of limiting the number of children to those whom I could see personally in my practice, extending my program to the greater autism community benefits more children. For me, that's the bottom line. Now, instead of serving a few hundred families, I am able to offer this approach to thousands.

My overriding goal through in using all of these means is to empower parents. With greater knowledge, parents can make quality health care decisions on behalf of their children. When parents understand the underlying scientific rationale for the supplement suggestions, they can better grasp their child's individual health needs and follow the program in order to effect recovery.

However, undertaking the program in this way does require parents to do more than many people are accustomed to doing to address a health issue. First, you must take the time to read the books, watch the DVDs, come to conferences, and search and read the older posts. It's vital to interact with other families via the chat room to get the full benefit of the program. Even using all these resources, understanding the science will not happen overnight; it is a slow process as you immerse yourself. Know that you will be supported, helped, and guided by other veteran members of the chat room on the website to make the process smoother and easier. Ultimately, this is a program that requires you to take charge of your own—or your child's—health. You are going to have to put in the time and the work to get your arms around it, but as you do, the team of families will be right there to support you every step of the way. I do not believe in telling you what to do; I believe in teaching you about the processes going on in the body so that you are in a better position to make informed choices on the path to health and wellness.

### ***Working With a Practitioner***

Still, no book can replace individual consultations with your practitioner of choice. I encourage parents to familiarize themselves with the protocols and discuss them with their practitioner. And I also welcome practitioners who would like to integrate this approach into their practice to read this book, access these resources, and attend the presentations I offer at various conferences. Accessing a proven protocol can give practitioners a basic understanding of the many elements involved in the presentation of autism. More complete information for practitioners can be found on the DVDs and books recommended in the resources section.

### **Using This Book as a Guide**

I encourage all of you to use this text as a handbook. While it's designed to be read when you begin this program, I also hope that those of you already following the protocol will be able to use it to explain it to your practitioners, friends,

and relatives. Although much of it may already be familiar, along with a complete explanation of the step-by-step approach, you may also find a few new gems. One of my goals in undertaking this approach is to empower parents, practitioners, and adults who have other, related health issues.

By nature, multifactorial conditions like autism are complex. Any form of individualized health care also must account for the many individual variations. Due to my goal of offering empowerment in health care, I seek to share the core science with you, rather than simply offering recommendations for addressing this condition. I do this so that you don't have to take my word for the recommendations, but can understand for yourself why they are valid. This information not only empowers you, it also helps you follow the program.

At the same time, this science is complex, so I encourage a gradual immersion. As you first read this book, begin the steps, and avail yourself of the vast amount of information on the chat room, just take it one step at a time. Gradually, the program, and the science underlying it, will become more and more familiar.

Accordingly, I've designed this book to make it as easy as possible for busy parents, busy practitioners, and adults facing a chronic condition to become familiar with the foundations and begin the steps toward health.

### ***The Core Science***

In Part One, I'll cover the foundational science. Following the basic introduction are two chapters detailing some of the core science underlying the program. These two chapters are designed so that the most essential material can be found in the first half to two thirds of each chapter—with more detailed information provided as the chapter progresses. That way, you can decide to read the more complex content now, skip it to read later on, or go back and reread it as you gain your footing. Don't feel concerned if you need to read some of this material over and over. After all, most of you probably do not have an advanced scientific degree. But don't worry, over time it does make sense—I promise!

And a word to the scientists and practitioners: Some of you may already be very familiar with the basic framework and will enjoy a few of the new ideas and clinical insights I'll share. For those now considering for the first time the unique synergy between genetics, biochemical testing, and natural supplements that this book offers—I want to welcome you and say how honored I feel to be able to open further access to this promising new arena of scientific discovery. While you can rest assured that every single facet of this approach is built on a solid foundation of research and clinical practice, this handbook has a specific purpose: It's a user's guide to the program. Therefore, I'm not providing references and footnotes. However, all of the articles can be found on my website, where you will find an extensive list of resources.

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## ***Following the Program***

In Part Two you will find the what's and how's of following the program. If you feel adventurous, as you read skip ahead to get a sense of what the basic steps are. There are specific things that you can and should begin to do right now, so feel free to begin right away if you would like to.

Finally, I know both from myself and my three daughters that different people learn in different ways. Some of us are more visual, some more linear and logical. Some learn better through seeing or hearing or touching or feeling. If you know yourself to be a visual learner, I also encourage you to consult the website, where there are many visual presentations of the ideas contained in this book. While you'll note that this book also contains some visuals, its basic purpose is to unfold the ideas in a linear, narrative sequence, and I hope that this will be helpful for all of you who learn that way.

## **The Complexity of Modern Life**

Once upon a time . . . life was a lot simpler. And just as life is more complex today, so are our illnesses. We have fast food, fast cars, and a fast pace of life, with all the stressors that go with it. Years ago as *Father Knows Best* played on our black and white televisions. Mom was typically the homemaker while Dad went to work. Now it's common for both parents to work in order to make ends meet, with everyone juggling work and family responsibilities. Since the 1950s, the divorce rate has doubled, resulting in more single-parent households, with more people than ever before acting as both Mom and Dad. It sometimes seems that the more progress we make, the more difficult things become. Or, as the Dalai Lama put it, "We have more conveniences, but less time, more experts but more problems, fast food but slow digestion, and more medicines but less healthiness."

These and hundreds of other changes have not only added stress to our lives, they have also greatly increased our exposure to chemicals. In 1950, there were forty million cars on the road, compared with the over 225 million vehicles in 2000. The exhaust from this nearly 600% increase has brought an equivalent increase in carbon monoxide, nitrogen dioxide, sulfur dioxide, benzene, formaldehyde, and polycyclic hydrocarbons. And that's not the only source of novel chemicals to which our bodies must adjust. With more processed foods, over-the-counter and prescription medicines, and health and beauty products, the last decades have seen an explosion of product offerings, with all product categories bringing increasing amounts of chemicals to us and to our water, earth, and air. Recent studies connect the rising incidence of asthma to air quality and reveal that, in many regions, the water supply contains residues of hormones and prescription drugs. In the aftermath of September 11, 2001, there have also been larger societal changes that produce additional stress, whether the source is fear of terror-

ism, economic worries, the challenges of daily life, or addressing children with special needs.

How do all of these stressors and exposures combine to affect us? For far too long, we've simply assumed that we could handle it all. Yet these diverse factors combine and interact, increasing certain inflammatory mediators in our bodies, so that the stress we are under in turn increases our risk factors for everything from the common cold to cancer. And while we cannot predict the precise turning point when underlying stress combined with genetic susceptibilities and infectious diseases will manifest as a health condition, we do know from research that there are well defined pathways that link the stress people experience to physical illness. For this reason I have given talks solely on the role of stress, not only in autism but for those who are the caregivers for those with autism and other neurological conditions such as Alzheimer's disease. Many of the tenets of this program are applicable to other health conditions. That is why one mantra for those in the program is "It's not just about autism." When we look at the underlying genetic susceptibilities to autism we must consider that family members not suffering from autism may be at risk for related conditions. The excess stress the parents inevitably experience will tend to increase health risk. Once a family has recovered a child, other family members will often begin to use this program to address their own, related health conditions.

More specifically, the same underlying factors that can lead to autism may also be responsible for the increase in Alzheimer's disease, the increase in chronic fatigue and fibromyalgia, the increase in ADD/ADHD, as well as the increase in mitochondrial disease. A growing number of adults with chronic fatigue/fibromyalgia use the very same program that has proven so effective for autism and achieved positive results with these adult conditions. This supports the view that these and other adult health conditions arise from many of the same factors.

In fact, it's possible to view the autism epidemic as the tip of the iceberg in terms of future increased/epidemic rates of a range of disorders. And that's why it is so critical to understand the why behind the condition, so that we can make informed choices to not only reverse the tide of autism, but to prevent similar increases in related conditions.

### **The Complexity of Modern Ailments**

With the rising rate of autism, neurological ailments like Parkinson's disease and chronic conditions such as diabetes, heart disease, arthritis, chronic fatigue syndrome, and others, many people are facing the fact that these disorders aren't as easy to "fix" as we first hoped they would be back in the 1950s. Where once people felt assured that the right drug could combat almost any disease, we're just beginning to understand that health conditions are more complex than that, and

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do not occur as an isolated incident or event. There is no panacea, no magic cure, nor do most conditions arise from one sole cause, like a hostile bug or a toxin. Many different factors act together to influence their development, and as our understanding of their complex origins changes, so must the manner in which we address them. Still, most people and even many doctors find this complexity confusing, as they have to face up to the reality that the days of simple treatments and health guarantees are behind us. So is the time when we could entirely entrust our health to experts. As a result, many more people have decided to take matters into their own hands. In this new territory, people need solid information and a road map, with clear directions they can follow to journey toward healing. That is what this book aims to offer.

Before we move forward, if you are the parent of a child with autism (or are yourself struggling with a health issue) and you are eager to begin with some actual health steps, now or at any time you would like to, you can check out chapter 5, which offers some concrete action steps you can put in place as you lay down your groundwork of understanding by reading this and the next several chapters.

### ***The Myth of the Magic Bullet***

In our society, the conventional wisdom holds that for every health problem there is a “magic bullet,” and if only we could find it, the problem could be eliminated. Accordingly, in certain billion-dollar industries, the search is on for the miracle drug that provide an instant cure. Reflecting upon the evolution of modern medicine, it’s important to recognize one of its highpoints—the mid-twentieth-century advent of antibiotics. These medical treatments were hailed in their day, and were undoubtedly successful for acute bacterial infections. At one time, an antibiotic could readily treat nearly any bacterial infection. But now a decline in the efficacy of antibiotics, along with better research on their downside, reveals their limitations.

Moreover, the “magic bullet” approach to health, typified by antibiotics, has not proven well suited to the prevalent, chronic inflammatory conditions we now encounter in the twenty-first century. There are quite a number of major chronic conditions for which no magic bullet has ever materialized—despite decades of research. Even with this ever more evident shortfall, for the most part our approach to illness has not changed drastically over the last sixty years.

The persistence of the myth of the magic bullet over time represents a naïve belief—like the belief in Santa Claus or the Easter Bunny—that is best outgrown for a mature understanding of health. Yes, it’s a challenge to change and let go of undemanding explanations, but speaking as a molecular biologist, I derive inspiration from this wonder of complexity that we all are, and a sense of satisfaction associated with understanding the “why” behind what we perceive.

As a scientist, I'm also accustomed to mastering very tough challenges. And I know from encountering so many caring families that for anyone who still believes in the instant cure there can be no wake-up call more startling than living with children who suffer from autism. This experience cannot be readily imagined by others. Beyond the daily struggles are the many unanswered questions that reverberate during the few quiet moments you have to yourself: "Why did this happen to my child? How did it happen? What should we do?"

If we can no longer rely on the magic bullet, what's the best approach?

### ***Beyond the Single Cause and Cure***

Whether it's autism or some other health concern, the greatest potential for the next phase of medicine lies in recognizing the multiple factors contributing to a health problem and customizing individualized treatment approaches. As we move beyond the prevailing belief that each condition has a single cause and treatment, we come to recognize that our approach needs to be as unique and individual as we are. When our illnesses were simpler, we could address a sole factor and regain health. But now that they are more complex, we need to address multiple factors.

Erika Check, writing in *Nature*, in September, 2003, said the following:

Medicine's molecular revolution is long overdue. By now, enthusiasts led us to believe, gene therapy and related treatments should have transformed clinical practice.

Diseases, they told us, would be cured at their genetic roots, by repairing defective DNA or by disabling the genes of infectious microbes. But it has proved frustratingly difficult to make these methods work in the clinic. If you get sick, your doctor will probably still treat you with the pills and potions of old fashioned medicinal chemistry.

Nearly all ailments occur in a wider context, with multiple factors from within and without acting upon us. Among the many factors influencing the likelihood that we will develop any given condition are the stress load, the environment—and the toxins we absorb from it, the total number of infectious agents to which we are exposed, and any underlying genetic susceptibility. This combination of risk factors, acting more powerfully than ever before, makes it vital to address all the contributing factors to a health issue. In this more complex environment, we no longer have the luxury of limiting our attention (or treatment) to a single factor. We need to access approaches that address all the critical factors. The approach detailed in this book is your entrée into this new kind of health care.

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## ***Stress + Infectious Agents + Toxins + Genetic Susceptibility = Health Condition***

When we hear the debate among scientists as to what is the right approach for a given ailment, like autism, it's important to recognize that each of them may have something to offer. For example, one doctor may feel that the key issue in autism is chronic viral infection, another might focus on metal toxicity, and a third on the lack of the biochemical metallothionein. In a sense, all of them are right. That's why if we address just one causative factor, it's possible we may be overlooking something else. I believe that taking the best elements from all these approaches—and customizing them to your child's unique genetic needs—leads to synergistic effects and better results.

Accordingly, in the approaches to which I'll introduce you in this book, you (or your practitioner) will be the ones to design the customized program that is right for your child (or for you, if you're suffering from a health problem.) I'll orient you to the principles, offer you a selection of tools and recommendations, and guide you through the steps—but ultimately your child's individual responses, or your own if you have the health issue, will determine both the pace as well as the nature of each step along the way.

### ***Where to Begin?***

When we first widen our lens to look at all these factors, this new territory can seem so vast and complex. I want to offer a roadmap through it, so that you can focus your efforts on what I've discovered over the years of my practice to be the most helpful ways to intervene. I'll focus on the approach I've refined and recommended over the last decade. You'll receive both an overview and a step-by-step guide on how to specifically address autism in children. Although I focus on autism, please understand, as I mentioned earlier, that the same philosophy and methods can be applied to many different conditions. While I don't cover those in detail here, if you are seeking further information, please consult my website, [www.holistichealth.com](http://www.holistichealth.com), where you can join a discussion group in which others undertaking this approach for various ailments share their experience and ask and answer questions.

I have often told the over 8800 families who have traveled these pathways to recover their children, undertaking this program is not a sprint—it's a marathon. Pace yourself for the journey, and Godspeed!

### **The Puzzle of Autism**

Research indicates that in individuals with autism, certain typical imbalances occur. These imbalances impact the proper functioning of the organ systems,

the neurotransmitters, and many interactive biochemical processes in the body. For example, organ system imbalances can result in allergies, reactive responses to foods, and digestive disturbances, all of which are quite common in children with autism. Neurotransmitter imbalances can impact behavior, mood, attention, and speech. Trying to address all these different areas of imbalance can seem overwhelming, and parents are often in “triage” mode, trying to put out the latest fire before racing to the next crisis, making it harder to gain an overall perspective on what is going on with their child.

When, as a scientist, I look at a child with autism, I see someone who is experiencing an extensive degree of systemic and metabolic disorganization that challenges the balanced functioning of many bodily systems. Supporting that person means identifying what’s needed to reorganize their functioning so that it’s more successful and balanced. It can sometimes feel like one is taking apart the pieces of a puzzle and putting them back together in a healthier arrangement for that child. And in a certain sense, that is exactly what we are doing.

As a result, identifying and moving just a single piece will not always be sufficient to solve this complex puzzle. We have to address and reorganize all the pieces in their relation to each other. Beginning with the next chapter, this book will help you understand both the individual pieces—to the extent we now understand them—and the interplay among them. The step-by-step program explained in the chapters of Part Two will direct you down a sequential pathway that will support your child into a healthier reorganization. At the end of all of these pathways, it’s my hope that each of you will discover that the puzzle has been largely solved, and that your child has moved toward health, function, and biochemical balance.

### ***Multifactorial Effects***

Sometimes, a number of seemingly unrelated events occur simultaneously, resulting in disaster. A prime example of this was the death of Princess Diana. If she had been wearing her seatbelt, if the car hadn’t been speeding, if the driver hadn’t been drinking, if the paparazzi weren’t chasing the car, if they hadn’t driven into a narrow tunnel . . . if there had been a way to eliminate any one of those factors, that tragedy might have been averted. The multitude of factors that must occur to create the condition we call “autism” can be viewed in a similar fashion. Without a particular combination of genetic mutations, heavy metal toxicities, chronic viral infection, underlying bacterial infections, and excitotoxin damage leading to a negative cascade of neurological events, then autism (and other spectrum disorders) might not have manifested. But they did, and it did, and so we need to recognize and accept while initiating a step-by-step process to reverse the disorder.



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## ***Individualized Treatment***

When seeking to address autism and other complex conditions, we have tended to assume that the same approach should work for all people—but it's just not so. Even well-intentioned integrative practitioners tend to overlook the reality of genetic individuality and prescribe the same program for all sufferers of a health problem. That view fails to account for why some people react well to a given substance, while others do not. Whether it's a food, a drug, or even a vitamin, people react differently, and as a scientist, I believe that it's our job to understand why.

Why does one person react to a drug, while another does not? Why is someone allergic to a given food that another can eat without harm? We can't begin to answer questions like these without taking many factors into account. As a result, our approaches haven't fallen short, in that we really don't understand why a program works for some and not for others. In the past, as scientific experts, in the face of different responses to treatments, we just had to shrug and walk away, without examining these differences and understanding their significance, or customizing our treatments to take them into account. If they worked for a certain percentage of people, that was considered good enough. But I believe that we need to constantly work at the frontiers of science and expand our approaches so that we are able to take individual differences into account and, by doing so, help each and every person who is affected. While I believe that one day all health care will be personalized, fortunately, as it relates to autism and related conditions, we already have new tools for that level of personalization.

Through the new science of Nutrigenomics, we can now begin to account for the underlying genetic propensities that are risk factors for conditions such as autism. After customizing a health recovery program based on the Nutrigenomic findings, we can next undertake follow-up biochemical testing to ascertain biochemical status and toxic load and monitor our progress in addressing health issues. Thanks to this new science, we can at last address people as individuals in accordance with the principle of genetic individuality. With the discovery of human uniqueness through the ongoing work of characterizing the human genome, a new vista opens to truly personalized medicine. Let's go there together. With what we discover when we truly individualize our approaches, we can at last address autism and other complex conditions. Let's take a look at what that entails.

## ***Understanding the Pieces of the Puzzle***

As I mentioned earlier, autism can be viewed as a puzzle created from a variety of biochemical, genetic, and physiological factors as they collide in the body of a developing child. To make informed decisions about undoing the damage that has been done in this “crash” of negative factors, each piece of this puzzle must be examined carefully, its function understood, and balance restored.

This book will look at each piece of this puzzle as I understand it at this time, and suggest programs of supplementation to address potential imbalances. The information presented reflects the most current view of the process of neurological inflammation that results in “autistic-like” behaviors, including the entire spectrum of autism-related conditions, including ADD and ADHD. This field is evolving almost daily with new information and new literature, and I will evolve with it. Future editions of this book will reflect new information as it comes to light.

First of all, customizing health programs requires that you get to know the many factors that act as toxic disruptors, contributing to imbalances. Here’s a brief list of some of the most common ones; a more detailed discussion can be found in later chapters:

- **Excitotoxins:** These are stimulating chemicals present in many common foods that overstimulate brain chemistry via the neurotransmitters and nerve receptors. This over-stimulation can trigger nerve cell death, which results in poor signaling, contributing to “stims,” and language difficulties.
- **Heavy metal toxicity:** Arising from environmental exposures, and compounded by metals in vaccines, heavy metals disrupt the immune system and the digestive organs, reduce energy, impair cognitive and neurological function, and weaken the individual.
- **Chronic viral and bacterial infections:** Arising from environmental exposures as well as the bacteria and viruses in vaccines, these chronic infections disrupt the immune, digestive, and respiratory systems, thus undermining the body’s ability to maintain and repair itself.
- **Methylation deficiencies:** Under- or overactivation of methylation, a key cellular pathway that promotes detoxification, controls inflammation, and balances the neurotransmitters, can result in mood and emotional shifts as well as liver, pancreas, stomach, intestinal, adrenal, thyroid, and hormonal imbalances.

Taken together, these imbalances can result in impaired function throughout many bodily systems. But your child may not suffer from every single imbalance. That’s why we must customize the approach to match his or her specific health needs. The good news is that through this program it is possible to address all of these areas and rebalance these systems. However, this process takes time and patience. Success can be achieved by calmly correcting each imbalance.

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I am convinced that all the symptoms we see arise from causes that can be addressed. From the many families with whom I've been privileged to work I know that children with autism have tremendous brainpower, and I am dedicated to helping them shine.

## A Brief Review

Let's take a moment to review some of the core understandings we've covered so far and add some new ones that we will come back to time again and again throughout this book. If you ever wonder where you are as you delve into the science, I invite you to come back to this list for review, as it will help you grasp the main aspects of this approach.

- **The multifactorial nature of disease.** We've been taught that disease management is just a matter of taking one pill, but it's far more complex than that. I want you to begin to see health conditions differently so that you can individualize the approach and access what you need to do. In this protocol, we'll take into account a range of factors contributing to all health conditions, including genetic, environmental, and toxic burden. The protocol aims to supply the key nutrients needed to address these factors and manage the factors undermining health.
- **Individualized approach.** The need to recognize "genetic individuality" and develop customized programs.
- **Nutrigenomic testing.** New services only developed in the last several years permit us to examine an individual's genetic uniqueness and customize protocols for him or her. In the next chapter, I'll reveal the opportunities for individualization that open when we take genetics into account.
- **Genetic bypass.** Using specific natural supplements to support areas of identified genetic weakness to create balance and full functioning of all bodily systems is a key to this program, in this book, you'll learn ways to do that and get to know the supplements useful for the range of issues and genetic profiles commonly seen in children with autism.
- **Methylation pathway or cycle.** This is a crucial biochemical pathway that we aim to optimize through this approach. In the next chapter, I'll delve further into how dysfunctions on this pathway create health problems, and how we can restore optimal methylation function.

- **Neurological inflammation.** When the methylation cycle is not functioning optimally, instead of producing components needed for DNA, cellular repair, detoxification, psychological well-being, focus, and speech, the body will produce inflammatory substances that produce a range of health symptoms we need to address.
- **Toxins.** These are the various foreign substances that enter the human body and remain lodged there, disturbing function and producing imbalances and symptoms.
- **Detoxification.** This is the process of supporting the methylation cycle and organs to gently release toxins.
- **Biochemical Testing.** In this program, we test key areas that help us track progress of our individualized genetically-based programs.
- **Remyelination.** This is the final stage of the recovery process, in which we support the body with key substances needed to repair nerves.

### Book Overview

In Part One, I'll introduce you to the scientific foundations of this approach, which is based on addressing the multiple factors that come together in any form of disease presentation. In addition, I'll reveal certain key areas of our genetics and biochemistry that are impacted in both autism spectrum disorders and a wide range of other conditions.

Following years of research and clinical practice, it's my conviction that a one-size-fits-all approach is inadequate to address a complex ailment like autism because of the diversity of factors involved. Moreover, one-size-fits-all is a less than an optimal approach for other chronic and serious disease syndromes. At this point in history, we are standing on the threshold of personalized medicine, and the philosophy and approach detailed in this book will become your entryway into that world.

Although personalization is new, in my experience, it can create better outcomes.

Here's why: Personalized medicine is based on a deeper understanding of an individual's uniqueness and customizes approaches to achieve the best possible combination for that person. Customization begins with a genetic profile, focusing on a range of key genes, with programs targeted to achieve the best results given the specific needs and/or weaknesses of a person with that unique combination of genes.

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In the next chapter, “Nutrigenomics and the Methylation Cycle,” I’ll introduce you to the evolving science of genetic testing and supplementation to optimize genetic shortfalls. I’ll also focus on the biochemical pathway that I consider crucial to identifying areas of dysfunction and optimizing function—the methylation cycle.

Addressing toxins and infections through a careful and safe approach to systemic detoxification is key to healing. In chapter 3, “Promoting Detoxification Safely,” I’ll explore the rationale for detoxification, reveal obstacles to the detox process, and examine the key toxins we need to detoxify.

With all of this foundation in place, in Part Two I’ll orient you to how to use this book to undertake specific protocols. Chapter 4, “Step One, Part One—Building a Foundation for Health Balance” will introduce you to an overview of the Three-Step Program, and also reveal the foundational elements of the protocol that anyone can and should begin at once, even before they have received their genetic test results. In this chapter, you will learn which foods and ingredients to eliminate because they tend to exacerbate neurological inflammation. In chapter 5, “Promoting Healthy Digestion,” you’ll learn how to ready the bodily systems to undergo the health restoration that occurs in Step Two. Key to this approach is accessing customized supplement protocols for your child (or yourself, if you are an adult following this program). Chapter 6, “Step Two, Part One—Optimizing the Methylation Cycle,” and chapter 7, “Step Two, Part Two—Increasing Detoxification,” will take you through the program sequence and offer some of the foundational protocols you can consider. In chapter 8, “Remyelinating Nerves,” I offer the program sequence for restoring damaged nerves.

## **My Promise to You**

I will not give up until every child is given the chance to recover; until all of the pieces of the puzzle fit together, and this chronic condition no longer threatens the next generation.

## Chapter 2. Nutrigenomics and the Methylation Cycle

### The Dawning of the Age of Personalized Medicine

**T**oday we stand at the dawn of the age of personalized medicine. Integrative medical doctors herald its potential, drawn from traditional medical approaches—like Chinese and Ayurvedic medicine and homeopathy—that emphasize individuation of treatment. Conventional medicine, too, looks forward to breakthroughs in this new field, although it's been predicted that it may take several decades before these new understandings can be applied. But, I ask, why wait? There is urgent need today! We have the technology and knowledge—now. We are able to look at crucial nutritional pathways and examine their underlying genetics—now. We can customize programs to meet individual unique needs and make a difference—now. That's what this book is all about.

With the mapping of the genome, we now know that there are approximately 25,000 genes in the human organism, but thus far they have yet to be sufficiently well characterized. The result is that clinicians are able to apply their understanding of genetics to just a few factors applicable in day-to-day health care practice. With extensive expertise in biochemistry and molecular biology, I was a principal of a biotechnology company and pursued research in this arena for over fifteen years. I know that over time, as we map the genome, we will learn more about the properties and functions of each and every gene. We can look forward to the day when we are able to identify risk factors throughout the entire human genome in order to optimize health and prevent adverse health conditions. However, since that work is already underway, why not put into practice what we know now?

One reason that this form of health care is not yet considered standard is that it's only a rare individual who can afford to undertake genetic testing for all the body's 25,000 genes. And even for the few who are able to do that, the information they derive may not be very useful or applicable until the genes have been better characterized by scientists—in the far-flung research process now underway.

As a result, and in order to operate more cost effectively, some clinicians and labs have identified and offer testing services for a narrower range of genes. Through

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genetic testing of genes, we are able to identify the specific genetic mutations, also called “single nucleotide polymorphisms” (SNPs—pronounced snips) within each individual. People with specific health conditions or risk factors seek this information to more accurately target treatments and preventive strategies based on their test results. If you search the Internet, you will see that various labs offer genetic testing services, typically testing somewhere between 20 and 35 SNPs.

But the critical question in undertaking any such genetic test is: Which SNPs should the lab test? Testing approximately thirty or so can cost anywhere from \$500 to \$1500, a significant expense that most insurance doesn't cover at this time. So, before undertaking any tests, it's vital to assure that the lab will examine (and report consistent and accurate results for) the genes most essential to you or your child's health condition. My work over the last several years has been to define what I believe to be the most effective range of genes to test, and to do the groundwork of characterizing those genes, which means identifying what they do and how their performance interacts with other genes to perform critical bodily biochemical functions.

As a result, in this book, as in my talks, DVDs, and chat-room comments, I share my hypotheses and new discoveries as this ongoing research evolves. When you are first introduced to this science, it can sound a little complicated—and it is a complex and wondrous science. However, over time you will become more familiar with it.

### ***Why Get to Know Biochemistry and Molecular Biology?***

Gaining some comfort level with molecular biology and biochemical pathways will help you:

- Understand the causes of the symptoms experienced.
- Monitor program responses and results.
- Determine when to add or subtract supplements and when to test.
- Understand the reasons for the specific nutritional supplements we use to bypass areas of genetic weakness.
- Feel reassured about the scientific validity of the treatments recommended.

Most of all, becoming familiar with this science will empower practitioners, parents, and adults with health issues. For far too long, people have left their health nearly entirely in the hands of others. While it's vital to rely on those with expertise, it's also essential to be informed, aware, and motivated to take

action oneself. Getting to know some of the underlying science is an opportunity to do that.

But do it at your own pace. In this and succeeding chapters, the most basic information is contained near the front of the chapter. The later, more detailed scientific material, toward the back of each chapter is there for your reference, and will become clearer with repeated readings (and experience of the program) over time. Although this is only a basic entrée into the underlying science, far more extensive information is available to you in my lectures, which are available on DVDs, and in my other books. This book could not contain it all and still be a handbook for practitioners and parents. Please know that I continue to add to our understanding and develop this foundational science through my replies to posts in the chat room on my website, [www.holistichealth.com](http://www.holistichealth.com). By joining the chat, you can search for and find answers to the most common questions, receive support from other parents, ask your questions, and get answers. All the scientific articles that serve as the foundation of this approach are also found on this site. Once again, this book is primarily a handbook and is therefore not footnoted.

### Neurological Inflammation

More than ten years ago, I began to research the genetics of neurological inflammation, the physiological precursor to a number of adult health ailments, such as chronic fatigue syndrome (CFS), Parkinson's disease and MS. At that time, it was not my plan or design to work with children with autism, but as chance or destiny brought me the first children with whom I worked, I began to recognize that, just like these other neurological ailments, the condition we call autism arises from underlying neurological inflammation and therefore can benefit from approaches similar to those I offered to my adult clients.

One contributor to neurological inflammation is the overexcitation of neurons in the nervous system and brain, leading to misfiring, exhaustion, and death of these nerves. As I looked more deeply into the biochemical factors that mediate and/or contribute to neurological inflammation, both ground-breaking research and clinical results demonstrated that one particular biochemical pathway is key. As a result, I've concentrated my efforts on forging a more complete understanding and characterization of that pathway: the methylation cycle.

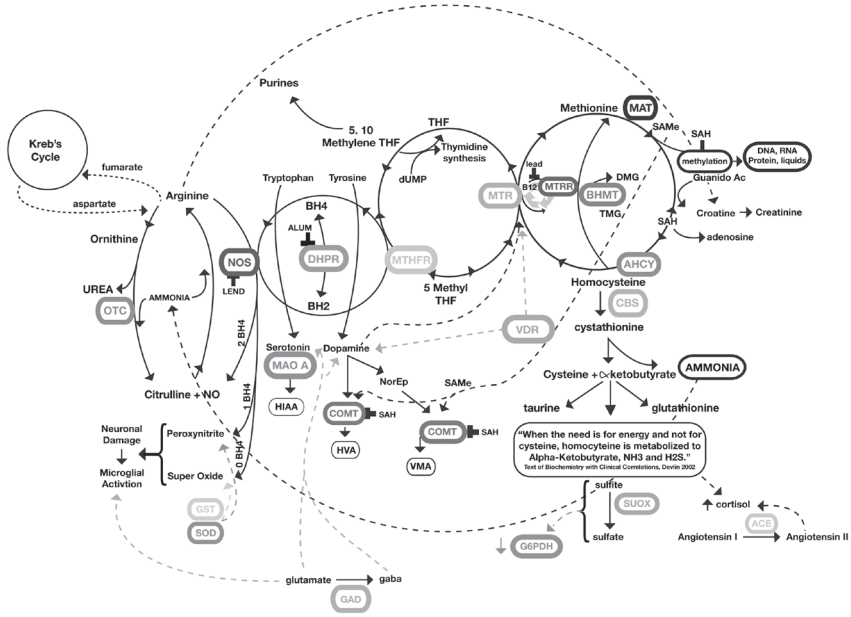
There are a vast number of different and distinct biochemical pathways in the body that interact to perform all the many complex functions that are going on all the time without our awareness. So what makes this particular pathway so unique? First of all, I know from analyzing thousands of tests that an extraordinarily high percentage of children with autism have one or more mutations in this pathway, compared to the rest of the population. Secondly, I believe that the proper functioning of this pathway is critical to overcoming any form of neurological inflammation. This does not mean that every individual with mutations



in this pathway will develop autism; problems with the methylation pathway may be a necessary but not a sufficient condition for autism.

What I refer to throughout this book as the methylation cycle is actually a combination of four interrelated biochemical cycles, including:

- The methionine cycle
- The folate cycle
- The BH4 (biopterin) cycle
- The urea cycle



To my knowledge, no other clinician has traced the interactivity of these four cycles or emphasized their function for clinical practice as much as I have, although the folate and methionine cycles are widely regarded as interactive. To describe and evolve a program based on what I am calling the methylation cycle required combining divergent pieces of information not previously connected in order to recognize and find approaches to address the synergistic functioning of these four cycles. It's by considering them all together as the "methylation cycle" that we create a solid foundation for addressing critical dysfunction.

### **The New Science of Nutrigenomics**

Over time, I've evolved a holistic approach for bypassing genetic issues in the methylation pathway through the use of the budding science of "Nutrigenomics." Nutrigenomics is a hot new area of research that you may have read about, based on the understanding that, while we cannot change our genes, we can change the way our genes act. For example, certain foods or supplements prompt our genes to act in healthy or unhealthy ways. Through the study of Nutrigenomics, scientists are learning what to eat (or to avoid) to promote healthy vs. unhealthy "genetic expression." Using Nutrigenomics, labs compare the genomes of a large sample of individuals to determine which genetic "print-outs" represent "normal" vs. mutated variations.

#### **Genetic expression = How our genes act**

For example, a man—let's call him Hal—may have a slight tendency to be irritable. Let's say that is part of his disposition, his basic makeup. Nevertheless, overall he's a solid, well-intentioned man—until a hot summer's day at a family picnic, when he gets a bit too much sun. Next, Hal eats spicy chili and drinks a few martinis. Before you know it, his teenage son does something that annoys Hal, and his temper flares. Another person with less of a tendency to become inflamed and angry might react differently. But for Hal, staying out of the sun, perhaps drinking mint tea, and eating a salad would help manage his innate tendencies. In just the same way, by knowing more about our genetics we can help our genes to respond favorably, rather than flare and cause an undesirable reaction.

The goal of Nutrigenomics is to supply the body with the specific nutritional ingredients it needs for healthy functioning on a daily basis. Most of us have genetic mutations of some kind.

#### **Nutrigenomics is genetically targeted supplementation.**

These mutations impair our ability to perform all the biochemical actions necessary for ideal function. As a result, we may produce too much or too little of something, creating biochemical imbalances that lead to dysfunction and ultimately to health problems. Through supplying the missing nutritional ingredients that the body requires but cannot adequately produce itself due to genetic mutations, Nutrigenomics helps us to, in effect, "bypass" the genetically induced decrease in function, and restore proper functioning.

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## Genetic Testing

To determine which of our genes may have mutations, we must first undergo genetic testing. I don't believe that it's advisable—or indeed ethical—to perform genetic tests out of idle curiosity. Unless the clinician can offer an approach to address the genetic defects that testing may reveal, I don't recommend it. That's why I'm not in favor of random testing. As a result, my focus has been on the testing of genes and the Nutrigenomic support of genetic mutations in a pathway critical to health, the methylation pathway. By using nutritional supplements derived from natural substances to address gene defects, we can improve function and restore health.

### A Tale of Two Mice

Folic acid is a crucial nutrient produced by—and contributing to—methylation. In a classic study, two groups of mice were given the same diet, except for the level of folate. The group that received higher folate levels produced more methyl groups—a carbon with three hydrogen atoms—which altered the expression of DNA, which in turn resulted in a visually noticeable difference between the two groups: The ones that produced more methyl groups had a different fur color, body weight, and size than the control group.

Folate is a very common ingredient in nutritional supplements. Yet scientists recognize that about 40% of Americans have an SNP (a mutation) that limits or eliminates their ability to process common folate. Most people with this mutation are unaware of it. To benefit from supplementation, then, these people require a special form of folate.

Folate is a part of the very specific pathway we look at, the methylation cycle, and that is why the testing we do focuses on certain key aspects of the body's ability to use folate properly.

The bottom line is that through focused genetic testing and the application of Nutrigenomics, we can:

1. Identify the presence of SNPs in key places in the methylation cycle.
2. Use the right supplements to control how these genes act, in effect bypassing the genetic mutations to optimize methylation cycle function.
3. Benefit from all of the necessary tasks performed by a functioning methylation cycle.

## Chapter 2. Nutrigenomics and the Methylation Cycle

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4. Reduce (and repair the effects of) neurological inflammation to improve the biochemistry of the various bodily systems, supported by methylation.
5. Over time correct imbalances, relieve symptoms, and optimize a person's potential for good health

This series of steps is really the foundation of this program and has been used successfully to address the various conditions that arise from neurological inflammation, including autism, chronic fatigue and immune dysfunction syndrome (CFIDs,) and neurological ailments—but, as mentioned earlier, its application may not be limited to these areas. We'll revisit this throughout this book. But for now, let's look at what happens when the methylation cycle is impaired by a combination of genetic weakness and environmental impacts.

### ***Why Do We Need Methylation?***

Why have I singled out this particular pathway? What functions does it perform in the body? Why do we care about methylation at all?

Going forward in this chapter, I'll explain the key functions of this pathway and describe why we need it for so many key bodily processes. In addition, I'll briefly review some of the key functional areas that are impacted by inadequate methylation, as well as highlight a few of the issues that can manifest when the methylation cycle is not doing its job well.

#### **Methyl Messengers**

Methyl groups are the body's messengers and movers and shakers. They join with other compounds to “jump-start” a reaction (such as turning a gene on or activating an enzyme). When the methyl group is “lost” or removed, the reaction stops (or a gene is turned off or the enzyme is deactivated), OR when a methyl group is lost a gene is turned on (for example, a gene related to cancer) when it is not ideal to have it turned on.

When the methylation pathway performs well, it produces various byproducts, including biochemicals needed to perform other tasks. For children with autism, as for adults with neurological and other conditions, the healthy byproducts of methylation do many essential things, which you will be introduced to in this chapter. On the other hand, when the methylation pathway is not well functioning, there are two principle results:

1. A wide range of key bodily functions will not be performed effectively.

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2. The byproducts of this pathway can lead to inflammation, a precursor to various conditions ranging from autism to Alzheimer's to cardiovascular disease.

## **Which Genes Should We Test?**

If testing 30–35 genes is currently the most practical approach to genetic testing, then you want to test where it counts. You want to get all the crucial information, focusing on genes that govern a vital functional area, rather than using the scattershot approach common in certain genetic tests, which test a little of everything. To see why that's important, imagine that you have Googled driving directions to a city you want to visit. You need a detailed map that shows every major turn onto the roads that lead to your destination. It wouldn't do you much good to receive directions that omit key turnoffs, leave out main roads, and instead show you a few addresses in twenty other states. In effect, some genetic tests do just that. The test designers may be well-intentioned, but in my opinion, scattershot testing does not produce reliable "directions to the destination."

Why? Because like people, genes do not function in isolation—they are interconnected. Imagine each biochemical pathway as a kind of assembly line in which a series of actions occur in sequence. When a given gene does its job well, it creates a biochemical that receives something produced by an upline biochemical and does something with it, and it then passes it along to a biochemical downline, almost like passing a baton in a relay race. Therefore it's essential to study not just isolated genes, but biochemical function along specific pathways. To troubleshoot where the problems are, we need to know how well both the up- and downline genes and allied biochemistry function. That way we can make all the corrections necessary to recreate proper pathway functioning.

By characterizing the effects of genetic polymorphisms at key areas of the methylation pathways, it's possible to create a personalized map of specific, individual imbalances that can impact your child's or your own health. When we identify these precise areas of genetic fragility via Nutrigenomic testing, it is then possible to target appropriate nutritional supplementation to optimize the functioning of these crucial biochemical processes.

Why have I elected to focus on the methylation pathway? Because both the research literature, as well as my own clinical work, have revealed its centrality to a number of significant bodily processes.

## **Autism: A Multifactorial Condition**

As I mentioned in chapter 1, it's important to recognize that autism is a multifactorial condition, with *genetic*, *infectious*, and *environmental* contributors. What

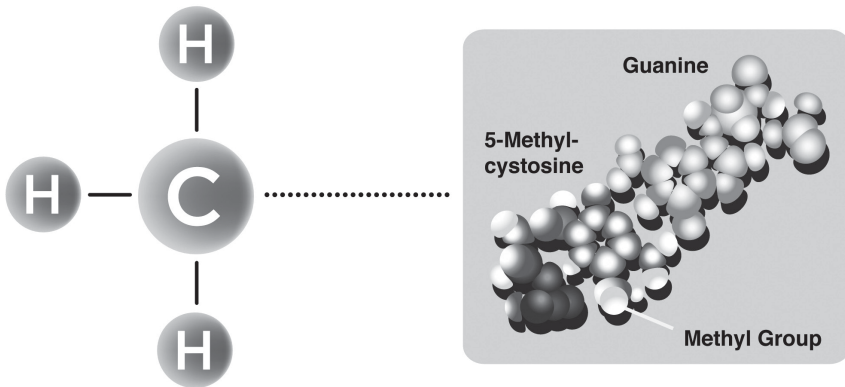
makes the methylation cycle so unique and so critical for health is that mutations in this pathway can have an impact on all of these factors. This concept is so important that I will repeat it, just to be sure you have gotten the message:

**Autism is a multifactorial condition, with genetic, infectious, and environmental contributors.**

What makes the methylation cycle so unique and so critical for health is that mutations in this pathway can have an impact on *all* of these factors. Picture each mutation as an accident causing a traffic tie-up. One accident will slow down the flow of vehicles on the highway. A second or third will snarl things even more. Through targeted supplementation, we are in effect creating a way for a vehicle to bypass the sites where the accidents have occurred, take a detour, and move further toward its destination. In the case of the methylation highway, these bypasses permit us to move beyond the blockades caused by mutations to produce and deliver the methyl groups that are key to a wide range of bodily functions.

### Methylation

#### Methyl groups - CH<sub>3</sub>



Bound to DNA, enzymes, vitamins

Each methyl group consists of a carbon atom bonded to three hydrogen atoms, CH<sub>3</sub>. But since a carbon atom can bond with four other atoms, each methyl group has one more available bond, which constantly attaches to and detaches from numerous other molecules in the process known as methylation.

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It is their ability to connect and create a new process that makes methyl groups so important.

## Methylation Is the Message

Methylation is involved in almost every reaction in your body and occurs billions of times every *second* in your cells. To give just a few examples—and you will encounter many more throughout this chapter—without proper methylation, there is increased vulnerability to viruses, impaired attention span, and less efficient nerve transmission. We can get a basic idea of the impact of methylation on the nervous system by looking at the effects of coffee and the drug Ritalin. Coffee has a large number of methyl groups, which is why it causes such a sudden improvement in focus. And because Ritalin is a methyl donor, children on Ritalin may also experience improved focus.

Methylation is central to such critical reactions in the body as:

- |  |                   |
|--|-------------------|
| Repairing and building RNA and DNA                               | Inflammation      |
| Immune function (how your body responds to and fights infection) | Membrane fluidity |
| Digestive Issues   | Energy production |
| DNA silencing  | Protein activity  |
| Neurotransmitter balance   | Myelination       |
| Metal Detoxification   | Cancer prevention |

Because it's involved in so many processes, inefficient function or mutations along the methylation pathway can result in a wide range of conditions, including the following:

- |                    |                              |
|--------------------|------------------------------|
| Aging              | Bowel dysfunction            |
| Allergic reactions | Cancer                       |
| Alzheimer's        | CFS/FM                       |
| Anxiety            | Chronic bacterial infections |
| Arthritis          | Chronic viral infections     |
| Autism             | Cytoskeletal breakdown       |
| Bipolar disorder   | Diabetes                     |

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Down's syndrome	Neural tube defects
Heart disease	Pneumonia
Herpes	Psoriasis
Huntington's disease	Renal failure
Language and cognition impairment	Rett's syndrome
Leaky gut	Schizophrenia
Leaky gut syndrome	Seizures
Metal toxicity	Sleep disorders
Miscarriage	Systemic Lupus Erythematosus (SLE)
Mitochondrial disease	Thyroid dysfunction

Let's look at a sampling of the issues arising from inadequate methylation.

### ***Repairing and Building DNA***

One extremely crucial function of methylation is its role in the synthesis of DNA. DNA carries the blueprint, or genetic coding, needed to build the components of living organisms. Every time your body needs to repair the gut lining, or create an immune cell to respond to an immune threat, or to heal when you have cut yourself, you need to synthesize new DNA. But without a functioning methylation cycle, your DNA is not going to replicate properly. Why?

DNA is composed of building blocks called nucleotides, chemical compounds that contain four bases—cytosine, guanine, adenine, and thymidine. Several of the enzymes involved in the creation of these bases are a part of the methylation cycle. For instance, one gene has the very long name of methylenetetrahydrofolate reductase (commonly abbreviated as MTHFR). As you can see from the beginning of its name, MTHFR contains a methyl group. That is why a mutation in the gene responsible for making this enzyme may impair the ability to make the necessary elements for DNA. As we will see later, the base most affected by the lack of methylation is thymidine.

Undermethylation is also responsible for what is known as “trinucleotide repeat disorders.” The bases are arranged on our genes in sequences of three, or “trinucleotide repeats.” But unless those three-base sequences are methylated, they will repeat themselves as much as a thousandfold, creating various serious conditions, such as Friedreich's ataxia, Fragile X and Huntington's disease, depending on which sequences are repeated. When there is insufficient methylation and these three-base sequences repeat themselves into very long sections, they also attract



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the limited number of methyl groups that are available, increasing the risks for these disorders.

Very similar to DNA is RNA, which is crucial to building proteins, transferring the information carried by your DNA and regulating your genes. In fact, RNA is even more abundant in your body than DNA. Just to keep your DNA constant—without even mentioning the amount of nucleotides we need for RNA, the body requires enormous amounts of nucleotides, the building blocks of DNA and RNA. One reason I suggest the use of RNA and nucleotides as supplements is to take some of the burden off the body, so that instead of the body needing to utilize the methylation cycle to make so many of its own building blocks, we supply some of those building blocks, leaving methyl groups for some of the other important roles we have mentioned. For example, when certain cells can't make enough of the bases adenine and guanine on their own to keep up with the body's needs, we are able to take some of the burden off the system by supplying RNA. Later in this book I'll discuss the special RNAs (and nucleotides) we use to support the body.

The use of RNAs and other supplements can help to provide the body with what it needs even in the presence of mutations. Nearly all children with autism have impaired function (the blockage on the highway) caused by the genetic mutation in MTHFR along with mutations in other genes in this pathway. Now, suppose that a child also has had environmental exposure to thimerosal, a mercury-containing preservative used in many vaccines, which can also interfere with methylation. When both things occur together, they interact and further weaken the body's ability to perform key functions.

Here's another example: Another one of the enzymes critical to methylation, methionine synthase (MTR), requires an active form of vitamin B12 in order to function properly. The body's ability to supply B12 can also be impeded by the MTHFR mutation. Further, research has shown that mercury adversely affects this reaction, and so it can impede DNA methylation. With both the mercury present in the thimerosal and the MTHFR mutation you now have two accidents (the MTHFR mutation and mercury exposure) on the highway, causing a roadblock (impaired MTR function.) It's going to be that much harder to clear two accidents and a roadblock than it would be to clear just one accident in order to restore adequate methylation function. The end result? Greater difficulty in creating the building blocks for DNA.

## ***Immune Function***

Methylation also plays a key role in the ability of our immune system to recognize foreign bodies or antigens to which it needs to respond. Whenever there is an assault on the immune system, the body must synthesize new T cells, which belong to your white blood cells. These cells help fight viral and parasitic infections,

and are also needed to help to control B cells, which produce antibodies. Due to mutations in the methylation pathway, you may lack the ability to produce the methyl groups necessary for making new T cells. When that occurs, there is an increased tendency to produce B cells, which may therefore result in an autoimmune disorder. When I and my practitioner colleagues look at the blood work of many of the children, we often find these kinds of imbalances—they have too many auto-antibodies, not enough of a T-cell response, and too much of a B-cell response. I have seen several cases in which the level of auto-antibodies has declined after proper methylation cycle supplementation.

Methylation of DNA also regulates immune cells. Immune receptor DNA is initially in the “off” state and remains that way until the immune cells need to differentiate in order to respond to an intruder. As you will learn in greater detail below, at that time the DNA loses its methyl groups in a regulated fashion and the DNA is turned “on.”

As we have just seen, methylation is generally correlated with the silencing of genes. But research has also shown that when genes are not methylated at specific points, the immune system can be tricked into reacting against itself.

So, to sum up, methyl groups help turn your genes on and off. They also help determine the ways your immune system reacts. Unless methylation is operative, the immune system may react when it’s not needed, creating autoimmune disorders, or fail to respond to actual threats when it is needed.

### ***Digestive Issues***

The functional areas impacted by improper methylation are in a dynamic relationship with one another—that is, they are mutually interactive. So it is with the relationship of your immune cells to digestive issues. Since many of your immune cells reside in the digestive tract, there’s a close relationship between methylation, immunity, and such digestive problems as leaky gut, allergies, and various forms of digestive distress that the children commonly experience. Briefly, if methylation is low and T cell production is low, then histamine levels tend to be high. Histamine is linked to inflammation, a contributing factors to leaky gut as well as allergies.

### **↓ Methylation ↓ T Cells ↑ Histamine ↑ Inflammation**

With the underactivity of T cells, B cell activity can take over, which can lead to autoimmune issues like allergies and food sensitivities. That’s why so many children with autism benefit from a gluten-free, casein-free diet. While some practitioners working with children with autism recommend this type of diet, knowing the underlying biochemistry helps explain why it often proves helpful.

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## ***DNA Silencing***

Methylation is critical to what we call “gene expression.” Although your genes never change, they can be active or inactive, as we saw earlier in this chapter. The body turns on (expresses) a gene, or turns off (silences) a gene. Whether it’s preferable for the body to either express or silence a gene depends on its role.

How does this work? To regulate our DNA, to help to turn it on and off, the body adds methyl groups to the DNA strands. If you think of your DNA as a charm bracelet, it’s as if the methyl groups are hanging off the bracelet at different points. Wherever there is a methyl group on the bracelet, those genes will be silent, and wherever the methyl group is removed, those genes will be expressed. A lack of proper methylation means that DNA that should be quiet can be expressed, and this may cause specific changes in the body. For example, many children change hair color as they grow older. A child with blonde hair may change into a brunette. This is because the gene for brown hair, which was switched off, becomes switched on. Lactose intolerance is another example. You may be able to easily digest milk as a child, but once your gene for lactase, the enzyme for digesting milk, is switched off, you no longer can.

Of course, gene expression or silencing can have far more significant consequences than hair color or lactose intolerance. Take the measles, mumps, and rubella (MMR) vaccine as an example. When viruses (such as those contained in this vaccine) are inserted into your genome, it’s not healthy for those viruses to be “turned on” and become active. However, without adequate methylation, that’s exactly what can happen. Unless you have adequate methyl groups that attach themselves to the viruses to silence them, they can become active.

What occurs if these genes are activated? Instead of evoking an immune response that grants resistance to measles, mumps, and rubella, as they are supposed to, these vaccines can produce an entirely different, unwanted effect. The recipient of the vaccine can become subject to chronic infection from these activated viruses that now, like a Trojan Horse, have taken up residence in the body. In a similar way, methylation plays a role in carcinogenesis, the growth of cancer cells. If, due to inadequate methylation, DNA isn’t regulated properly, then it doesn’t send the right signals, and cell division can become uncontrolled, resulting in cancerous growth.

When there is improper methylation, not only will the DNA bracelet lack the methyl groups that can turn your genes on and off, but the bracelet itself, the actual DNA links on the bracelet, will not be as stable.

## ***Neurotransmitter Balance***

Neurotransmitters are chemicals that control the signals between a neuron, a

nerve cell, and another cell. Impaired methylation results in a lack of the components needed to generate neurotransmitters like serotonin, which regulates mood, emotion, and appetite, as well as problems converting serotonin to melatonin, so we can sleep at night. Many of the children I see have difficulty sleeping because they can't utilize their bodily stores of serotonin and convert it to melatonin. Adults with chronic fatigue and fibromyalgia also frequently complain about sleep issues. Imbalances in the methylation pathway will also affect the neurotransmitter dopamine. Proper dopamine signaling requires that the dopamine receptor be able to move freely within the cell membrane. The dopamine receptor, located on the cell surface, is like a fishing pole that catches dopamine. Methylation supports receptor activity by keeping the phospholipids in the cell membrane fluid. Membrane fluidity also aids proper signaling of the immune system and protects nerves from damage. The symptoms of diseases such as ALS and Alzheimer's disease result from nerve damage.

In the methylation pathway, one crucial component for neurotransmitter balance is the component, S-adenosyl methionine, or SAMe (pronounced "sammy"). SAMe is the most active methyl donor in your body, bringing methyl groups to numerous chemical compounds in your body. It also acts upon the neurotransmitters by changing them into other needed compounds. If we don't have sufficient SAMe—or if SAMe can't be recycled due to weaknesses in the methylation cycle, this can result in imbalances in our neurotransmitters, which in turn can impact mood, focus, sleep patterns, and a range of behaviors.

### How We Use SAMe

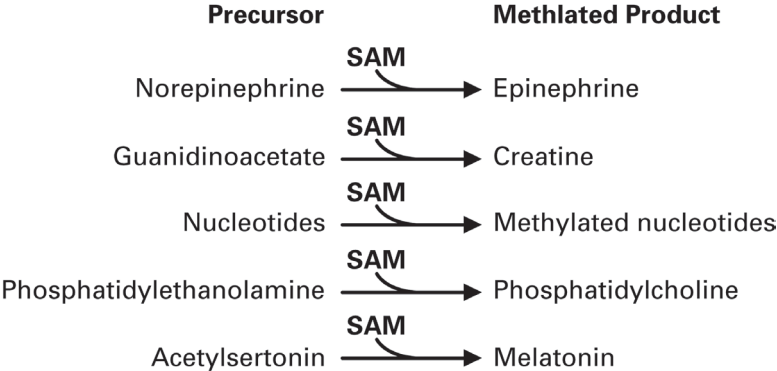
- To convert serotonin to melatonin, which supports the ability to sleep
- For glutathione synthesis, which is critical to the body's ability to detoxify
- In the formation of many proteins, including myelin, the nerve sheaths that are so important to proper nerve firing
- In the creation of CoQ10, creatine, and carnitine, compounds essential to the work of the mitochondria, the energy factories of our cells
- To convert the neurotransmitter norepinephrine into epinephrine, (also known as adrenaline)

Together norepinephrine and epinephrine regulate the fight-or-flight response and, along with dopamine, are critical for attention and focus. That's why psychostimulant medications such as Ritalin, Dexedrine, and Adderall are prescribed to people with ADD to help increase levels of norepinephrine and dopamine. In the neurotransmitter test results for children, I often see excess norepinephrine.

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Because there's not enough SAMe, with its methyl groups, it's a challenge for the children to convert sufficient amounts of it to epinephrine. This is one contributor to ADD behavior. In addition, every time the body makes norepinephrine, it automatically reduces the level of the neurotransmitter dopamine, which is, I believe, one of the critical features for recovering language in children with autism. That's why it's important to address both these factors together through supporting methylation function.

The methylation pathway not only has to produce SAMe, it also has to recycle it. Once SAMe has given up its methyl groups to help create neurotransmitters, it is then "recycled"—that is, re-methylated. After SAMe has received its new methyl groups, it can perform its job all over again. Because of its essential role



in reactions involving neurotransmitters, it's not surprising that a lack of SAMe plays a role in neurodegenerative conditions. Due to methylation pathway weaknesses, some people can neither produce nor recycle SAMe. Fortunately, we can supplement SAMe to bypass mutations and attain its many benefits.

### ***Metal Detoxification***

Certain metals are referred to as "heavy" because they have a high atomic weight, at least five times greater than that of water. Not all heavy metals are bad. In fact, the body needs about seventy friendly trace-element heavy metals. Zinc is a common metal that is needed for a number of reactions that occur daily in the body. However, in addition to the heavy metals that we need in our bodies, there are twelve heavy metals that are poisonous to humans, and four in particular—lead, cadmium, mercury, and arsenic—that are especially toxic, even in low concentrations. Nickel, thallium, and tin, among others are also toxic when found in high amounts in the body. Through its publications, the Environmental Protection Agency recognizes our increased exposure to heavy metals. Not all toxic metals

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are heavy. For instance, high levels of aluminum in the body can cause a range of negative effects, and while aluminum is a toxic metal, it is not a heavy metal.

Increasingly, through industrial and agricultural waste, these metals have entered the air and soil and water and are now present in the food supply. The toxic metals gather in the soft tissues and bones of the body and contribute to the epidemic of degenerative illnesses we see today globally, and in all age groups. They begin to accumulate with the amount you get from your mother in utero, and continue throughout out life.

Common sources of heavy metals include:

- Inhalations from metals released into the air from industry and pollution
- Consumption of metals in foods (such as mercury in fish)
- Absorption of metals used as ingredients in skin and body care (such as aluminum in deodorants)
- Use of medications containing metals
- Injection of metals via vaccinations

Because these metals tend to carry a positive charge, they combine easily with negatively charged molecules to form complexes.

How, exactly, do heavy metals overload your body? In the walls of your arteries, these metals can impede the normal flow of blood. In your adrenal glands they can reduce the production of hormones and can cause premature aging, stress, lowered sex drive, and aggravation of menopause. In your cells, they may interfere with a wide range of metabolic processes. They can cause problems such as depression and impair your ability to think clearly. They can aggravate conditions like osteoporosis and hypothyroidism. High levels of metals also impair myelination, the process of coating the nerves, resulting in misfiring. Memory and cognition are therefore directly affected by metal toxicity.

But the most serious problem, which I'll address more fully in the next chapter, is that they contribute to the weakening of the inner biochemical environment of your body. As a result, opportunistic bacteria, viruses, parasites, and fungi are able to thrive in your body creating a dual challenge. That's why the programs offered later in this book will help support the detoxification of both metals and microbes.

Metals can be extremely difficult to remove, and sometimes their presence cannot be easily determined by testing. One reason this occurs is that some metals, like mercury, can be hard to detect as they may be tightly associated with virus or bacteria in your body. This is another example of the interaction of two ac-

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accidents on the highway—metals and microbes (viruses and/or bacteria). Alone, each can be an issue, but together they may have an additive effect, just as two accidents on the same roadway can have a greater impact on traffic flow than two individual accidents on different highways. If, due to improper methylation, this situation does occur, then metals and microbes can inhabit your cells together, and the former may not be easy to detect. However, using the approach outlined in this book, when we first support the methylation cycle and next address infections, we often see an excretion of metals as well, traceable through standard biochemical testing.

Many of the symptoms we see in autism resemble those of heavy metal toxicity. That is why some doctors treat autism through metal chelation (binding) and detoxification, and as a result of these treatments we often see improvements in cognitive function, speech, and other areas of functioning. Because of this empirical confirmation, detoxification has become a major focus in the holistic approach to autism and other disorders.

However, not all physicians are well versed in the rationale and methods of detoxification, and not everyone can accept the image of the body's being full of toxins. Let me assure you, we are exposed to them, and they remain unless we successfully detoxify. Certain bodily pathways help us to do that. A growing body of genetic research clearly shows that a variety of genes serve a detoxification function and that specific genetic impairments in those genes may increase the risk of disease.

A number of agents are currently utilized for chelation of heavy metals, including DMSA, DMPS, EDTA, glutathione, alpha lipoic acid, and garlic. Interestingly, each of these agents also has antiviral capabilities. Garlic is well known as an antiviral, antifungal, antibacterial nutritional supplement. Glutathione is one of the body's most important defense mechanisms against viruses. There are examples in the literature of EDTA eliciting virus from cells. DMSA, which is widely held as solely a mercury chelator, has been described in the medical literature as having antiviral activity, more specifically antiretroviral activity (measles and mumps are retroviruses). DMSA is commonly used to help chelate heavy metals and for detoxification with children exhibiting autistic behavior. However, it is important to realize that DMSA has been shown to trigger the inflammatory mediator TNF alpha, so it is important to use caution and actively add agents that can effectively reduce and/or control inflammation when using DMSA. DMPS is also listed on the NIAID therapeutics database as showing antiviral activity against HIV. Both DMSA and DMPS have potential side effects and should be used with caution and under the care of a doctor familiar with chelation protocols.

It is possible that all of these chelating agents act to both chelate heavy metals as well as to trigger the removal of chronic virus-containing metals from the body. The “detox rash” with which most parents of children with autism are familiar may in some cases be a viral rash, as chronic virus is eliminated from the body along with the excretion of toxic metals. To use the example again of automobile accidents tying up traffic, this would be like removing two disabled vehicles at one time, and letting through the flow of cars.

### *Methylation and Detoxification*

As I just mentioned, one common method for removing metals used by some doctors is a process called chelation. Chelating agents like EDTA bond chemically with the metal ions and make them water soluble, so they can be carried away by the blood and excreted harmlessly. But some of these toxic metals are so bound up and sequestered in the body that traditional chelators cannot get to them. An important part of the protocol presented in this book is a proprietary approach to metal detoxification that allows us to target these sequestered metals, along with microbes in the body. The success that this new approach is providing is seen in clinical improvements, along with significant increases in urine and/or fecal excretion of toxic metals. These results suggest that these chronic infections efficiently bind toxic metals in the body where no chelating agent seems to be able to effectively remove them. These results are observed even with patients who, it was thought, did not have significant levels of mercury. Yet, in these patients, there is a substantial release of mercury and other toxic metals as the viral and bacterial load is reduced, and patients’ symptoms improve dramatically.

One major reason that we need a well-functioning methylation cycle is that the methyl groups the cycle produces can help in the removal of these metals. For example, with arsenic, methyl groups do this by directly combining with these sequestered toxins and removing them. Most of the methyl groups used for metal detoxification are donated by SAME. However, you need a well-functioning methylation cycle to produce all the components (including SAME) that create sufficient methyl groups. Overall, having a functional methylation cycle can also help to reduce the bacterial or viral load, indirectly aiding in toxin excretion. However, with mutations in this pathway, the body may have difficulty addressing toxin excretion, which is why testing and supplementing for genetic weaknesses on the pathway can be so important.

On the other hand, the fact that methylation is so necessary for detoxification but environmental toxins can disrupt methylation creates a toxic catch-22.

For example, cadmium inhibits the methylation of phospholipids, which affects your cellular membrane function. And arsenic, nickel, and chromium can cause overmethylation of DNA, which can result in turning “off” important regulatory genes, such as tumor-suppressor genes. Genetic testing reveals that some people



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have a tendency to produce insufficient numbers of methyl groups. Obviously, this factor alone reveals why a one-size-fits-all treatment approach is not helpful. That's why testing is so vital.

Researchers have found that many children with autism do not make enough of the antioxidant glutathione, which is also crucial to removing toxins from the body. When the methylation pathway is dysfunctional, the body can't produce sufficient glutathione. Further, if the cellular mitochondria are dysfunctional—as they are in some children with autism—they will produce more free radicals as a byproduct and deplete the body's glutathione. Toxic metals such as aluminum can decrease mitochondrial energy, contributing to mitochondrial dysfunction. What's more, higher bacterial loads can cause the body to retain aluminum. So, first, aluminum and bacteria can interact to decrease mitochondrial function; impaired mitochondria create a greater need for the anti-oxidant glutathione; however due to impaired methylation the body can't produce the glutathione it needs—another example of the multifactorial, multilayered nature of this condition.

## ***Inflammation***

Inflammation has been implicated in a host of health conditions. There is a reciprocal relationship between methylation and inflammation, almost as if they were on a seesaw: increased inflammation will tend to decrease methylation and vice versa.

Let's see how this works. IL6 and TNF alpha are two bodily biochemicals that lead to inflammation. They frequently arise in response to stress. Higher levels of these inflammatory chemicals exacerbate low methylation status.

Under-methylation contributes to several kinds of inflammation in your body:

- Heart and vascular inflammation
- Autoimmune disorders
- Neurological inflammation

## **Heart and Vascular Inflammation**

Proteins, especially meats and dairy, contain the amino acid methionine. Notice the prefix “meth”—indicating that methionine contains a methyl group. At a certain point, methionine converts to SAME, which as I mentioned earlier is the biggest methyl donor in the body. SAME travels around providing methyl groups to hundreds of reactions, and enables many processes to take place. Once SAME has delivered its methyl group, it becomes homocysteine, which is then ready to transform itself back into methionine, so the process can begin again. But

supposing there are too few methyl groups and homocysteine can't convert back to methionine? In that case, homocysteine levels build up in the body, producing inflammation, heart disease, poor circulation, degenerative and other health conditions.

To prevent congestive heart failure, the body needs adequate levels of CoQ10. Clinically, CoQ10 has been used in the treatment of angina, heart failure, and after coronary artery bypass and cardiomyopathy—inflammation and weakening of the heart muscle. The synthesis of CoQ10 requires components of the methylation pathway—in particular, adequate levels of SAMe. Elevated homocysteine levels bring an increased risk of heart disease. Researchers have seen this increased risk in those with a particular mutation, C677T, in the gene MTHFR, which is located on the methylation pathway. Many of the children have this mutation, and their parents may have it as well.

### **Autoimmune Disorders**

#### *Arthritis, Lupus, Diabetes*

Part of what I believe often occurs with autism is too much emphasis on the B-cell immune response, which is mediated by antibodies, relative to the cell-mediated response, which is mediated by the T cells. This may be due (at least in part) to the fact that the methylation cycle is needed to make new T cells. Unlike B cell clones, which are “set for life” so to speak, T cell clones need to expand “on demand.” This expansion requires the synthesis of new DNA and RNA, a task that in turn requires building blocks generated via the methylation cycle. A prevalence of immature T cells increases the inflammatory response if not properly regulated. This dysregulation commonly occurs when there are adequate helper T cells to aid in the antibody response but a lack of enough suppressor T cells to control that response—resulting in autoimmune disorders like lupus, rheumatoid arthritis and type-1 diabetes.

#### *Allergic Reactions*

Histamines, as I mentioned earlier, cause allergic reactions when they are released in response to antigens. Histamine levels in your body are dependent on the methylation cycle because histamines are broken down, or deactivated, by receiving a methyl group. Impaired methylation therefore leads to abnormally high levels of histamine and increased allergic sensitivity, something we often see in children with autism.

Another factor leading to inflammation is inflammation itself. Chronic inflammation creates an undesirable feedback loop: improper functioning of the methylation cycle produces inflammation, while inflammation worsens the ability to methylate properly.

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## Neurological Inflammation

Excitotoxins are a significant contributor to neurological inflammation. These chemicals do just what they say—they excite the neurons to fire and ultimately lead to nerve cell death. This can occur over many years—by the time an individual experiences symptoms, the damage has been done. That’s why, in this program we take active steps to limit excitotoxin damage.

Excitotoxins occur naturally in the body, but they have also been added to our food supply in huge quantities in the last fifty years. Monosodium glutamate, aspartame, hydrolyzed vegetable protein, and other additives—all these excitotoxins stimulate your taste buds and mask the real taste of food. Commonly, they are added to enhance the flavor of artificial and processed foods, which wouldn’t taste very palatable without them; natural foods, in addition to their higher nutritional value, don’t require this form of flavor enhancement. Excitotoxins in food overexcite the neurons to the point where they become inflamed and begin firing so rapidly they become completely exhausted or die. Companies producing these excitotoxins sometimes claim that, since glutamate is found naturally and abundantly in the brain, additives that contain it, like MSG and aspartame, are “natural” and therefore not harmful. That is misleading, since you must take into account that, in the body, glutamate exists only in very, very small concentrations. When the concentration rises above this very minute level, your neurons can become overexcited and fail to fire normally.

Further, a wide variety of nutritional supplements contain glutamine or glutamate, while many consumers and practitioners remain unaware of its potential for harm in genetically susceptible individuals. It’s my recommendation that you read labels on food products and supplements to determine whether they have added glutamate. If they do, eliminating them is one of the very first steps in this program, as detailed in Part Two of the book. While there are many steps in the program, as well as individual variation in how each person must go through it, one thing everyone without exception can safely do is limit neurological inflammation by eliminating excitotoxins in the diet.

In addition to food additives and supplements, bodily glutamate load can also increase due to mutations in the methylation pathway. If the methylation pathway is not functioning optimally, folate—a polyglutamate—sits around unused and can break down into glutamate. This, by the way, may also have the effect of increasing intelligence, because to handle that excess load of glutamate, you increase the number of your glutamate receptors, and this can correlate with high intelligence—something I find in many of the children I work with. So mutations in the methylation pathway drive both the excitotoxin damage and may also help to explain the high intelligence observed in children with autism. Through this program, my aim is to foster the intelligence, while limiting the damage.

### ***Membrane Fluidity***

Why do we need our cell membranes to be permeable? The cell membrane surrounds your cells like a protective skin and selectively regulates what enters and exits. Certain proteins embedded in your cell membranes also act as signals between cells, coordinating cell actions like growth, tissue repair, and immune response. Still other proteins on the surface of the membrane, known as markers, identify cells to each other. For all these subtle processes to work properly, your cell membranes have to have exactly the right composition—the right amount of fats, or lipids, in combination with proteins and phosphates. Think of the signaling and marker proteins as large rafts in a sea of phospholipids. If the sea is fluid, then the rafts can move around as needed. But if the sea is solid, like Jell-O, then the rafts cannot move and ferry around what they are intended to transport. Here again, methylation is a crucial player. As mentioned earlier, the methylation of phospholipids in the cell membranes is critical for membrane fluidity. Without proper methylation, due to mutations in the methylation pathway, there may be insufficient methyl groups necessary for this task. As a result, membrane fluidity is directly affected by improper methylation, and signaling between cells may be impaired.

### ***Energy Production***

All cells need to produce energy to survive, and they produce it via a process called the Krebs cycle, also known as the citric acid cycle. This metabolic pathway produces the energy “currency” of the body, known as ATP. The Krebs cycle takes place within the cell in an organelle known as the mitochondria. Think of mitochondria as a cellular power plant, or the engine on a train—you have to keep shoveling coal into it to keep the train moving. The Krebs cycle is closely connected to the methylation cycle, and any impairment of one impacts the other. Essential to the action of the mitochondria are carnitine and CoQ10, both of which are dependent on the methylation pathway. That’s why at certain phases of the program, people often supplement these two bodily components.

### ***Carnitine***

L-carnitine is the compound that transports long-chain fatty acids into the mitochondria so they can be broken down for energy. In fact, it is one of the few natural materials known to allow fats to cross the mitochondrial membrane, so it is crucial to fat metabolism. This is important because mitochondria fatty acid oxidation is the main energy source for heart and skeletal muscle. The synthesis of carnitine in the body begins with the methylation of the amino acid L-lysine by SAMe, which demonstrates the close interrelationship between the Krebs and methylation pathways.

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## **Coenzyme Q10**

Coenzyme Q10 is an enzyme essential to the production of ATP—it's involved in 95% of the energy-producing reactions in your body through its role in electron transport. CoQ10 delivers electrons to precisely the right places during the formation of ATP. CoQ10 is also a very powerful antioxidant, which helps to protect the mitochondrial membrane and cell walls from attack by free radicals. And just as with carnitine, the synthesis of CoQ10 by your body depends on the methylation pathway.

Low muscle tone and extreme muscle weakness, which we often see in children with autism and adults with chronic fatigue, may in part be due to decreased mitochondrial energy—and, as we will see below, to myelination problems resulting from reduced methylation cycle capacity.

## ***Protein Activity***

I've already discussed how DNA, which contains your genetic information, is regulated by methyl groups—CH<sub>3</sub> groups—that attach to parts of the DNA and turn genetic information on and off. If methylation is impaired, then the wrong information may be expressed, or information that should be expressed, isn't. Through the intermediary work of RNA, the DNA in your body is used to create specific proteins, that is, the building blocks for your cells and tissues. RNA may be “arm” or “lip” or “liver” RNA, that provides the blueprint for building those specific proteins. Each of them is made up of amino acids in specific combinations, and here again methylation is crucial with regard to how those proteins are arranged. Impaired methylation means trouble at both ends of this process—at the DNA end and in the formation of the proteins themselves.

## ***Myelination***

Think of your nerves as wires. Without insulation, the wires will short circuit. In the same way, unless your nerves are coated, they cannot transmit messages accurately and efficiently. Methylation is directly tied to the production of the myelin that coats the nerves, a process called myelination. The most commonly known myelination defect is multiple sclerosis, an ailment in which antimyelin antibodies are made; antimyelin antibodies are frequently found in children with autism as well. Myelination requires methylation.

Without adequate methylation, the nerves can't myelinate in the first place. Second, they can't remyelinate after insults such as viral infection or heavy metal toxicity. And without myelination or remyelination, there is inadequate “pruning” of nerves, leading to excessive, dense, and bunched wiring, unused neural connections, and the misdirection of nerve signals.

### **The Role of Methylation in Health Conditions**

Although it's not within the scope of this book to delve deeply into the role or treatment of the wide range of adult disorders impacted by the methylation cycle, I'll touch briefly on a few of them here. Some researchers have focused on specific genes in this pathway because of their possible connection to certain adult conditions, prevalent in our society today.

#### ***Cancer***

Undermethylation of the entire genome is referred to as “global hypomethylation.” Global hypomethylation, when paired with overmethylation of specific, repeated genes, is associated with both aging and cancer. Both undermethylation of tumor-causing genes (genes that should be switched off but are switched on) and overmethylation of tumor-suppressing genes (genes that should be switched on but are switched off) are contributing factors to cancer. Improper methylation can also contribute to the inability to inactivate estrogen, and excess estrogen has been linked to an increased susceptibility to hormone-sensitive cancers. Epidemiologic and mechanistic evidence suggests mutations in the methylation pathway are also involved in colorectal neoplasia (colon cancer) as well as a number of other cancers.

#### ***Pregnancy Risks***

Periconceptional supplementation to support the methylation cycle helps to prevent a wide range of potential risk factors in pregnancy, including miscarriages, neural tube defects, and others. That's why in an ideal world, all parents considering conception would go for genetic testing first and support any defects to assure a healthy pregnancy, birth, and child. We know that mutations in the MTHFR genes of the methylation pathway, as well as mutations that lead to decreased B12, are risk factors for neural tube defects. Mutations in the methylation pathway, specifically methionine synthase (MTR), methionine synthase reductase (MTRR), as well as elevated homocysteine, are risk factors for having a child with Down's syndrome.

It's important to consider methylation pathway mutations when supplementing folate during pregnancy. Using folate during pregnancy helps to decrease the risk of neural tube defects. This does not change the DNA but has a regulatory effect on the ability of the DNA to be expressed, known as genetic expression, or epigenetics, which I've discussed throughout this chapter. Running a Nutrigenomic test to determine the appropriate form of folate is critical, because the wrong kind of folate can block the ability to absorb and use the right kind of folate. Although many supplements contain common folic acid, about 40% of people cannot use it and need to take a different form of folate. Genetic testing can reveal this.

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## ***Aging***

Methylation pathways decrease in function as we age. DNA methylation is also known to decrease with aging. These age-related decreases in methylation can also lead to decreased methylation of T cells, which may, in part, explain changes in your immune function with age. Age-related decreases in methylation, for example, can result in increased levels of homocysteine, increasing the risk of arthritis, cancer, depression and heart disease. Increasing the body's level of methylation through supplementation may extend healthy life span. A clearer idea of your specific methylation cycle mutations may help you to customize supplementation to bypass mutations for better methylation cycle function.

## ***Infections, Bacteria, and Viruses***

Viruses are very old—they've been around longer than humans, and so from an evolutionary standpoint, have had a lot of time to learn how to trick the body. Like cells, viruses have a membrane. But viruses are basically parasites, with proteins sticking up from their surface that snatch components from your cell membranes, or fuse with them.

Remember, that methylation is necessary to silence viruses. When viruses build up in the system, they can hang onto and store heavy metals. When we look at the possible interconnection between vaccinations and autism, it's evident that vaccinations can deliver viral and metal loads into the newborn infant and developing baby and child. The rising rates of autism indicate that, for a variety of reasons, a growing number of children may not be able to tolerate those loads. Instead of instigating the desired immune response, the child's immune system is literally overwhelmed. Whether these responses are due to higher environmental exposures to these toxins or certain weaknesses in the child's methylation pathway, supplementing with the appropriate nutrients prior to vaccination may perhaps compensate for that increased exposure or weakness. With that support, the child's immune system may be able to produce the desired immune response, rather than become overwhelmed. Moreover, knowing the risk factors may help parents make decisions to delay vaccinations or to avoid vaccinating at times of higher risk, as, for example, when the child's immune system is already addressing an infection or other health challenge.

## **Methylation: Nature vs. Nurture**

A July 9, 2005 article in *Science News* reported that, although identical twins have identical DNA, they often have differences in a number of traits, including disease susceptibility. This study suggests that as identical twins go through life, environmental influences affect which of their genes are actually turned on or off. Methyl groups attach to DNA like charms on a charm bracelet—this modifica-

## Chapter 2. Nutrigenomics and the Methylation Cycle

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tion of the DNA is known as gene expression, or to use the more scientific term, epigenetic regulation. The combination of the environmentally determined addition of these “charms” to the bracelet of DNA, combined with inherited DNA changes or mutations, lead to an individual’s susceptibility to various health conditions. The scientist who headed this study, Dr. Manuel Estseller, said that “people are 50 percent genetics and 50 percent environment.”

This statement should give us some understanding as to why mutations in the methylation pathway can be so devastating. Mutations in the methylation pathway affect the “nature” half of the equation, the 50% of the pure genetic susceptibility; this would be analogous to defects in the links of the chain of our charm bracelet. But, in addition, because methylation is also necessary for the epigenetic modification of the DNA, methylation also affects the “nurture” side of the equation as well, the environmental 50%. In other words, genetically inherited mutations in the methylation pathway cause problems in the links of the DNA bracelet and environmental effects create a problem with the ability to put charms (methyl groups) on the bracelet. Problems in the methylation pathway therefore can affect 100% of our susceptibility to health conditions. This is why it’s critical for health maintenance to understand where our weaknesses in this pathway reside and then supplement appropriately to bypass these mutations. By bypassing mutations in this way, we are using the “nurture” side to both optimize “nurture” and counteract any shortfalls in “nature.”

A second study that has also addressed the nature vs. nurture question used animal models. Researchers were able to show that the adult response to stressful situations was heavily influenced by the interactions the animals had as pups with their mothers. Those pups with higher levels of care showed differences in the methylation patterns of stress-related genes when compared with pups in the lower-care test group. This work suggests that there is a bridge between “nature and nurture” and that nurturing can influence DNA methylation. However, nurture alone cannot be the answer. To use our analogy again, proper nurturing can influence the epigenetic modification of DNA, that is, it can affect the number of charms on the bracelet. But, once again, genetic mutations in the DNA sequence (the bracelet) itself will affect the overall methylation capacity in the body. Without the mechanisms to produce the methyl groups in the first place, all of the nurturing in the world will not be able to overcome the lack of ability to methylate. In other words, if the body cannot produce charms for the bracelet, how easily you are able to attach them becomes a moot point. Nutrigenomic support to bypass these mutations is necessary to address the weaknesses in the DNA that would result in reduced capacity in this pathway.

Perhaps the easiest way to explain the difference between genetics and epigenetics is to use a computer analogy. If your computer keyboard has a broken M key, when you type, that letter will always be missing from any words that



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include it. The mutations we look at are like the words with the missing M, and that will not change over time. That is one reason the Nutrigenomic profile you get today is so useful—the information will be applicable five, ten, or fifty years from now. Just as the broken M will not magically fix itself, your actual genetics and mutations will not change. But suppose you ran a spell-check after you typed a document. The spell-checker would find misspelled words and propose substitutes for them. For *ister* it would ask you if you mean *mister*, and so on. Epigenetics is like the spell-checker. It can change over time, and it can compensate for what is missing. But the spell-checker itself relies on methylation and proper nutritional support to function properly. This highlights why this pathway is so important. Using this analogy, looking at SNPs in the methylation cycle helps us to determine which keys on our computer are broken as well as to be sure that our internal spell-checker is working properly.

It's also important to keep in mind that the factors that impact the expression of our basic DNA have a broader truth and application throughout all areas of bodily function. On this program, my goal is to give you information and tools so that you can:

- Optimize function through bypassing genetic weaknesses
- Provide the supports and nutrients the body needs
- Reduce and eliminate the impacts of toxins and substances that cause bodily harm

With this program, you access ways to optimize both nature and nurture and restore health.

## Meet the SNPs

Throughout this book, I've shown you the interplay of the various factors that, taken together, can contribute to autism as well as other health conditions. What differentiates the program offered here from others is the ability it gives you to fine-tune your approach based on genetics and biochemical individuality, as captured via the Nutrigenomic testing of key genes on the Methylation Cycle. Key to following the program are the results of the Nutrigenomic test (available at [www.holisticheal.com](http://www.holisticheal.com)). Remember that, by itself, the fact that you or your child carry a specific mutation does not mean that particular enzyme is not working correctly, at 100%: these markers are indicators of potential problem areas, which can manifest as a result of other influences.

Gaining familiarity with your child's (or your own) test results is a bit like learning a foreign language. In this section of the book, my aim is to begin to introduce you to that language, so let's review some key points.

In undertaking Nutrigenomic testing, our goal is to identify which genes along the pathway have single nucleotide polymorphisms, or SNPs (pronounced snips). To help provide a sense of what you may find when you get back test results for you or your child, I'll offer a brief introduction to some of these SNPs. A more comprehensive explanation of all of them (and how they interact) can be found in my book, *Genetic Bypass*. I also continually update my findings in the online chat room, so please make sure to check there as well.

### **Why Gene Testing?**

Because of recent breakthroughs, we can now test for specific areas of genetic weaknesses. Yet, despite the great opportunity for improvement offered by understanding and addressing SNPs, this potential remains untapped for a variety of reasons. One reason is that people have felt concern about the potential misuse of genetic screening to discriminate in employment or insurance coverage. However, a federal law, the Genetic Information Nondiscrimination Act of 2008 (GINA), now offers protection to those who want to make use of this new area of science.

Other people are fearful of finding out their exact genetic weaknesses, particularly when gene testing may reveal the potential for illnesses for which there is no effective treatment. I understand this concern, and I also do not believe in testing if we have no positive way in which to address results we receive. I believe in focusing on genetics in pathways in which we do know how to address mutations that are found. I consider it a waste to possess this technology and fail to use it to our advantage. I think these kinds of assessments should be made in the context of following the program and using nutritional supplementation. In other words, targeted genetic testing is appropriate in my view when it fine tunes the approach, rather than merely serves idle curiosity.

That's why I've been using my knowledge of biomolecular Nutrigenomics to define ways to address genetic weakness through supplementation, RNAs, and other approaches. Once the molecular pathways affected by specific SNPs are known, Nutrigenomics uses combinations of nutrients, foods, and natural ribonucleic acids to bypass these mutations and restore proper pathway function. With this approach, you're not just giving yourself or your child a one-size-fits-all array of supplements without some prior indication that this particular child is going to benefit from taking them. The use of genetic testing allows us to not only know our genetic profiles, but to take full advantage of that knowledge.

This is commonly done with a simple saliva test, cheek swab, or finger prick blood sample. I prefer the blood sample because I find the results to be more consistent and accurate. So let's say you decide to go ahead and test yourself and your child. What exactly will the test reveal?

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## ***The Alphabet of Genes***

In Nutrigenomic testing, we are able to identify changes in the order, or what we sometimes call the “spelling,” of the genetic bases. These spellings are a shorthand used by scientists which deploy the letters A, T, C, and G to designate each of our four genetic bases—adenine, thymine, cytosine, and guanine—that combine in various ways. These four bases are organized into a particular sequence to create or “spell” every single one of the genes in the body. Taken together, these bases make up all our DNA.

To see how we identify mutations, let’s look at an example in which DNA fragments from two individuals vary by just a single nucleotide. In other words, one “letter” in the gene sequence differs from the norm. In our example, the difference occurs between the C and the T in the fifth position. Accordingly, Joan will have the gene sequence **AAGCCTA**, while Bill will have the gene sequence **AAGCTTA**. Scientists call these variations alleles. Most common SNPs have only two alleles. In other words, all the other “letters” in the sequence remain stable and unchanging. In our example, Joan has the most common gene allele, while Bill’s genetic sequencing contains the variation—the SNP.

What happens when you or your child has a mutation in a genetic sequence?

To understand this, let’s take a deeper look at the task performed by each gene. That task will differ depending upon the functional area that the gene impacts. A change in that gene will change the action of that enzyme, catalyst or activity. As an example, let’s say that we are dealing with mutations in genes that affect your enzymes. Enzymes do many different things. Certain enzymes join together to make components needed to perform a particular task. Other enzymes may break down one biochemical or transform it into another. Enzymes also govern the speed and efficiency with which these tasks are performed. For example, let’s say you’re sleepy one morning, so that when you went to make drip coffee, you forgot to use a filter. As a result, the grounds wind up in your coffee mug. Not good! In just the same way, if a group of enzymes that are supposed to filter out or address a harmful substance (like the inflammatory substance homocysteine) fail to do their job, you will wind up with more homocysteine than your body can manage.

Biochemical actions can also be slowed down or accelerated by enzymes. Many people would feel over-stimulated and have trouble going to sleep if they drank caffeine before bedtime. On the other hand, some individuals possess a biochemistry that can handle it. Just as the caffeine “speeds up” one’s energy, certain SNPs speed up (or slow down) certain biochemical functions. Accelerated activity can be more efficient, or it can produce undesirable effects. For example, speeding up certain neurotransmitters can result in stims. On the other hand slowing down

activities can also be problematic, causing sluggish reactions. By identifying the presence of a SNP, we can compensate for it, and give the body the support it needs to perform its tasks successfully.

### ***SNPs and the Methylation Pathway***

In this book and in my overall approach, I focus on the methylation pathway, a central pathway in the body that is particularly amenable to biomolecular Nutrigenomic screening for genetic weaknesses. In practice, I have found that virtually all individuals carry at least a single mutation in the methionine/folate pathway. As a result of decreased activity in the methylation pathway, there is a shortage of methyl groups in the body that would otherwise serve a variety of important functions.

Defects in methylation lay the groundwork for further assault by environmental and infectious agents, resulting in a wide range of conditions, including autism. What makes the methylation cycle so unique and so critical for our health is that mutations in this pathway also have secondary effects on genetic expression. In other words, they affect all three of the factors that can lead to autism.

It's my hope that this groundbreaking approach to optimizing function of the methylation pathway will serve as a model for working with genetic polymorphisms that affect other crucial biochemical pathways. Looking to the future of twenty-first-century medicine, I'm convinced that with time, research, and clinical practice, we can optimize the functioning of a wide range of other bodily processes as well.

### **How to Read the Nutrigenomic Test**

In looking over this sample, please note that there are two copies of each gene, one from each parent. When both copies are identical, they are called homozygous and indicated by (+/+) or (-/-). With a few exceptions, these symbols mean that both have a particular mutation (+/+), or that neither has it (-/-). For example, MTHFR C677T(+/+) means both genes of the methyl tetrahydrofolate reductase enzyme have a mutation on the 677th position of the MTHFR gene, where cytosine is normally found. In this case, thymidine is substituted for cytosine. If only one of the two genes has cytosine and the other has thymidine, they are called heterozygous. This is indicated by C677T(+/-) .

Although the (+) designation refers to a change from the norm, keep in mind that the definition of the norm can vary from lab to lab. This is why the call letter (the "C" in C677) is important. In cases where there is a discrepancy from one lab

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to another, the call letter can tell you that tests run from different labs have given the same experimental result, even though their reference standard was different.

To review, if an individual has a double (homozygous) mutation, its effects may be more pronounced than a single one (heterozygous.) However, by itself, the fact that an individual carries a specific mutation does not always mean that the particular activity (governed by that gene) is impaired. These markers are indicators of potential problem areas, which can then manifest either on their own or as a result of other influences. For example, while defects in the MTR (5-methyltetrahydrofolate-homocysteine methyltransferase) gene can impair detoxification, toxins like mercury can compound the effect by decreasing MTR function—creating a corresponding decrease in the efficiency of detoxification. With both the genetic mutation and the exposure, you will tend to have more of a “double whammy” than either one on its own.

## ***Basic SNPs***

When you join my online chat room, you may notice that many of the parents post their child’s SNPs after their names. This is a way they share with one another the kinds of issues they are struggling with. Knowing your child’s or your own SNPs serves as the foundation for all the supplement recommendations as well as the steps you will follow on this program. Still, there is always an interaction between the recommendations and how each individual person responds. That’s why it helps to understand which functional areas are effected by mutations, so that you can try to assess your child’s (or your own) response to supplementation. It’s also vital to always introduce supplements slowly at minimal doses, to proceed gradually and work with your doctor or practitioner.

Now let’s take an initial broad overview of some of the genes, because the enzymes they produce are important for methylation cycle function. Once again, more complete information can be found in my book, *Genetic Bypass*

- **CBS (cystathionine-beta-synthase):** regulates the enzymes that help to convert homocysteine into glutathione, a major antioxidant. Specifically, certain types of mutations in the CBS genes will produce more sulfur end products from the methylation cycle. In particular, individuals who have the CBS (+/+, or +/-) the homozygous or heterozygous variants may want to limit intake of sulfur-containing foods (like crucifers, garlic, and supplements, such as MSM as well as medications like DMPS.) Both the CBS homozygous and heterozygous mutations also have a higher risk for ammonia detoxification issues. (This mutation can also indirectly affect an enzyme called G6PDH, which has negative effects on blood sugar metabolism, red blood cell formation, and blood vessel stability, leading to easy bruising, bleeding, and broken blood vessels.)

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Gene Name	Variation	Result	Call
COMT	V158M	+/+	A
COMT	H62H	+/+	T
COMT	61	-/-	G
VDR	Taq	+/-	Hetero
VDR	Fok	+/-	Hetero
MAO A	R297R	+/+	T
ACAT	102	+/+	A
ACE	Del16	+/+	DELETION
MTHFR	C677T	-/-	C
MTHFR	3	-/-	C
MTHFR	A1298C	-/-	A
MTR	A2756G	-/-	A
MTRR	A66G	+/-	Hetero
MTRR	H595Y	-/-	C
MTRR	K350A	-/-	A
MTRR	R415T	-/-	C
MTRR	S257T	-/-	T
MTRR	11	+/-	Hetero
BHMT	1	-/-	A
BHMT	2	+/-	Hetero
BHMT	4	+/-	Hetero
BHMT	8	+/+	T
AHCY	1	-/-	A
AHCY	2	-/-	T
AHCY	19	-/-	A
CBS	C699T	-/-	C
CBS	A360A	+/+	T
SUOX	S370S	-/-	No Support Needed
SHMT	C1420T	+/-	Hetero
NOS	D298E	+/-	Hetero

- COMT (catecholo-methyl-transferase):** A primary function of the COMT gene is to help to break down dopamine. Dopamine is a neurotransmitter that is recognized for its role in attention, as well as reward-seeking behavior. It helps to cause pleasurable feelings that aid in reinforcing positive behaviors. COMT is also involved in the breakdown of another neurotransmitter, norepinephrine. The balance between norepinephrine levels and dopamine levels has been implicated in ADD/ADHD; in addition, dopamine levels are important in ailments such as Parkinson's disease. COMT is also involved in the proper processing of estrogen in the body. COMT (-/-) individuals break down dopamine effectively, and as such will be depleting methyl groups from the cycle and can tolerate more methyl group supplementation. With COMT (+/+), the homozygous mutation, the enzyme works sluggishly, essentially slowing down methylation of brain chemicals. In some situations, this is a better scenario for a child with autism, because that individual will tend not to use up excess methyl groups. However, with this profile, people may need to limit or avoid methyl donors, as excess methyl donors can lead to hyperactivity, irritability, and erratic behavior. Sensitivity to pain has recently been found to be correlated COMT (+/+) individuals.
- MTHFR (methylenetetrahydrofolate reductase):** The MTHFR gene products are at a critical point in the methylation cycle. One function

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helps to convert homocysteine into methionine, serving to keep homocysteine levels in a normal healthy range. Several mutations in the MTHFR gene have been well characterized as leading to increased homocysteine levels, which increases the risk of heart disease, Alzheimer's, and cancer. Other genetic variations in MTHFR may play a role in the level of the neurotransmitters serotonin and dopamine, as well as the conversion of BH2 to BH4.

- **MTR and MTRR (methionine synthase/ methionine synthase reductase):** These two gene products work together to regenerate and utilize B12 for the critical “long way” around the methylation pathway, helping to convert homocysteine to methionine. Mutations in MTR can increase the activity of this gene product so that it leads to methyl group depletion and greater need for B12, as the enzyme is using up B12 at a faster rate. The MTRR helps to recycle B12 for use by the MTR. Mutations that affect its activity would also suggest a greater need for B12.
- **NOS (nitric oxide synthase):** The NOS enzyme plays a role in ammonia detoxification as part of the urea cycle. Individuals who are NOS (+ /+) have reduced activity of this enzyme. NOS mutations can have additive effects with CBS up regulations due to the increased ammonia that is generated by the CBS up regulations. Mutations in NOS may also play a role in dealing with proper processing of oxidized species. This may be important with respect to oxidized species generated by the mitochondria and impact energy, as well as play a role in the aging process and our risk for cancer.
- **SUOX (sulfite oxidase):** This gene byproduct helps to detoxify sulfites in the body. Sulfites are generated as a natural byproduct of the methylation cycle as well as ingested from foods and preservatives we eat. Sulfites can also be used to prevent rust and scale in boiler water that is used to steam food, and even in the production of cellophane for food packaging. Because many reactions have been reported, the FDA requires the presence of sulfites in processed foods to be declared on the label. Difficulty in breathing is the most common symptom reported by sulfite-sensitive people. Sulfites give off the gas sulfur dioxide, which can cause irritation in the lungs, and cause a severe asthma attack for those who suffer from asthma. A person with SUOX (+/-) should be extremely careful with sulfur foods and supplements.

In addition to these major players, issues with other enzymes (and more are likely to be discovered) play a role in autism:

- **ACE (angiotensin converting enzyme):** Technically, the changes that affect the activity of this gene are not a SNP but a deletion (that means that a base is eliminated rather than substituted as occurs with a SNP) that can lead to elevated blood pressure. In animal studies, imbalances in this pathway were also correlated with increased anxiety and decreases in learning and memory. Increased ACE activity can also throw off the essential mineral balance in your system due to decreased excretion of sodium in the urine and increased excretion of potassium in the urine, provided the kidneys are functioning properly. Decreased potassium can also lead to fatigue and decreased energy production. This reaction is also tied to the stress response, in that situations of chronic stress can result in additional sodium retention and increased potassium excretion.
- **BHMT (betaine homocysteine methyltransferase):** **The product of this gene is central to the “shortcut” through the methylation cycle for converting homocysteine to methionine.** The activity of this gene byproduct can be affected by stress, and may play a role in ADD/ADHD by affecting norepinephrine levels.
- **SHMT (serine hydroxymethyltransferase):** This gene product helps to shift the emphasis of the methylation cycle toward the building blocks needed for new DNA synthesis and away from the processing of homocysteine to methionine. While DNA building blocks are important, mutations that affect the ability to regulate this gene product and interfere with the delicate balance of the methylation cycle may cause accumulations in homocysteine as well as imbalances in other intermediates in the body.
- **AHCY 1,2,19 (S adenosylhomocysteine hydrolase):** These gene byproducts promote activity through the portion of the pathway that goes from methionine to homocysteine, effecting levels of homocysteine and ammonia. Therefore, the AHCY mutations will limit those activities, and may partially mitigate the effects of CBS upregulations, such that taurine levels remain moderate rather than elevated.
- **ACAT 102 (acetyl coenzyme A acetyltransferase):** This gene byproduct contributes to lipid balance, helping to prevent the accumulation of excess cholesterol. ACAT is also involved in energy generation, through supporting the conversion of protein, fats and carbohydrates (from food) into energy. As a result ACAT mutations impact lipid balance, cholesterol levels, and energy levels, and may also deplete B12, which is needed for the long route around the methylation cycle.



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- **PEMT (phosphatidylethanolamine N-methyltransferase):** This gene interfaces between the methylation cycle and estrogen. People report that a modified form of the program used for autism also appears to benefit chronic fatigue syndrome (CFS), a condition that affects more women than men. In addition, in the methylation cycle, PEMT helps to convert phosphatidylethanolamine to phosphatidylcholine. Moreover, PEMT requires methyl donors for its activities and may therefore both impact (and be impacted by) methylation cycle imbalances.

Don't worry! You don't have to memorize these. As you proceed with the program, you will be hearing about these many times—and over time, they may become familiar to you—especially if you decide to take the test (for your child or yourself) and work with the program. Welcome to Nutrigenomic science! In Part Two we will use the foundational understandings we've built here, and show you how to use this information more specifically to follow the program.

## Chapter 3. Promoting Detoxification Safely

In addressing multifactorial health conditions, which arise from neurological inflammation, we have to consider the interplay between:

- Genetic factors that undermine efficient functioning
- Environmental factors, including heavy-metal loads; and
- Infectious agents

### Genetic Factors

In the previous chapter, I discussed how we can effectively use Nutrigenomics, the science of bypassing key genetic mutations with nutritional supplements. The foundation of this program is using these supplements to support the methylation cycle, a biomolecular, nutritional pathway that impacts many key areas of function. As we've seen, in the presence of certain mutations that are common to children with autism and/or spectrum disorders—as well as many adults who suffer from chronic conditions, the methylation pathway is not able to produce the methyl groups needed to perform a wide range of functions.

Many bodily systems act together to remove harmful substances or waste. But if these processes are not operating effectively, or if we absorb more toxins than our system can excrete or handle, our body will store them, eventually creating a toxic overload that acts as a prime contributor to ill health. Optimal methylation helps to keep toxins and foreign substances at safe levels, where they can't harm the body. However, when the methylation cycle is not able to do its job, due to either genetic factors or toxic overload, we can't eliminate toxins, which linger in the body, creating health problems. A core principle of naturopathy and other forms of holistic health care is to give the body what it needs and to remove from the body whatever causes harm or imbalance. In this chapter, I'll explore why we need to detoxify to restore health, and what we need to give the body in order to detox. In Part Two of this book, we will explore in greater detail how people actually detoxify on this program

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## Environmental Factors

The last century was a golden age of chemistry. White-coated scientists working in laboratories synthesized a continuous stream of novel substances. I know, because in an earlier part of my professional life, I was one of those scientists. Many products now in widespread daily use in food, agriculture, health and beauty, and medicine, and in our offices, factories, and homes never existed before this revolution in chemistry. As a result, human beings, animals, and even the earth itself, have been exposed to a wide range of new substances—and none of us keeps a tally of how many of them we have absorbed over our lifetime, or how much of them we retain in our bodies. While many of these new chemicals undergo some kind of testing for safety, typically these safety assessments are done one at a time. As a result, such assessments fail to evaluate the bodily effects of carrying multiple toxins simultaneously, nor do they examine how these substances interact with each other.

### *The Invisible Burden*

Why are the unintended synergies of multiple chemicals interacting in novel ways potentially problematic? To use an analogy, household cleaners containing bleach are reasonably safe if used correctly. So is a cleaner that contains ammonia. But what happens if you mix them together? Boom! You get chloramine gas, which, if inhaled, can be corrosive and actually harm your respiratory tract.

Another example comes from studies conducted at Duke University, which looked at chemicals used to protect Gulf War soldiers. The researchers found that when the chemicals were used separately, even at three times the normal doses, the soldiers had no immediate ill effects, but when used in combination, the chemicals could cause neurological deficits.

In the same way, most scientific studies aren't designed to look beyond the safety of a specific ingredient or product on its own. As a result, studies rarely make an assessment of how a given ingredient will interact with ingredients from other sources. So when we are told that a given product or ingredient has been "studied," we tend to assume that its safety has been assured. However, most often the safety assessments do not look at the many kinds of interactions that occur outside of the controlled laboratory environment, in real life. As a result, there is much that we don't know about the bodily impact of the sum total of all these novel ingredients to which we are now exposed.

But our body knows. And our body lets us know that it's gotten more than it can handle by creating a health symptom or condition.

The rising rates in the United States of chronic conditions that don't have a single apparent cause may be indicators that—over a lifetime—many people are accu-

mulating more toxins than they can handle, and that those toxins are interacting in unanticipated ways. That's why I often say that the children with autism are like canaries in the coal mine. In fact, for the logo on my website, I chose the symbol of the canary, out of respect for the children and as a constant reminder that it's not okay to allow our children to serve as the canaries in the coal mine. Miners traditionally carried canaries down into the mines because these tiny birds would act as early detectors of carbon monoxide, a deadly gas. In the same way, because they are younger and more vulnerable, children with autism are the first to register the effects of the rising levels of toxins that many of us carry.

Doctors use the terms “body burden” or “toxic load” to describe this combination of toxins that the body stores in its cells and tissues. You can think of this toxic load as an invisible backpack that each of us carries around. The heavier the backpack, the greater the burden. With a five hundred pound backpack, you are lucky to make it across the room. But with detoxification, the backpack gets lighter and emptier, and functioning becomes easier and easier. One key aspect of my program is to address this body burden, support the elimination and release of toxins that contribute to health breakdown, and lighten the toxic load in order to improve bodily functioning.

Let's look at some of the key toxins we seek to address.

### ***Key Environmental Toxins***

Our environment has changed drastically since the 1950s. With worldwide industrialization, environmental levels of toxic metals have increased markedly. Lead, mercury, arsenic, and cadmium, to name just a few, are currently found in far greater concentrations in our bodies than is recommended for optimal health and longevity.

The concentration of lead in all human bones tested anywhere on earth today is 1000 times higher than it was four centuries ago. Excessive levels of lead are problematic for multiple reasons. During the past three decades, epidemiologic studies have demonstrated inverse associations between blood lead concentrations and children's IQs at successively lower concentrations. In response, the Centers for Disease Control and Prevention (CDC) has repeatedly lowered its definition of elevated blood lead concentration, which now stands at 10 µg per deciliter (0.483 µmol per liter). The fact that associations are seen at such low concentrations implies that there is no safe level of lead in the blood.

Mercury is neurotoxic even at very low levels of exposure. Over 630,000 children a year are born with unsafe mercury levels. Coal-fired power plants alone release over 50 tons of mercury into the air annually just from burning coal for our electric power. Mercury also enters the body as the preservative in some vaccines.

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Aluminum increases the propensity of bacteria to gather and replicate in the gut. Mercury, lead, and especially aluminum, also inhibit DHPR, a key enzyme that helps to recycle BH2 back into BH4. That's important because inadequate levels of BH4 can result in a deficiency of the neurotransmitters dopamine and serotonin, impacting mood, behavior, focus, and speech.

Arsenic is an extremely toxic poison that can heighten the risk of developing cancer, heart disease, and neurological ailments. Unfortunately, it's now added to the feed of some commercially raised chickens. Cadmium, another known carcinogen, leaches into the environment through batteries and landfills. Cadmium is now being recognized as a contributor to osteoporosis and hypertension.

We'll look at the effects of these metals on the bodily processes in greater detail later.

Some people doubt the negative effects of heavy metals on our health. On the one hand, certain studies fail to find a correlation between toxic metal exposure and certain health conditions. On the other, there is inconsistency even among various governmental agencies and experts about what constitutes safe vs. excessive toxic metal levels. Maybe you have encountered this dichotomy in dentistry, where there are some dentists who advocate careful removal of mercury amalgam fillings, while others ridicule this practice and assure you that amalgams are perfectly safe. Even though the health risks of rising exposure have not been widely studied, I—like many doctors who have looked into the medical literature—find ample evidence that toxic metals are a prime contributor to the epidemic of degenerative conditions we confront today. In fact, lead, arsenic, mercury, and cadmium have been known since ancient times to have serious effects on human health. In our own era, the toxic effects of heavy metals have been well characterized. Maile Pouls, Ph.D., in a paper presented at the University of Michigan, writes:

Human exposure to heavy metals has risen dramatically in the last fifty years...Today, chronic exposure comes from mercury-amalgam dental fillings, lead-based paint, tap water, chemical residues in processed foods, and personal care products—cosmetics, shampoo and other hair products, mouthwash, toothpaste and soap. In today's industrial society, there is no escaping exposure to toxic chemicals and metals. Although we can't see, smell, or taste them, heavy metals are present in our air, drinking water, food [along with] countless human-made chemicals and products.

To repeat, these metals are absorbed into the body by our skin, by our lungs breathing in metal-laden air, and through food, water, and drugs taken both orally and injected. Although most people—and indeed some physicians—fail to draw the connection between environmental exposures and human health,

there is no question in my mind that the connection is there. I'm convinced that we require a multifaceted approach to address these complex interactions. Old models of treatment from the innocent days of the 1950s, when these exposures were not so numerous or significant, need to be reassessed.

### ***Toxic Metals and Neurological Inflammation***

How does carrying excess levels of heavy metals contribute to negative health impacts? As I discussed in the earlier chapters of this book, in my view, autism and a host of other disorders result from an underlying condition of chronic neurological inflammation. Symptoms of neurological inflammation may include:

#### **The Accumulation of Risk**

Seizures	Confusion
Depression	Anger mood swings
Irritability	Inattentiveness
Aggressiveness	Fatigue
OCD behaviors	Poor problem-solving
Disturbing thoughts	Fear
Obsessing	Anxiety
Lack of concentration	Depressive disorders
“Brain fog”	Psychosis
Loss of memory	Insomnia
Poor judgment	

A precautionary approach to health care would assess, limit, or reduce toxic loads in those at greater risk. However, it's not standard practice to comprehensively or regularly test for toxic metal loads or individual susceptibility to harm. Nor is it standard practice to take into account all possible sources of exposure. Through my ongoing research and clinical work, I've been privileged to gain an evolving understanding of the interaction of risk factors, exposure levels, and health symptoms. Although I can set forth here only a basic understanding of the role of the bodily load of heavy metals in health imbalance, this understanding is key to the rationale for the approach recommended in Part Two.

According to the garbage-in/garbage out phenomenon, our bodies want to get rid of metals and other toxic substances. The question then becomes, how well can they do that?

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Although detoxification is a natural bodily process, Dr. Pouls writes that when “heavy metals enter and accumulate in body tissues faster than the body’s detoxification pathways can dispose of them, a gradual buildup of these toxins will occur. High-concentration exposure is not necessary to produce a state of toxicity in the body, as heavy metals accumulate in body tissues and, over time, can reach toxic concentration levels.”

When we’re not able to detoxify successfully, the body will try to find any way it can to excrete toxins. For example, toxins excrete through the skin via rashes. Toxic loads can also result in dysfunctions like digestive disturbances, as the immune system (located in the gut) struggles to respond. Alternatively, the body may store the toxins in the fat, brain, DNA, or other cells. Unfortunately, we may then remain unaware that they are present.

Fortunately, naturopathy and allied holistic health practices have found ways to support the body in detoxifying by using a wide range of practices, including colon cleansing, skin brushing, saunas, and supplements that support the digestive tract and other organs of detoxification—the kidneys, liver, lungs and skin.

In addition to my own work, there are a number of protocols that emphasize metal chelation (removal of metals by an activating agent such as the commonly used substance DMPS). Some of these have proven successful in helping to reverse symptoms of autism. Others, less so. This has prompted me to develop a proprietary approach to metal detoxification that goes a step further: It allows us to target metals that may be sequestered by virus and bacteria. Using this method, parents report both clinical improvements concurrent with significant increases in urine and/or fecal excretion of toxic metals. These results confirm the supposition that chronic infections help to sequester toxic metals in such a way that most chelating agents are inadequate to remove them.

## **Methylation’s Role in Detox**

The key to my approach to detoxification involves supporting the methylation cycle. With adequate methylation, we can detoxify with greater ease; without it, our ability to detoxify is undermined. When mutations in the genetic pathways prevent the body from successfully detoxifying, we are more likely to hold on to metals and store them in our cells, tissues, and DNA, and this burden of stored metals creates a range of health problems. That’s why one crucial goal of the program I’ll introduce you to in this book is to bypass genetic mutations affecting this cycle, in order to optimize its functioning. Once we restore adequate methylation, the body is able to more readily release metals and other harmful substances.

## ***Infectious Agents***

Metal loads are not the only substances with which we must contend. In addition

to metals, there are a whole range of microbes, which include bacteria, viruses, parasites, and fungi. It's not uncommon in this day and age for people to harbor a number of chronic bacterial and viral infections in their system simultaneously. In spite of antibiotics and aggressive vaccination programs, the infectious disease landscape has become more complex in recent decades.

### Antibiotics: Symptom or Cure?

In 2004, the Journal of the American Medical Association associated antibiotic use with an increased risk of breast cancer, and in the same year the New England Journal of Medicine connected antibiotics to an elevated risk of heart disease. But do antibiotics cause (or significantly contribute to) cancer and heart disease? I feel very strongly that the need for antibiotics indicates the presence of a chronic bacterial infection in the body. The body's bacterial load may help to hold onto toxic metals in the body. Therefore, the combination of chronic bacteria and metals may contribute to cancer or heart conditions. Antibiotic use may simply be a symptom of the problem, not the problem itself. The increase in breast cancer and heart condition may be related to the same chronic bacterial issues and metal retention that we see with autism. (In fact, the same SNPs that we look at for autism are known to play a role in risk for cancer as well as heart disease.) Considering these complex interactions reveals why merely taking an antibiotic may not be sufficient to restore health. Instead, both practitioners and the general public require a deeper understanding of the true cause. We also need to grasp the health risks if these underlying problems are not addressed comprehensively. When someone needs to use antibiotics frequently, in my view this is a signal that they should be looking at their toxic metal excretion, the bacterial burden on their system, and their genetics.

That is why, increasingly, doctors consider the “total microbial or pathogen burden” and its effect upon an individual. In a sense, these organisms, like unwelcome guests, set up housekeeping wherever they can grow and flourish. Although the immune system is supposed to protect against outside invaders, when it's overwhelmed, or if there is a lack of methylation cycle function, it cannot respond, permitting these pathogens to settle in and multiply.

Let's get to know some of the ones most frequently seen. These include streptococcus, gut bacteria, and the viral load we can receive through vaccination.



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## ***Strep and Gut Bacteria***

Many women have low-level streptococcal infections, often without realizing it. The streptococcal bacterial to which a newborn is exposed in utero is the “opening deposit” in the “bacterial account,” so to speak, beginning the buildup of chronic bacterial infection.

Streptococcus infection (and the antibiotics used to treat it) can increase intestinal membrane permeability leading to leaky gut. Streptococcus can also cause a wide variety of motor and behavioral disturbances, such as OCD and facial tics. With leaky gut often comes the depletion of glutathione, one the body’s most potent antioxidants and an important defense against viruses. Streptococcal infection flourishes in a high glutamate, low glutathione environment. So higher levels of streptococcus can result from depleted glutathione and also act to deplete glutathione. You will recall from an earlier chapter that decreased methylation cycle function may cause decreased levels of glutathione.

### **↑ Glutamate ↓ Glutathione ↑ Strep Infection ↑ Leaky Gut ↓ Glutathione**

Again, we see the interplay of multiple factors that come together to create complex health conditions. We also previously spoke about the role of glutamate as an excitotoxin. Here we see another role for glutamate with respect to bacterial infection. As you go through this book and the other resources for this program you will continue to see this pattern of multiple factors coming together to help to create health imbalances.

Also, recall the role of the methylation cycle in proper functioning of the immune system. Generally, bacteria elicit a B-cell mediated immune response, and viruses elicit a T-cell immune response. However, in reaction to streptococci, the immune system engages both B and T cells, resulting in a major inflammatory reaction. That’s why chronic streptococcal infection can deplete both T and B cells, creating a vicious cycle of depleted immune response and chronic infection. For those with methylation cycle mutations, this problem can be exacerbated, since the balance between T and B cells can be impaired by insufficient methylation.

When persistent, streptococcal infection can lead to autoimmune responses and inflammatory reactions against various areas of the body, including the heart, the basal ganglia, and the GI tract.

## ***Vaccination-Induced Viral Load***

Vaccinations aim to prevent more serious conditions such as measles, mumps, and rubella infections, which can, in the worst case scenario, result in brain dam-

age, deafness, blindness, photosensitivity, and neurotoxicity. Yet as vaccines have decreased in efficiency over the years, vaccine makers compensated by increasing the vaccine's viral load, which may heighten the risk for chronic viral infection. The components of the MMR (measles, mumps, rubella) vaccine can act like retroviruses, which insert their own genetic information into our genetic material. During the viral replication process, these RNA viruses commandeer our cellular resources for their own purposes—in particular, they use our cells' nucleic acids to replicate themselves, and in the process inhibit many of the vital cellular functions, ultimately causing cell death. If the cell dies, the virus is released into the body, proliferating the infection. If the cell doesn't die, the virus remains within the cell as a chronic infection.

Multiple factors contribute to the development of chronic viral infection in response to viruses contained in vaccines. These include:

- A lack of normal gut flora
- Elevated levels of the inflammatory mediator TNF alpha
- Methylation cycle mutations
- Heavy metal toxicity
- Depletion of glutathione due to streptococcal infection

Children with the abovementioned conditions may be at heightened risk when they receive vaccinations of developing the types of chronic viral infections and gut problems that are frequently seen in this population.

### ***Herpes Viruses***

DNA based viruses like chicken pox (Varicella-zoster, or herpes zoster) or human herpes virus 6 (HHV6) can compound the problem. The impact of herpes on autism has been described by researchers. HHV6 has also been implicated in the demyelinating condition of multiple sclerosis. Recently, HHV6 has been found to be directly correlated with seizure activity. Chicken pox is known to cause neurological damage, particularly during pregnancy. As with the MMR, the chicken pox vaccine contains a live attenuated virus that can also breed a chronic infection. Cells harboring the DNA of the varicella zoster virus are prone to accumulating heavy metals. The role in autism of herpes and other DNA-based viruses warrants further exploration.

### ***Other Chronic Viral Infections.***

Certain other viruses are already implicated in neurological inflammation, including CMV (cytomegalovirus), EBV (Epstein-Barr virus), and RSV (respira-

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tory syncytial virus). These may contribute to the pathology of autism by exacerbating heavy metal retention. It's possible that any type of virus can be involved in autism—even atypical viral infections. Atypical viruses, sometimes called “stealth viruses” can evade the immune system and lead to chronic infection. Viral infection can also activate autoreactive T cells, creating autoimmune responses.

## ***Microbes and Metals***

In addition to focusing on the individual microbe, we need to understand and consider the overall context that permits the microbial burden to build.

What permits microbial overgrowth? Just as termites infest rotting wood, a wide range of bodily imbalances permit opportunistic organisms to thrive. It may not be enough to hunt down and kill an individual microbe. We may instead need to consider all of the factors that undermine health and balance in order to create an environment less hospitable to microbial overrun. That's why this program entails undertaking steps that strengthen and balance health. We introduce nutritional support (via supplementation) to target specific microbes as well as supplementation that helps to build a healthier overall gut environment.

Yes, people sometimes become ill even when taking excellent care of their health. However, just as security measures reduce the risk of an intruder in the home, so with proper health maintenance measures we can reduce the risk of opportunistic microbial invasion.

What factors create the kind of environment in which harmful microbes thrive? A close relationship exists between chronic infection and retention of metals. Metals seem to function synergistically with the microbes I discussed earlier in this chapter. As we will see, bacteria and viruses have learned to survive—and to create additional havoc in our bodies by acting as “accomplices” to these toxic and heavy metals in order to further weaken our immune system so that our bodies remain good hosts to the viruses.

### **↑ Microbes ↑ Metals ↓ Immunity**

Chronic infections in fact help these toxic metals hide in the body, where traditional chelating agents are unable to effectively remove them. As we have noted, tests may show the metal levels to be insignificant because the sequestered metals “hide,” and cannot be measured, misleading people into thinking that metal loads are not a problem.

### Accounting for Genetics When Chelating

Although there are many different kinds of programs that aim to eliminate metals, these programs may or may not be able to activate their release. Parents have reported that some widely used chelating agents will work effectively for some children. But due to genetic mutations, other children may not be able to tolerate the very same agents or get good results. That's why in my view, first accounting for the genetic profile is the foundation of safe detoxification.

Many people in the program have found that when you first account for genetic weaknesses and next support the elimination of chronic infection, you detoxify the body of metals as well. With these protocols to encourage the elimination of bacteria, yeast, parasites, and viruses, we often see the corresponding release of toxic metals from the system. This can be verified and tracked with biochemical testing. Even more critically, in many instances, with the elimination of microbes and the release of metals, parents frequently report a dramatic improvement in children's symptoms. And that of course is really the bottom line.

As the old adage has it, the proof of the pudding is in the eating. Scientific theories are further validated and fine-tuned in clinical practice. That's how our ever-changing scientific understanding evolves. When we see many children and adults progressively recovering function, alertness, and language following the release of metals as documented by biochemical tests, this affirms several things:

- First of all, it verifies the interrelationship between microbes, metals, and toxins.
- Second, it confirms the connection of this triad to certain health problems experienced by many children as well as many chronically ill adults.
- And third, when used by hundreds and thousands of people, it confirms the validity of this approach.

Finally, by definition, those undertaking detoxification of microbes and metals will nearly always be people with health challenges. As a result, it's vital to undertake any form of detoxification in a gentle and graduated way that can be tolerated. I've devised this step-by-step approach to accomplish that. That's also why I repeatedly state that it's not a sprint, it's a marathon. When in doubt, go slowly and be gentle. And as always, work with your health care provider.

To summarize, the overall goal of this program is to support the detoxification pathways that will permit the body to release both microbes and metals.

To learn more about the crucial interplay between our genetics and our environment, let's return our attention to the methylation cycle.

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## The Roots of Metal /Microbe Retention

There are a number of ways that microbes gain a foothold in the body. As I discussed in the preceding chapter, adequate methylation function is key to successful detoxification, as well as other biological processes. By supporting methylation function, we optimize the body's natural ability to detoxify—with the long-term end result that the body harbors fewer harmful microbes and lower levels of toxic metals. Here, I'll highlight just a few of the many ways methylation helps to control retention of metals and microbes:

**Methylation contributes to the production of the immune system's T-cells.** Without adequate methylation, the body may not have sufficient T-cells, the immune system's protection against invaders.

**Methylation controls viral proliferation.** Methylation function works to help us silence viruses—in other words, to hold them in the body in an inactive and therefore less harmful state. When viruses are silent, we still have them, but they are not expressed, proliferating, and creating health problems.

**Methylation helps manage metallothionein (MT).** It has been documented that viral infection can cause an increase in the level of MT proteins. MT proteins help to detoxify heavy metals, including mercury, and to balance copper and zinc in the body. However, unlike MT proteins that are triggered in response to cellular signals, MT proteins that are triggered in response to viral infection may act to sequester metals inside the cell.

Viruses are akin to parasites, and so when they upregulate and enlist metallothionein to retain metals, they are not doing it to help, but to weaken the immune system—in order to help themselves. I refer to this as the Trojan Horse strategy, because what appears to be a gift turns out to be just the opposite. The virus, in other words, takes the very same metallothionein proteins (MTs) that were meant to help your body excrete metals, and may use them to hang onto metals in order to weaken the immune system and create a better home for themselves.

This may explain the low levels of metallothionein that have been observed in children with autism. If this is in fact the scenario, then it also helps to explain the difficulty of removing heavy metals from children with autism. It would be necessary to first eliminate the chronic virus in order to fully eradicate the heavy metals from the body.

When, through Nutrigenomic testing, we identify these methylation pathway mutations, bypass them through targeted supplements, and optimize methylation, we naturally restore the body's detoxification process, so that microbes and metals can be released.

That's why the health program I recommend proceeds in a step-by-step fashion, and why it's important not to skip any step. This not only assures a complete

and thorough release of toxins, but also accomplishes it with the least possible discomfort—although of course, discomfort and setbacks may be part of the process.

After introducing support for the methylation cycle, we further support detoxification and address microbial overgrowth through the use of certain key supplements, which will be reviewed in Part Two of this book. Throughout, we are able to track the detoxification process through biochemical tests. Because each person and each child is individual, everyone has an individual pathway to healing and recovery.

Now that we've looked at certain factors that work together and separately to increase toxic load, let's look at some key areas in which toxins act to undermine health and function.

### **How Metals Interfere with Healthy Function**

As we have seen, viruses may hold onto metals, and metals in turn interfere with numerous important reactions. I'll mention some of these here, with the caveat that our understanding of these interactions continues to evolve.

In the body, mercury interferes with the methylation cycle, making a bad situation worse for those whose methylation cycle is already impaired. Lead, mercury, and a number of other toxins can inhibit a key enzyme that converts the neurotransmitter dopamine to norepinephrine. With lower levels of norepinephrine, the body cannot effectively regulate attention and focus, contributing both to attention disorders that many children experience as well as to brain fog and other focus issues that adults with ailments like chronic fatigue syndrome may experience.

#### **↑ Toxins ↑ Norepinephrine ↓ Focus**

Lead lessens energy levels by interfering in heme synthesis. The heme molecule (with an iron atom at the center) is the non-amino acid component of a protein, helping the protein's biological activity. Heme is also the component of hemoglobin that helps to hold onto oxygen in your blood. Reduced oxygenation can have a serious effect on energy levels and may be a contributing factor to fatigue. In addition, without heme, the body can't make cytochromes. The membrane of the mitochondria, the cells' energy factories, are typically loaded with cytochromes, which are needed for electron transport in and out of the mitochondria. As a result, high lead will often tend to decrease energy levels through its effect on oxygenation as well as its effect on cytochromes. Many children with autism have problems with energy. You also see energy issues in chronic fatigue, fibromyalgia, and low muscle tone. Lead plays a very strong role here along with the role of aluminum discussed earlier.

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Lead interferes with the GAD enzyme, which converts glutamate to GABA, the chief inhibitory (calming) neurotransmitter in the central nervous system. If glutamate is not converted to GABA, the elevated levels of glutamate can cause seizures and cell death, and elevated levels of glutamate also make even low doses of mercury more toxic.

**↑ Lead ↓ Heme ↓ Cytochromes ↓ Energy ↑ Glutamate  
↑ Neurological Inflammation**

As we have already started to discuss, and as I'll cover more extensively in Part Two, the amino acid glutamate acts as an excitotoxin, overstimulating neurons and causing neuronal cell death.

That's why limiting all factors (including many common foods and supplements) that increase glutamate is core to this program. Further, when glutamate levels are reduced (and brought into balance with the complementary neurotransmitter, GABA), parents often report a decrease in stims. In fact, if you implement no other suggestion from this program, simply eliminating foods that increase glutamate is vital for children with autism.

**What Are STIMS?**

Stims refers to repetitive body movements that self-stimulate one or more senses in a regulated manner. Common forms of stimming include hand flapping, body spinning or rocking, lining up or spinning toys or other objects, echolalia, perseveration, and repeating rote phrases. About 10% of neurotypical children also show stims.

It has been shown that in the absence of glutamate, neurons are affected by exposure to mercury. But we also know that in the presence of glutamate, mercury becomes more toxic. And adding to the loop of negative interactions sparked by metals and microbes acting together, glutamate levels can also rise due to infections. For example, auto-antibodies produced in response to rubella (from the MMR vaccine) may disable a key enzyme that keeps glutamate levels low. Therefore another goal of this program is bringing down glutamate.

**Infection ↑ Glutamate ↑ Mercury Toxicity ↑**

Aluminum, as I noted earlier, appears to be more closely associated with bacteria than viruses. Excess streptococci, or other unfavorable gut bacteria can contribute to aluminum retention. Under certain conditions, aluminum inhibits the

recycling of a bodily component called BH4, which can be pivotal for language development. Aluminum also inhibits the activity of acetylcholinesterase, a catalyst that regulates the neurotransmitter acetylcholine. If you cannot break down acetylcholine with acetylcholinesterase, you may get either too much stimulation or listlessness. (That is because, in this case, the same molecule, acetylcholine, causes both stimulation and calming, depending on its receptor site location.) Aluminum stores in the body can also affect thyroid function, which governs metabolism and energy levels. Aluminum also interferes with the proper functioning of the Krebs energy cycle—a double whammy as far as energy is concerned. In my experience, many females have higher levels of both aluminum and chronic bacteria. It's possible that the prevalence of chronic fatigue among women is related to higher aluminum levels. It is also possible that in females this relationship between bacteria and aluminum, combined with methylation cycle mutations, may play a role in susceptibility to breast cancer.

### Tracking Detoxification

People often wonder how exactly I spend my days. More often than not, I spend them looking at test results—quite honestly, sometimes for 12 hours a day. Over 8500 families participate in the chat room on my website, and I monitor the test results of those who choose to run their biochemical follow up tests through my office. Based on what I've seen looking at tests for close to 2,000 families over the last few years, here are the key cornerstones for success:

1. **Individualize your approach**— Each child's or adult's genetics, biochemistry, and toxic load, along with resulting health status, function, and behavior are unique.
2. **Go slowly**— Like canaries in the coal mine, the children I work with are sensitive, and that is why I always counsel proceeding slowly and gently, backing off when necessary and monitoring results
3. **Track results**— Closely monitor the interplay between test results and change.

The relationship between detoxification and recovery of function is not a straight ascent. Instead, what we often see is an advance, then slight regression, a further advance, then slight regression, and on like that. That's why it's important to have some measures to help us in the times of slight regression to ascertain whether any behavioral changes we notice are due, say, to a supplement not agreeing with a specific child or to a temporary detox reaction, with a developmental leap waiting just around the corner.



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In order to give parents and practitioners a basis for making such judgment calls, as well as to adjust supplements and monitor and validate progress along the way, at a certain stage of the program, regular biochemical testing is a great resource, and therefore is an integral part of this program. As a service, I review and comment on tests that are run through our office. I'll say a lot more about how to use and read tests in Part Two, but for now, I want to share some of the insights culled from looking at thousands of tests.

### ***Patterns of Metal Elimination***

Metals do not all leave the body at the same rate. Think of them as cars lining up at a toll booth, waiting to go through. When we follow the test results, in person after person, we've seen that the following sequence typically occurs:

Cadmium precedes lead, usually. We also tend to see nickel excreted before mercury, generally, but again, this may vary with the individual. Some individuals show no signs of getting rid of aluminum, yet once the other metals have begun to leave, aluminum will start to flow. Similarly, you may not see any mercury excretion, and then suddenly high levels start to show up as the sequestered metals are released.

If a child has very high virus levels, as indicated by antibody titers, the chances are that child is loaded with metals, even if you are not seeing them on the metal excretion tests. For example, one child with severe autism who undertook our program had been given provoked urine tests. For readers who are unfamiliar with this kind of test, the person undergoing it is given a biochemical agent to "provoke" further release of heavy metals via the urine. Despite these various tests, no mercury release was shown on his test results, leading to the conclusion that his heavy metal load was low and not a factor in his autism. Let me note that this happened repeatedly over quite a bit of time, as the family worked in turn with several different doctors. Well-trained professionals in the field of detoxification felt that mercury really wasn't an issue for this little boy. Not long after he began our comprehensive program, we started to address chronic virus in the system, and lo and behold, we started to see mercury in the test results, and then more mercury, and more mercury—the mercury just kept coming!

What is the correlation between metals excretion, like that described here, and behavior? First of all, it's vital to recognize that as a result of their different genetic polymorphisms, each child will react differently. That's why the combination of our understanding of the underlying genetics, the current status captured by biochemical tests, and the changes in the child's behavior all serve to guide us in interpreting where we stand and how to proceed in the best possible way with detoxification. Some children exhibit the worst behaviors just before they excrete high doses of metals. For other children, the behaviors are at their worst during

maximal excretion and do not calm down until after the metals have stopped flowing. A third group that I often see includes children who have the worst behavior associated with increasing creatinine levels.

### ***Using Creatinine to Monitor Progress***

This biochemical marker is useful for monitoring results and helping guide our progress with the program. In a urine test, we can ascertain creatinine levels, which act as indicators in the following way.

What happens if we can't get the creatinine values up? In general, when creatinine is high, there is more virus elimination, and following that, more excretion of metals. Generally, behavior improves after creatinine levels peak.

### **Over time, rising creatinine levels lead to increased viral excretion and increased metal excretion**

We observe that creatinine levels appear to climb with viral infection. Therefore, we can use the creatinine value as a way to follow the progress of addressing chronic viral issues. The color of the urine seems to relate to creatinine levels, such that very dark urines have higher creatinine levels and lighter urines have lower creatinine values. Obviously, creatinine levels are just one component in a complex series of biochemical reactions. But these levels are critical in monitoring the detoxification process; we'll return to them during our coverage of how to follow the program in the next part of the book.

## **Conclusion**

Although detoxification is central to this program, and even though it may literally take months and even years to release the toxic load, I just want to alert you that I never recommend that people begin immediately with detoxification. We don't want to dislodge metals and then have them circulate without being excreted, which may occur when the organs of elimination are compromised, as they often are with ill people.

On this program, people first support the organs of elimination to assure that they are functioning such that they can release the toxic burden. Frequently, the kidneys and/or liver need support, provided by herbs, supplements, and other formulas, such as special RNAs that I've formulated. Many of the children have obvious digestive distress, such as bloating, gas, constipation, and diarrhea. Immune system function and intestinal integrity are interrelated, because much of the immune system resides in the gut.

When the gut has been compromised, as it nearly always is in children with autism, in addition to addressing infections that undermine immunity and di-

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gestive function, many parents decide to identify and remove exposure to all irritants and allergens. Depending on the child, this can include fibers in clothes, ingredients in household materials, and cleaning and body-care products. It's also advisable to remove all foods to which the children are reactive, sensitive, or allergic. Unfortunately, these are often the foods that the children most crave. Prior to beginning this program, some have already adjusted the diet, or if not, some parents learn from other parents on our chat room. They have invaluable tips for implementing a gluten-free/casein-free diet (GFCF), and there are also many useful websites. Frankly, so many excellent practitioners offer guidance on this and other diets, and the parents are so knowledgeable, that I leave that to them. I'll provide further contacts in the resources section of this book. Even though I don't emphasize the diet aspect in this book, I consider it foundational because we won't be able to correct health imbalances and restore immune integrity if a child is constantly exposed to non-ideal foods.

Once the organs are supported, and with the right diet in place, we can proceed to implement the supplements that help to bypass mutations, and these will naturally increase detoxification. With the right methylation supports in place, it's time to undertake the detoxification program, covered more extensively in the next part of this book.

Finally, after completing detoxification, we can support the nerves in healing, rebuilding, and recovering from inflammation in the final phase of the program. I want to alert you that this process is not always linear—but support and guidance are available every step of the way.

## **II. Implementing the New Approach**



## Chapter 4. Step One, Part One

### Building a Foundation for Health Balance

In the past when people first learned of this program, I suggested that they make it a priority to spend time getting complete information before beginning to implement the protocol—and I have always applauded those who do this. But over a number of years, I've also seen that many more people want to begin right away. Whether they are addressing autism in their child or their own adult health issue triggered by neurological inflammation, many people feel a sense of urgency. I understand that, and that's why I've designed the program so that you can begin the first step as you continue to inform yourself—as well as wait for your test results. Nutrigenomic test results take approximately eight weeks to come back from the lab, and we don't want to waste that valuable time simply waiting when there are things that you can do right away, before knowing your own or your child's specific mutations. What's more, for financial reasons, many families who participate in the chat room on my website are not able to undertake Nutrigenomic testing from the outset. They've found that just following the first step of the program, detailed in this and the next chapters, brings improvement. Whatever your situation, there are many things that can be done to help your child or yourself today—and I urge you to begin now.

However, there is one caveat. You will see as you proceed through the program that I encourage people to undertake certain biochemical tests periodically, as this allows us to track progress, troubleshoot challenges, and appropriately transition to new supplements or steps in the program when the body is ready. These tests take out the guesswork. Accordingly, I often recommend that people undergo a few tests at baseline to determine the body's status. The genetic results show lifelong health predispositions, while the biochemical tests show the current situation. For example, suppose your roof was made of substances that were projected to last eight to ten years. Before deciding on a roof repair after eight years, you might want to go up and assess the actual damage. Biochemical tests allow us to assess both health challenges, backsliding, and progress. You can undertake them prior to beginning Step One, during Step One, and/or prior to

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beginning Step Two. If you do the tests prior to beginning Step One, make sure you have gone off all supplements from prior programs for two weeks prior to baseline testing. Once you are on the program and adding the supplements I have suggested based on Nutrigenomics or other biochemical tests, then I want you to stay on all your supplements for any subsequent testing. List all the supplements you are taking along with the current biochemical test. On the website, you will find downloadable supplement forms you can fill out. The reason for baseline testing is to assess the biochemistry in the absence of supplementation. Once you've begun the individualized approach to supplementing based on Nutrigenomics (or other test results) then testing will reveal how well those supplements work in correcting imbalances in the various biochemical pathways.

## **Baseline Tests**

**UAA**—Urinary Amino Acids from Doctor's Data Inc. (or equivalent)

**MAP**—Metabolic Analysis Profile from Genova Diagnostics, **OAT** from Great Smokies (or equivalent)

**CDSA/CSA**—Complete Digestive Stool Analysis and/or Complete Stool Analysis from Doctor's Data Inc. (or equivalent)

**UTM/UEE**—Urinary Toxic Metals/Essential Elements from Doctor's Data Inc. (or equivalent)

If you wish, you can order the tests through my office at [www.holisticheal.com](http://www.holisticheal.com). I comment only on test results (in conjunction with the Nutrigenomic tests) that are run through my office. You are also welcome to run tests yourself and through your practitioner, and if you send those results to my office, we will keep them in your file to make sure that our medical record on you or your child is complete.

## **A Three-Step Program**

The program consists of three basic steps:

1. Preparation, diet, and supplementation
2. Detoxification
3. Nerve generation and repair

### **Step One Overview**

The first step is basic preparation, which can be done by anyone—no matter what your SNPs, and whether you know them or not. In my view, almost anyone would benefit from many of the foundational recommendations in the first step.

In the first step, you will:

- Focus on a healthy diet
- Eliminate or limit common ingredients that contribute to neurological inflammation
- Make dietary changes that help to balance the neurotransmitters GABA and glutamate to lower neurological inflammation
- Use supplements that strengthen the digestive organs to help prepare the body for detox, which will be undertaken in subsequent steps of the program

You can also think of Step One as what you do while you await your test results, which will allow you to then target support for your own or your child's specific SNPs throughout the later steps of this program.

### ***Step Two Overview***

While continuing to follow many of the recommendations of Step One, you will move on to Step Two, in which you begin the process of detoxification. Detox consists of two parts:

1. Supplementing to bypass mutations that have been identified by the SNP analysis
2. Using the “metals program,” which furthers the detoxification process

I like to start by supplementing to bypass mutations, as this will often trigger a lower level of natural detoxification. Once this detoxification runs its course, then you can implement the metals program.

I will discuss supplementing based on the SNP analysis in great detail in the next chapter, but let me just briefly indicate that there are several mutations that need to be addressed first if test results reveal them.

1. I first recommend addressing the SHMT and ACAT mutations if they are present.
2. Next, you can supplement to bypass any CBS upregulations.
3. Finally, we support the remainder of the methylation cycle weaknesses revealed by the test results as these will include customized recommendations to address the SNPs identified.

At the outset of Step Two, when you receive your Nutrigenomic test results, you



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will learn exactly which SNPs are present (including the ACAT, SHMT, and CBS upregulations), as well as which supplements to use and which guidelines to follow to address the specific imbalances revealed by the test.

In Step Two, as you begin to slowly and gradually introduce the supplements customized to your own or your child's SNPs, you or your child will naturally begin to detoxify. This occurs because supporting the methylation cycle makes detoxification more efficient.

In the second part of Step Two, if needed to complete the process of detoxification, you can step up detoxification with the metals program, which is designed to remove metals, bacteria, and viruses from the system.

### ***Step Three Overview***

Once sufficient detox has occurred via the Step Two process, which may take months or even longer, you can then begin Step Three, which helps the body remyelinate nerves and enhances nerve function. It takes time and commitment to halt and reverse the inflammatory process leading to neuron death. And no one really knows how long it takes to grow a new neuron. For years it was believed that it didn't happen at all. Now we know that when an individual commits to this program and stays with it, it's often possible to achieve incredible results. Remember, this is not a sprint, it's a marathon.

How do we restore health and function as outlined in the steps? With herbs, vitamins, and antioxidants. People can wind up taking many supplements, sometimes as much as fifty or more, depending on the severity and number of imbalances in the individual. This may seem like a lot of supplements. However, neurological damage is cumulative. By the time it's recognized, more than 50% of an individual's neurons may have been damaged. Recently, I've formulated supplements that are compounded based on SNP results. Using them will reduce the number of supplements that are needed, thus streamlining the supplementation process.

### **Step One: Preparing for the Program**

First of all, it's important to lay the groundwork for this program by putting some basic supports into place. In this book (and on my website) you will note that the suggested supplementation protocols are broken into categories. It is not necessary to take every supplement in every category. However, depending on the severity of an individual case of autism, you may find it necessary to use every supplement listed. Also keep in mind that it is possible that a child may be sensitive to an individual ingredient or supplement. It is best for this reason to add them slowly, allowing several days before progressing to new ones. Yes, it will take a while to introduce them all, but be calm and patient. Don't feel you

have to rush through the program. The Basic Supplement Support program is a good place to begin.

The suggested dosage of any individual supplement listed is usually ½ to 1 capsule or tablet, unless otherwise noted. This will be well below the dosage suggested on the labels of the bottles. The aim of this approach is to rebalance many different pathways in the body simultaneously. Picture the body as a system of roadways, and imagine that you are repairing the main roads, side roads, and back roads, all at the same time. To do all of this “road work” requires a small amount each of a large number of supplements traveling down multiple pathways and feedback systems to restore effective function.

In order to help to simplify and streamline the program I have recently formulated a series of new supplements that are customized and compounded to address specific SNP imbalances. These compounded formulas contain all of the individual components listed to help to bypass a specific SNP. When using the compounded formulas it is important to follow the dosing instructions, as the custom formulation has already taken into account the low doses of supplements and herbs that I like to use. Again, for the supplements formulated by SNP it is important to take the number of capsules or tablets listed on the label. You can slowly dose up, but ultimately, in order to have the proper amount of each ingredient, take the amount of capsules/tablets listed on the supplement bottle, rather than simply using only 1 or ½ of a capsule or tablet.

### ***Basic Supplement Support***

I recommend that you implement this program in conjunction with a healthcare practitioner.

Neurological Health Formula (General Vitamin)	Zinc
Nerve Calm Inflammatory Pathway Support RNA	Vitamin D-3
Stress Foundation RNA	Cod liver oil
General Inflammatory Pathway Support RNA (if needed)	Super Digestive Enzymes (with each meal)
Bowel Inflammatory Pathway Support RNA as needed	OraAdren 80
Cytokine Inflammatory Pathway Support RNA (if needed)	ImmunoForte
Magnesium (citrate or drops)	OraKidney + Kidney Inflammatory Pathway Support RNA (a few times per week)
	OraLiv + Liver Support RNA (a few times per week)

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OraPancreas

GABA

Pycnogenol

Grape seed extract

Branched chain amino acids (can be taken unless there is a maple syrup smell in the urine)

Vitamin C

Probiotics (several different types, rotated daily)

Basic mineral support such as Bio-Nativus, Cell Food and/or individual minerals based on test results.

Beginning in the next two chapters, and in the subsequent steps of the program, I'll provide a number of lists of supplements like the one for Basic Support. Each list will be targeted to support proper functioning in a specific bodily area that we need to address. On day one, it's not advisable to jump in and give your child or yourself, every supplement on the list. You should begin with a single supplement at a low dose, carefully monitoring how you or your child reacts to it. Other supplements can be added gradually one by one. Sometimes your child may not be ready to add in a new supplement, but he or she may be ready later on. Some supplements you may never add. Some children will benefit from a very narrow range of the appropriate supplements, while others may end up taking small quantities of them all. The important thing is for you and your practitioner to agree upon what works for your child.

Throughout all three steps of the program, you will continue using the supplements and diet you'll learn about in this chapter and begin in Step One. Moreover, as you test key biochemical markers, which I consider essential, with each new round of test results you can further refine the program, adjusting your child's intake depending on what these markers reveal. In most cases, wherever I offer supplement recommendations for specific areas of function, I also list the tests for those areas so that you and your practitioner can monitor results. Noticeable improvements in your child's behavior, speech, and function, combined with test results of key biochemical markers will guide you and your health care practitioner so that you can decide when you need to adjust supplementation as well as when your child is ready for the next step.

Parents report that some children experience a temporary setback when they are detoxing and then resume their forward momentum after they have released more toxins. That's why I always urge parents to introduce supplements slowly with small doses—often a sprinkle is enough. That way you can see how your child reacts and modify doses accordingly.

Remember that natural herbs and the other ingredients found in supplements are gentler than prescription medications, so we can use different guidelines in taking them. For example, most physicians recommend that you take a complete

course of antibiotics, rather than stopping prior to its completion. But the same cautions don't apply to natural supplements. You are free to adjust as you go. In the chat room, you can connect with other parents who have long experience of this process and can answer many of your questions. Not only can they reassure you, but they can also guide you as you and your practitioner move your child through the program. I strongly encourage anyone using the program to join the chat room and take advantage of that resource.

### ***Why We Use So Many Supplements***

Sometimes when people first see the supplement lists, they feel overwhelmed and ask me: "Why so many supplements?" Let me tell you, those of us who practice integrative health care did not set out with the intention to promote or provide supplements. However, many of us have found that not all supplements are made with the high standards necessary to produce successful results. That's why, over many years of clinical practice, like many practitioners, I've come to see that it's vital to use the proper tools to bring about real health changes. Quality supplements are crucial tools. Use good judgment in choosing your source of supplements. Please do not be guided simply by the price. The difference of a few dollars may mean the difference between a successful supplement program and one that is mediocre, I've heard parents say, "Oh, I've tried that before, it doesn't work," only to find that when they use a high-quality version of that same supplement, it does in fact make a difference. In other cases, people followed the suggested protocols with great success, but obtained less favorable results when they switched to a different supplement brand, or to a supplement that was not stored properly. Supplement quality is therefore a key aspect of this program. Supplements are not regulated. As a result, quality can vary greatly. If not shipped or stored properly, just like fresh produce, some supplements can spoil. Consequently, in following the recommendations, it's vital to use high-quality brands and know your source. This will assure that the product is fresh, rather than stale, and that it's been stored and shipped properly.

Finally, this book contains my latest supplement recommendations. Many of these recommendations have remained constant over several years, but periodically I make modifications in order to keep my recommendations in step with both new scientific findings and my own clinical discoveries. Therefore, please do check the website regularly for these updates. One more thing you will notice is that certain of these foundational supplements are marked to indicate whether or not they are appropriate for people with specific SNPs. Accordingly, once you've gotten your Nutrigenomic test results, you may wish to revisit the lists, as you will have some new insight on which recommendations apply to (or may not be indicated for) your child.

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In summary, rest assured that as you carefully work with diet, strengthen the body, balance key neurotransmitters, support processes that are blocked by mutation, and systematically detox the system, healing occurs.

My colleagues in scientific research and health practice often ask me how I came to develop this unique program. I regard this protocol as the outcome of my many years of training and research in molecular biology, combined with my training and clinical experience as a registered naturopath. My knowledge of these two fields enables me to have a unique, and I believe rare, cross-disciplinary perspective. Knowing different disciplines well helps me to think outside the box and see things that may not have occurred to others. Last, but perhaps most important, I am also a Mom writing to other parents. I want you to know that I understand the challenges in undertaking this kind of program and do everything in my power to make it as easy as possible for you to follow. My advice is to take it slow and take your time. You don't have to run the marathon in one day.

## ***Diet and Food Reactions***

Prior to bringing in nutrients via supplements, it's vital to lay the right nutritional groundwork through diet. As I mentioned earlier, the basic principle of naturopathy is to give the body what it needs and remove from it whatever may be harmful. Foundational to that is diet. It's common sense that if a child follows the program to a T while also consuming soda, candy, and junk food, he's not going to progress as easily as he would if he were avoiding all harmful synthetic food additives and eating healthy whole foods, like fruit and vegetables. While I consider the supplements I recommend to be a form of food, because they supply essential nutrients, the baseline nutrients most of us get every day come from food, and for these children, we want that food to be of the highest quality.

Since there are so many capable nutritionists, doctors, and parents who provide terrific information about what your child should eat, I won't discuss diet too extensively, except to touch on a few basics. Most parents are already familiar with these general dietary guidelines, but if by chance you aren't, you can read this overview and delve into the topic further by accessing other sources. These include the gluten-free, casein-free (GF/CF) diet, and the PKU Diet from the University of Washington (<http://depts.washington.edu/pku/diet.html>). Also see *Battling the MSG Myth*, a cookbook by Debby Anglesey, [www.msgmyth.com](http://www.msgmyth.com), and *Excitotoxins: The Taste That Kills*, by Russell Blaylock.

Going back to the naturopathic principle of bringing in supports and removing things the body doesn't need or cannot handle, let's consider what foods are harmful or hard to handle—especially for sensitive people—like many of the children on this program.

## Problematic Food Ingredients

Compounds found in certain foods, especially gluten (found in wheat and other grains) and casein (in dairy), can be a problem for many children and adults, especially at the outset of this program, before it's begun to rebalance their systems. If you are the parent of a child with autism, you are no doubt already aware of this. If not, please go online and search for information, products, and recipes for gluten-free/casein-free diets. In addition, there are other foods that can be problematic until the gut is in better balance. People sometimes report that they're "allergic" to a food based on sensitivity shown through IgG testing. Frequently, reactions arise because a leaky gut allows foods to pass into the bloodstream, where they act as foreign substances and stimulate an IgG type reaction. As we work together to get the gut in better balance, these foods generally cease to be problematic. (The program for balancing the gut is in the next chapter.)

In many cases I've seen, the Bowel Inflammatory Pathway Support RNA helps to restore gut integrity. You can track improvement via an intestinal permeability test. However, when sensitivity testing reveals a positive IgE (as opposed to an IgG) reaction testing, that indicates a "true food allergy." Avoid all foods to which you or your child has an IgE response.

Over the course of the program, one of our tasks will be optimizing digestive and immune function. As a result, over time some food sensitivities may decrease. But some will remain, requiring you to make sure that going forward, your child avoids specific foods and ingredients. As always, err on the side of caution. If you are concerned about your child's reaction to a food, then simply do not allow them to ingest it.

Now, I'll briefly highlight some other foods to look out for and eliminate if necessary.

- First, **synthetic food additives, sweeteners, pesticides, antibiotics, and hormones** should be reduced or eliminated, as these may act upon the body in unfavorable ways. These include chemicals devised in a lab and foods altered radically from their natural state. Many of these substances are applied directly to crops; others are added during the creation of processed foods. I'll familiarize you with some of these ingredients later in this section.
- Second, children with autism or adults with neurological conditions must eliminate **excitotoxins**, food ingredients and substances that cause overstimulation of the nerves and nerve damage. To protect itself from excitotoxin damage, the brain releases substances that elevate opioid levels, causing symptoms like brain fog. You may have noticed that your

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child becomes either overstimulated or spacy following consumption of certain junk or processed foods. Such symptoms indicate that ingredients in those foods are producing a negative impact on your child's neurology and brain chemistry. That's why we want to limit their consumption.

- Third, **specific natural substances** found in certain foods tend to increase neurological inflammation and should be avoided or limited in the diet. I'll also familiarize you with those later in this section of the book.

Nowadays, nutritionists and natural health doctors have alerted people to a growing list of substances in foods that many believe are harmful. Given that children with autism are often reactive and sensitive, it makes good sense to consider eliminating some or all of them from your child's diet. Here is a quick overview that you can use to do your own research and make your own assessments:

- **Agricultural add-on's.** Many nutritionists agree that it's best to avoid pesticides, hormones, antibiotics, and GMOs—if possible by favoring organic foods, non-GMO foods, and meats raised without hormones or antibiotics.
- **Artificial and other sweeteners:** Saccharin, aspartame, sucralose and high fructose corn syrup are generally considered the most harmful. Sweeteners can cause blood sugar imbalances and radical swings in energy and mood. They can also contribute to yeast infections. Artificial sweeteners may contain excitotoxins and contribute to weight gain through disregulating satiation signals. Genetically, some people are more prone to blood sugar issues than others. If regulating blood sugar balance or controlling yeast growth are concerns, then even natural sugars can be limited, including the following: cane sugar, concentrated sweeteners, barley malt, beet sugar, date sugar, corn syrup, dextrose, fructose, maltodextrin, and turbinado sugar.
- **Altered fats:** Trans-fats, hydrogenated and partially hydrogenated oils. These become lodged in key cellular membranes to lessen membrane fluidity and reduce neurological function. There are many healthy fats that can be used instead. Please check food labels to determine if a particular product contains altered fats.

When practitioners or nutritionists characterize any food, substance, or chemical as helpful or harmful, they base these determinations on what research and/or practice has revealed. How does that substance interact with bodily biochemistry? Where does it throw key bodily areas off? Or conversely, where does it help improve areas of functioning? Until we look more closely at children with autism

to determine where and how their bodily biochemistry is imbalanced, we won't come close to understanding these disorders, nor will we be able to treat them. However, there's an upside. The upside is that the more we examine what's going on, the better our ability to address it with precision. That's what we'll be doing throughout this program.

There are so many areas of dysfunction in children with autism that parents often feel overwhelmed and wonder where to begin. In the next section I'll acquaint you with where I like people to begin—with a factor that I consider critical in this program. Addressing this common area of imbalance can and should be undertaken at the outset and continued throughout the entire program, through all of the steps.

## Controlling Excitotoxins

### ***Neurotransmitters: Balancing GABA & Glutamate***

In this section I'll explain why I consider it so important to balance two key neurotransmitters—and let you know how to do it. What are neurotransmitters? They're brain chemicals (usually amino acids, the substrates of protein) that communicate information throughout the brain and body, as well as relay signals between neurons. Neurotransmitters play a role in signaling the two halves of our autonomic nervous system—the sympathetic and parasympathetic systems, each of which helps perform a wide range of bodily functions. When one or both of them are out of balance, this imbalance can contribute to many symptoms. That is why treatments that balance neurotransmitter levels create significant improvement. Mood, energy levels, mental stability, resilience, speech, motor-skills, sleep, and hormonal function are just a few of the many functional areas closely tied to neurotransmitter balance.

We have two kinds of neurotransmitters, the excitatory (such as norepinephrine or glutamate), which stimulate, and the inhibitory (such as serotonin or GABA), which calm the brain to balance mood. Our biochemistry dictates that each paired set of neurotransmitters functions in a dynamic balance between excitation and inhibition. You can picture it as a kind of seesaw, with imbalances resulting when one side or the other becomes overactive.

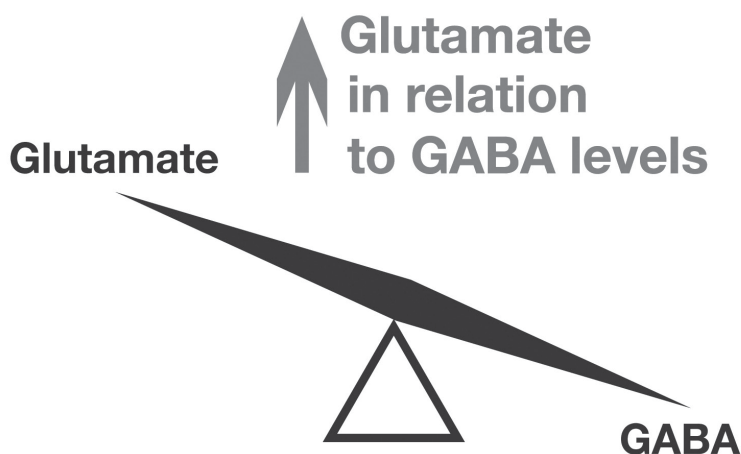
When an excitatory neurotransmitter becomes overactive, its counterbalancing inhibitory partner becomes depleted. As a result, stimulation will increase, while relaxation decreases. Conversely, if the inhibitory partner is overly dominant, drowsiness, lethargy, or even depression may result. So the key is maintaining balance.

Some of the SNPs we cover on the Nutrigenomic test contribute to regulating neurotransmitter levels. At later steps of the program, this information is



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used to fine tune what's needed by each individual to improve neurotransmitter balance. But there's one key neurotransmitter pairing that seems to be vital for everyone, so that even without testing, most of the children I see benefit from my approach to balancing the paired neurotransmitters glutamate and GABA (gamma-amino-butyric acid).



Glutamate is one of the main excitatory neurotransmitters in the body. It's particularly important for the children I see because adequate levels are essential for learning as well as short-term and long-term memory. Its complementary partner on the “seesaw” is GABA, a calming neurotransmitter essential for speech.

How does imbalance in this pair of neurotransmitters translate into autistic behaviors? On one side of the seesaw, high excitatory neurotransmission leads to stimulatory behavior, called stims, while on the low end of the seesaw, low levels of calming neurotransmission lead to lack of speech. In addition, high levels of glutamate can cause the nerves to fire, creating neurological inflammation and damage. This damage produces the symptoms we see in autism and other neurological conditions—as well as other symptoms I'll highlight later.

Since glutamate is also the biochemical precursor to GABA, under normal conditions excess glutamate automatically converts to GABA. You experience this normal balancing act when your brain starts to hit overload, you find yourself getting sleepy, and tune out. But when for various reasons, the body can't properly regulate glutamate, as often occurs in the children I see, glutamate can build up to toxic levels. This throws off the delicate balance between this pair of neurotransmitters, causing high levels of glutamate to accumulate while GABA levels remain exceedingly low. When the glutamate/GABA seesaws tips too far

over to glutamate, it's vital to reduce glutamate intake in order to restore balance and correct the health symptoms caused by high glutamate.

In his landmark book, *Excitotoxins: The Taste that Kills* (Health Press 1996), neurosurgeon Russell Blaylock characterized excitotoxins (glutamate and other amino acids widely used in processed foods) as well as their contribution to neurological damage. Even though his book was first published over a decade ago, many people remain unaware that MSG, aspartame, and other novel food ingredients contribute to health risks.

These ingredients are added to food by food scientists working for major processed food producers. The companies add these chemicals to processed foods because excitotoxins fool the brain into experiencing a particular food as tasty. Unfortunately, excitotoxins also raise levels of excitatory neurotransmitters, including glutamate, potentially causing nerve-cell death.

In addition, excess glutamate toxicity also has a negative impact on:

- **White blood cells** (causing elevations in the levels of eosinophils). This can result in an inflammatory reaction while also depleting other intermediates in the body.
- **Blood vessels** (causing migraines and reduced regulation of blood pressure). Studies indicate that glutamate can increase blood pressure but may also cause irregularities in blood pressure.
- **Certain areas of the brain**, including the hypothalamus, the hippocampal neurons, and the Purkinje neurons, which are involved with speech and language.

According to research and clinical practice, excess glutamate levels can contribute to a range of neurodegenerative diseases, including Alzheimer's disease, Parkinson's disease, Huntington's chorea, stroke, multiple sclerosis, and ALS. That's why managing glutamate levels is beneficial to both children and adults—and absolutely essential when the methylation cycle is not functioning optimally due to genetics. Although in my experience, most of the children benefit from lowering glutamate levels, you and your practitioner can make an individual determination for your child through lab tests or monitoring symptoms.

### Lab Tests and Other Indications of a Need for Glutamate/ GABA Balance

- Elevated: glutamate, glutamine, glutamic acid, aspartate, aspartic acid, and Low GABA (gamma aminobutyric acid on a urine amino acid test (UAA))

- 
- Low GABA on a Neurotransmitter test
  - Elevated quinolinic or kynurenate on OAT/metabolic test
  - Seizures, stims, poor eye contact, aggressive behavior

## ***How Glutamate Harms Nerve Cells***

A deeper look into how glutamate works and interacts with brain biochemistry reveals why it's a key factor in a disorder like autism.

Receptors are located on the surface of nerve cells. They function a bit like "fishing poles" and each type has a specific task—to reel into the cell a specific neurochemical. As in fishing, a certain hook will catch certain kinds of fish. Glutamate receptors have hooks that pull in glutamate. However, these receptors can also pull in other excitatory neurotransmitters which thereby enter the cell. The following neurotransmitters are pulled into the cell via glutamate receptors:

- Aspartate
- Aspartame
- Aspartic acid
- Glutamate
- Glutamic acid
- Glutamine
- Monosodium glutamate (Msg)
- Cysteine
- Homocysteine

More glutamate receptors will tend to pull in more excitatory neurotransmitters, causing higher levels of excitatory chemicals within each cell. In certain key studies, scientists found that individuals with autism had elevated excitatory neurotransmitter levels compared with non-autistic individuals. I suspect that people with autism may produce more receptors for glutamate and other related excitatory chemicals.

### The Relationship between Glutamate and Calcium

Glutamate can bind to six different types of receptors located in the brain, including the NMDA receptor, which helps the body carry calcium into the nerves. The combination of glutamate and excessive calcium makes it impossible for the neurons (nerve cells) to rest. The neurons continue to fire without stopping, causing the release of inflammatory mediators, which trigger additional calcium influx. This ongoing firing process results in neural cell inflammation and the death of neurons. Magnesium can modulate the calcium flow, as can zinc. (However, zinc is a double-edged sword since it can also activate glutamate release via the non-NMDA glutamate receptors.)

As Dr. Mark Neveu, a former president of the National Foundation of Alternative Medicine, said when speaking of excitotoxin damage, “glutamate is the gun and calcium is the bullet”. This is the main reason that, on this program, I recommend caution in supplementing with calcium. Both limiting calcium intake and supplementing with magnesium and zinc can help maintain low to moderate calcium levels. This strikes a balance between maintaining necessary amounts for bone health without damaging the nerves.

As you can see, achieving the appropriate levels of key minerals is also foundational. The best way to assure that your supplement levels are adequate is to take a test called the Urine Essential Elements (UEE). This will help you precisely determine current levels as well as monitor your success following supplementation. In addition, you can do weekly, spot, toxic urine tests and follow up with a UEE every few months. To interpret lab results on the UEE, please consult your doctor. However, here are some general guidelines that I consider in evaluating a UEE:

- A low/normal range is optimal for calcium, copper, and vanadium.
- No detectable iron on a urine essential element test
- A high range of normal is optimal for magnesium, molybdenum, and selenium. Zinc levels slightly above 50% but lower than magnesium levels
- Mid-range is best for chromium and boron.
- Sodium, potassium and phosphorus in essentially the same range on either side of the 50%
- More zinc than copper. Look for zinc/copper ratio to be greater than one.

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With these basic guidelines, and after checking with your doctor, you can use the following supplements to help achieve the proper levels of key minerals.

## **Adjusting Calcium Levels (if needed)**

### *Reducing Excess Calcium*

Magnesium

Boswellia

Vinpocetine

Zinc

Lithium orotate

Paradex or wormwood

### *Lab Tests/Other Indicators for Need to Reduce Calcium*

Elevated calcium relative to magnesium on a UEE or UTM

Elevated calcium relative to magnesium on a red blood cell element test

Stims

### *Increasing Calcium to Healthy Levels (if needed)*

Chamomile

Nettle

Chervil

Calcium and Magnesium citrates

Vitamins D & K

Bone Support RNA to support healthy bones but will not affect calcium per se

*Lab Tests Indicating a Need to Increase Calcium*

Calcium below the range of low-end normal on a urine essential elements test

Calcium below the range of low-end normal on an RBC element test

High level excretion of lead when checking urine calcium levels

**Other Essential Minerals to Keep in Balance**

Magnesium citrate or oxide

Zinc

Molybdenum

Chromium picolinate

Lithium orotate

Selenium

Strontium

Boron

Manganese

Vanadyl sulfate

Copper: Cell Food and BioThyro for copper support if recommended on testing

Sodium : You can use Aerobic O7 + ATP

Potassium: You can use Aerobic KO7 + ATP

Phosphorus (complexed) + ATP

*Lab Tests Indicating a Need to Address Zinc/ Copper Ratio*

Elevated copper relative to zinc on a UAA or blood work

Low levels of ceruloplasmin on blood work

Red hair is an indicator, to be confirmed with a urine essential element test

Decreasing Elevated Copper in Copper/Zinc Ratio

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Low Molybdenum on a UEE

*Adjusting the Zinc/Copper Ratio (if needed)*

Increase molybdenum

Increase EDTA

Carnosine (low dose)

As always work with your health care practitioner.

## **Glutamate and Intelligence**

Children with autistic type behavior have often been described as exceedingly intelligent, with a certain percentage considered to be “savants,” people with extraordinary mental ability in certain areas (such as an exceptional memory). Dr. J. Z Tsien and his collaborators have demonstrated a correlation between glutamate receptors and superior ability in learning and memory. However, his research indicated a significant downside: enhanced levels of glutamate were also correlated to an increased risk of stroke and seizure activity.

The takeaway from this study is that more highly intelligent people often have higher glutamate receptor activity. At the same time, higher receptor activity may make intelligent people more vulnerable to glutamate excess and nerve damage. That’s why the recommendations to address this issue by lowering glutamate levels can be used with:

Children with autism

Adults with neurological illnesses

People with a family history of such illnesses

Individuals with atrial fibrillation also seem to benefit from balancing glutamate and GABA.

In my view, lowering glutamate levels to prevent nerve damage is a sound preventive measure for nearly everyone.

How to do this? To restore balance, we first must decrease glutamate levels by limiting foods that contain glutamate. Simultaneously, we can increase GABA levels by following the supplement recommendations for supporting healthy GABA levels.

### Other Factors That Tip the Balance

Controlling glutamate intake is vital, but other factors also play a part. One of these is the body's ability to regulate glutamate and GABA, which can get thrown off all too easily in children with autism. Later steps in the program may help parents manage contributors to dysregulation.

How does dysregulation occur? Scientists are still trying to determine all the contributing factors. There are a few working theories currently being investigated. It appears that problems with the GAD enzyme, a pancreatic enzyme, may contribute to the disconnect, so that excess glutamate does not automatically signal a counterbalance of GABA. Several studies have found that the rubella virus (contained in the measles, mumps and rubella (MMR) vaccine) can cause the GAD enzyme to stop functioning properly. This may explain why children with autism who have received these shots may be more vulnerable to this imbalance.

Acute viral infection can lead to type I diabetes. In type I diabetes, the body makes antibodies against the GAD enzyme which may lessen its ability to balance the seesaw. Chronic viral infection may also contribute to problems with the GAD enzyme. If so, then addressing chronic viral infections as we do on this program could potentially help.

The GAD enzyme uses vitamin B6 as a cofactor for its activity. Supplementation of vitamin B6 has long been standard in the DAN (Defeat Autism Now) treatment, pioneered by Dr. Bernard Rimland. B6 taken via supplements may help the GAD enzyme convert glutamate to GABA which helps to explain the success many have experienced in following the DAN protocol. Nutrigenomics can also tell us which individuals can most benefit from B6 supplementation and help determine when to add B6. As mentioned earlier in this chapter, at the outset of Step Two, if CBS mutations are present, I recommend addressing those early on before introducing a number of the other supplements. Since the use of B6 also increases CBS activity, it's not an ideal supplement for those with particular CBS mutations (such as CBS C699T or CBS A360A). For this reason, it's best to get CBS in better balance before adding B6. This is just one example of how Nutrigenomic information helps to introduce the right support in the right time sequence. I call this "layering." Each child or adult is unique. While the basic need for glutamate and GABA balance applies to all, we can optimize health care and outcomes by accessing the Nutrigenomic profile to fine tune how and when we layer in supports, like supplements. There is also an interrelationship between glutamate and blood glucose levels.



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**↑ Glutamate ↑ Insulin ↓ Lower glucose  
↓ Lowered ability to remove glutamate**

Glutamate stimulates insulin release, which in turn lowers glucose. However, glucose regulates the removal of excess glutamate from the synapses. Therefore, a drop in blood glucose disrupts this removal process and allows the build up of toxic glutamate. In fact, hypoglycemia, or low calorie/starvation conditions induce the release of glutamate and reduce the ability to remove excess levels of glutamate from the brain, making it essential to provide regular nourishment through meals and snacks to maintain consistent blood sugar levels throughout the day. In the next chapter, you will see how the Nutrigenomic profile provides invaluable information for regulating blood glucose levels because it measures a genetic variation called the “VDR/Fok.” Individuals who have the VDR/Fok mutations may be more susceptible to sugar imbalances. Knowing that susceptibility alerts us to the need for sufficient pancreatic support to address the glutamate/GABA balance as well as blood sugar issues. If after getting your test results, you learn that you or your child have that mutation, you may want to revisit the recommended pancreatic supports and increase them if needed.

## **Symptoms of Glutamate Excess/GABA Depletion**

In addition to neurological damage, glutamate and other excitotoxins contribute to other bodily symptoms. Glutamate prompts the body to release opioids to protect the brain from damage, contributing to the “spaciness” that some of the children experience. Elevated glutamate levels can also deplete glutathione, a major antioxidant that promotes healthy detoxification and prevents inflammation. With lowered glutathione, there will be an increased tendency toward leaky gut (or Irritable Bowel Syndrome). Since glutathione helps to protect neurons from damage, its depletion also results in nerve cell death. Glutamate excess can also contribute to insomnia, bedwetting, and problems with eye focus and making eye contact.

### *Support to Reduce Stims*

Nettle

Inositol hexaphosphate (IP6)

Nerve Calm Inflammatory Pathway Support RNA

Cytokine Balance Inflammatory Pathway RNA

Stress RNA

Advanced Joint Inflammatory Pathway Support RNA

A decrease in GABA levels on this neurotransmitter seesaw can cause a range of symptoms. In particular, GABA is a key to speech. (That's why GABA is often used to help restore speech in stroke sufferers.) As a result, the return of language is often an outcome of balancing the glutamate/GABA seesaw.

How does this work? GABA is used by the brain to support sensory integration, helping us to tune in to the sounds we hear. With adequate GABA levels, we are able to dampen background sounds, so that it's easier to distinguish the onset of a particular sound or word, which is how we recognize words and develop speech. With lowered GABA levels, spoken words sound like a long run-on sentence, rendering comprehension difficult. I always imagine that this is what these children hear until they get sufficient levels of GABA. In fact, often when they first recover language, their first communications will sound like a run-on sentence. That's why children will understand better when parents speak slowly, with gaps between the words.

Decreased GABA levels also increase anxiety, something that many of the children, their parents, and even the practitioners working with them tend to experience. Dealing with autism creates tremendous stress.

Low GABA levels can also increase aggressive behavior, as well as decrease social behavior. Low GABA leads to decreased eye contact and difficulties in focusing. With some children, due to low levels of GABA, both eyes focus inward toward the nose, while other children may experience horizontal or vertical wavering of the eyes. Low GABA levels lead to decreased bowel function. It may seem counterintuitive that a calming neurotransmitter helps stimulate bowel activity, but GABA does indeed help the bowel to contract. In addition, GABA release may help to reduce the triggering of transient lower esophageal relaxations, decreasing gastroesophageal reflux (GERD). GABA is essential for proper intestinal motility.

That's why along with controlling glutamate, to help to create balance, many find it helpful to supplement directly with GABA as well as other natural substances such as valerian root, which indirectly helps to support GABA levels.

In looking over the recommendations of useful supplements for GABA/glutamate balance, please note that in a few instances, I've noted how the supplements can be further fine tuned once you have your test results. If you don't yet have your results, please use the supplements recommended for everyone.

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## *Maintaining a Healthy Glutamate/GABA Balance*

Branched chain amino acids (use only products that contain leucine/ileucine/valine—but discontinue immediately if urine smells like maple syrup)

Pycnogenol

Grape seed extract

GABA

Nerve Calm Inflammatory Pathway Support RNA

Lithium orotate (depending on levels on urine essential elements test)

Sublingual GABA/ glycine

Trehalose

Valerian root

Zen

In addition, after you've gotten your test results, you can revisit the following additional supports in balancing GABA and glutamate, which build upon knowing your mutations.

Progesterone cream (Best for ACE+/ MAOA+)

Sublingual methylcobalamin (B12)—Only use following Nutrigenomic testing if recommended

Sublingual cyanocobalamin—Useful for all unless contraindicated by test results

Sublingual hydroxycobalamin—Useful for all unless contraindicated by test results

Hydroxy B12 Oral Spray—Useful for all unless contraindicated by test results

Liposomal B12

Taurine (depending on urine AA test levels—not for CBS + or SUOX + -)

Theanine (Best for COMT V158M --)

Monocyte support RNA as additional supplementation if seizures are an issue

***Lab Test Results and Other Indicators for a Need for Glutamate/GABA Balance***

Elevated levels of glutamate, glutamine, glutamic acid , aspartate, and/OR aspartic acid on a Urine Amino Acid test (UAA)

Low GABA (gamma aminobutyric acid) on a UAA

Low GABA (gamma aminobutyric acid) on a neurotransmitter test

Elevated quinolinic or kynurenic on OAT/metabolic test

Seizures

Stims

Poor eye contact

**Toxic Food Ingredients**

For all of the reasons I've discussed, it's vital to avoid all foods (and nutritional supplements) that contain (or prompt the body to create) glutamate, glutamic acid, aspartate, and/or aspartic acid and cysteine. All forms of these various amino acids act as excitotoxins. In addition, it's best for a time to limit calcium intake to acceptable sources at low to moderate levels, by using herb and food sources of calcium that maintain healthy bone without producing too many calcium "bullets." Unless you exclusively eat a diet of healthy whole plant foods and grains, you will have to learn to read labels to discover which foods contain excitotoxins. (A list of common ingredient names can be found below.) Once they begin to read labels, many parents are shocked to realize how widespread these ingredients are. Don't be surprised if they show up in foods you have served your children all along!

What should you look for?

I recommend eliminating both glutamate and aspartate from your child's diet, because in the cells, glutamate can be made from aspartate, and vice versa. Both glutamate and aspartate are widely used as food additives, the two most common being MSG (monosodium glutamate) and aspartame. Later in this chapter, you will find lists of ingredients to be avoided, as well as lists of the types of products in which these harmful ingredients are most commonly found.

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### Finding Excitotoxins Hiding in Plain Sight

Most food prepared by major fast-food chains contains MSG.

Molasses, sugar beet and cane contain MSG.

MSG and Aspartame (NutraSweet) are found in everything from soups, sauces, and juice to frozen entrees, candy, cigarettes, and anything with seasonings (e.g., potato chips, meat, ice cream).

Binders and fillers for medications, nutrients, and supplements, both prescription and non-prescription, and some fluids administered intravenously in hospitals may contain MSG.

According to the manufacturer, Varivax-Merck chicken pox vaccine (Varicella Virus Live) contains L-monosodium glutamate and hydrolyzed gelatin, both of which contain processed free glutamic acid.

MSG is used as a plant “growth enhancer” (AuxiGro) sprayed on growing crops. AuxiGro Plant Metabolic Primer contains 29.2% by weight, pharmaceutical grade, L-glutamic acid.

Both glutamate and aspartate occur naturally in many foods, such as protein-rich foods, wheat gluten, hydrolyzed yeast, and milk casein. You can see why a grilled-cheese sandwich should probably not be on the menu of most children with autism. Many parents encourage their children to drink smoothies, but beware of the protein powder you use. The process of making protein powder releases glutamate.

Some recommend that children with autism eat high protein diets. While the amino acids that make up protein are necessary for normal brain function, most protein rich foods contain high levels of glutamate and aspartate which is why I don't recommend high protein diets for this population. Further, high-protein diets force the body into a state of cannibalism called metabolic acidosis, in which blood levels become so acidic that the body starts feeding on muscle tissue for nutrients. What's more, the breakdown of protein generates ammonia. Many children with autism have elevated ammonia levels, yet another reason for them to avoid high-protein diets. Instead, a low to moderate amount of protein is best. One exception is phenol-sensitive individuals, who have been advised to follow the PKU (phenylalanine-free) diet, which entails restricting all protein-rich foods since they contain a phenolic amino acid.

Many nutritional supplements contain glutamine (or glutamic acid), because it helps restore gut health and integrity. However, glutamine is readily converted

to glutamate, so I counsel parents to read supplement labels and avoid products containing glutamine.

I want to reassure you that it's neither possible nor advisable to limit every single molecule of excitotoxins, as we do need low levels of glutamate. However, it is necessary to avoid excessive intake in order to stop the inflammatory process that glutamate and other excitotoxins trigger. To help our nerves function, we need the stimulatory activity provided by the glutamate receptor. What we want to avoid is excessive stimulation.

### ***Foods to Avoid***

#### **Sources of MSG**

- Hydrolyzed protein or hydrolyzed oat flour
- Sodium caseinate or calcium caseinate
- Autolyzed yeast or yeast extract
- Gelatin
- Glutamic acid
- Monosodium glutamate

### **Excitotoxic Food Ingredients**

- |                                |                              |
|--------------------------------|------------------------------|
| Ajinomoto                      | Dough conditioner(s)         |
| Autolyzed anything             | Gelatin                      |
| Autolyzed yeast                | Glutamate                    |
| Autolyzed yeast extract        | Guar gum                     |
| Bouillon                       | Hydrolyzed anything          |
| Broth                          | Hydrolyzed oat flour         |
| Calcium caseinate              | Hydrolyzed plant protein     |
| Carrageenan (or vegetable gum) | Hydrolyzed protein           |
| Caseinate                      | Hydrolyzed vegetable protein |
| Chicken/pork/beef "base"       | Kombu extract                |
| Chicken/pork/beef "flavoring"  | Malt extract                 |
| Disodium caseinate             | Malt flavoring(s)            |
| Disodium guanylate             | Malted anything              |
| Disodium inosinate             | Malted barely flour          |

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Malted barley/barley malt	Soy protein
Maltodextrin	Soy protein concentrate
Meat flavorings (chicken, beef etc.)	Soy protein isolate
Monosodium glutamate	Soy sauce
Natural flavor(s)	Spice mixes that contain glutamate or MSG as an ingredient
Natural flavoring(s)	Stock
Nutrasweet/aspartame	Textured protein
Plant protein extract 1-cysteine	Vegetable gum
Seasoned salt	Whey protein
Seasoning(s) or spices	Whey protein concentrate
Smoke flavoring(s)	Whey protein isolate
Sodium caseinate	Yeast extract
Soup base	
Soy extract	

## Food Products That Commonly Contain Excitoxins and Other Harmful Ingredients

Remember to always read labels. Product contents can change at any time at the company's discretion. Clearly, you can't always avoid everything on the list below. But you can regard these foods and ingredients with suspicion, as they have been known to cause problems. Even if you do not eliminate them entirely, once you are aware of these concerns you can pay special attention after you or your child have eaten a potentially troublesome food and notice if there is an immediate negative reaction (within the next twenty-four hours.) On the other hand, we don't always get the immediate certainty conferred by a quick reaction to a food. More often, there is a long term cumulative effect, making it harder to trace the various factors contributing to an illness or symptom.

To understand how this works, first visualize a measuring cup as a metaphor for what is going on within us that we cannot see. Although this cup is empty at first, the cup gets a little fuller each time we eat foods that contain glutamate or MSG. Over time, the contents creep up to the top until the cup overflows. Like a human body, the overflowing cup can no longer contain or manage the accumulation of toxins to which it has been exposed. When the body can no longer manage, it responds with an illness or symptom. That's why I counsel people to moderate their food intake of excitotoxic ingredients. That will prevent the cup

from overflowing. I offer this long list of problematic foods not because I expect you to absolutely avoid every single item on it, but because with awareness, you can and should monitor your and your child's intake of foods that damage the nerves.

## Foods That Damage the Nerves

Anything enzyme modified	Cornstarch
Anything fermented	Corn chips (certain brands)
Anything protein fortified	Dough conditioners
Anything ultra-pasteurized	Dry milk or whey powder
Anything vitamin enriched	Egg substitutes
Anything with corn syrup added	Flavored chips (certain brands)
Anything with milk solids	Flavored teas, sodas
Baked goods from bakeries	Flour
Barbeque sauce	Flowing agents
Certain brands of cold cuts/hot dogs	Fresh and frozen pizza
Body builder protein mixes	Fresh produce sprayed with Auxigro—instead choose organically grown produce
Bottled spaghetti sauce	Fried chicken from fast food sources
Boullion (any kind)	Frostings and fillings
Canned and smoked tuna, oysters, clams	Gelatin
Canned soups (certain brands)	Gravy Master
Canned refried beans	Instant soup mixes/Stocks
Canned, frozen, or dry entrees and potpies	Kombu extract
Caramel flavoring/coloring	L-cysteine
Catsup	Low-fat/Diet foods
Cereals	Many salad dressings/Croutons
Chili sauce	Mayonnaise
Chocolates/Candy bars	Molasses
Citric acid (when processed from corn)	Most salty, powdered dry food mixes



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Mustards	Skim, 1%, 2%, non-fat, or dry milk
Non-dairy creamers	
Parmesan cheese	Some bagged salads and vegetables
Pectin	Some peanut butters
Pickles	Some spices
Salted peanuts (certain brands)	Soy sauce
Powdered soup and sauce mixes (certain brands)	Supermarket turkey & chicken (injected)
Processed cheese spread	Table salts
Ramen noodles	Tofu and other fermented soy products
Restaurant gravy from food service cans	Tomato sauce/Stewed tomatoes
Restaurant soups made from food service Soup base	Whipped cream topping substitutes
Sausages/Processed meats/Cold cuts	Worcestershire sauce
Seasoned anything	Xanthan gum/other “gums”

## Conclusion

Some parents opt to have their children take tests that measure neurotransmitter levels in order to precisely determine glutamate and GABA levels. Since these tests are costly, I don't recommend them that often. The bottom line is that once glutamate reaches a certain level, neurological damage has already occurred. To avoid getting to that point, the goal is to limit the amount of glutamate that comes into the body every day. As you learn the sources of glutamate and aspartate, you can make informed choices about limiting intake. The aim is to keep excitotoxins to a minimum; you will never avoid them completely.

Transitioning to proper nutrition and getting glutamate under control are foundational to this program, but I don't underestimate the challenge. Please seek out the techniques and approaches that work for your child and family, and remember that this is a marathon, not a sprint.

## Chapter 5. Promoting Healthy Digestion

**A**fter you receive the Nutrigenomic test results, (in Step Two), you will put into place the supports for methylation cycle function. With those supports, you will be naturally undergoing detoxification as well as addressing microbial imbalances more intensively. That's why it's vital to prepare the digestive organs for this process—in advance. The digestive supports that I'll suggest in this chapter can be continued throughout the entire program. As we repair and regenerate the digestive organs, the body is better able to receive nutrients and release toxins which are critical for Step Two of the program. Moreover, strengthening the digestive tract creates a better environment for addressing microbial overgrowths. In Step Two, we will upgrade our efforts to eliminate inhospitable bacteria and viruses. But we will begin that process by laying the groundwork now.

The organs that require support may include the liver, kidneys, pancreas, stomach, and intestinal tract. In addition, we will also address key hormones and neurotransmitters that lay a groundwork for wellbeing. Sometimes, the need for a supplement may be self-evident. For example, if a child is constipated, or has just undergone a course of antibiotics, many parents already understand that it would be good to restore healthy gut bacteria through probiotics. If a child has many allergies, both gut support and immune building supplements would be obvious choices. If a child is strongly reactive to sweets, most parents know that it's important to control sugar intake through diet, and to support the pancreas. In addition, when tests reveal the presence of bacteria, yeast, or other microorganisms, following the protocols to support gut health is advisable. However, a child may need additional support without that being immediately obvious. Therefore, in this chapter, I will list supplements for specific purposes as well as the test results (and symptoms) that might indicate a need to take them. I'm not recommending that you test your child in every instance, as for many people that is too costly. However, if you see symptoms that you or your practitioner believe could indicate the need for specific organ support, you can always confirm your supposition by testing.

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In addition, there are certain tests that are good to take as a baseline before you bring in methylation supports at Step Two. These can either be undertaken at the beginning of Step One, during Step One, or at the very beginning of Step Two. At the minimum, it's good to do a urine amino acid test and a metabolic analysis (or OAT) profile. If you run this test through my office, It will be held until your Nutrigenomic test results arrive, and then it will be used to fine-tune your recommendations.

You can also retest to find out if supplementation is producing the results you seek.

The liver, stomach, pancreas, and intestinal tract function interactively. That's why problems in one of these digestive organs can create imbalances in other organs. Although I won't touch on the wide range of interactions, certain ones are critical in addressing detoxification.

## The Liver

The liver is one of the most important organs of the body, working to metabolize carbohydrates, fats, and proteins. It stores vitamins and minerals and contains regulatory mechanisms for healthy blood sugar and hormonal levels. The liver also produces bile, a key player in the elimination of digestive waste. Most critically, the liver is a central site for bodily detoxification.

A healthy liver makes enzymes used to efficiently detoxify the entire body. The liver also contains the highest bodily levels of glutathione, one of the body's most powerful antioxidants. Glutathione is essential for both the Phase I and Phase II detoxification systems of the liver. Unfortunately, glutamate can reduce the liver's stores of glutathione. In addition, infection, inflammation, and low levels of the mineral, magnesium can also lower glutathione. Fortunately, certain herbs and other supplements are very helpful for maintaining liver health. Further, addressing mutations in Step Two should also help the body to create glutathione. You can elect to use the supports suggested, as well as take certain optional lab tests listed below.

### Liver Support:

- Liver Support RNA (a few drops daily)

- Milk thistle

- Rosemary

- Dandelion root

- Quercetin

- B Complex (depending on Nutrigenomics for COMT and CBS)

SAMe (depending on Nutrigenomics for COMT and CBS)

Alpha lipoic acid (1/2 capsule should be fine regardless of CBS status)

Taurine (depending on levels on UAA test)

Cod liver oil

Shark liver oil

OraLiv supplement

### **Lab Tests Indicating a Need for Liver Support:**

Elevated AST (SGOT) or below normal AST

Elevated ALT (SGPT) or below normal AST

Elevated alkaline phosphatase (ALP)

Elevated lactate dehydrogenase (LDH)

Elevated bilirubin

Elevated cholesterol

Elevated triglycerides

Long-term chelation with sulfur based chelating agents

High level excretion of toxic metals on fecal tests

### **The Kidneys**

The kidneys are among the organs of excretion, and thus detoxification. Chronic viral infections and detox both stress the kidneys, creating the need for kidney support. Chronically high creatinine levels indicate a need for strong kidney support. At the least, you can consider OraKidney, Kidney Inflammatory Pathway Support RNA, and dandelion leaf if test results reveal high creatinine for more than a month. Also, if there are any indications of chronic viral issues, such as elevated antibody titers, I would also recommend a consistent form of kidney support.

### **Kidney Support:**

Cranberry

Kidney Support RNA (a couple of drops daily especially during detox)

Dandelion leaf

Ora Kidney

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Curbita  
ATP  
SAMe

## **Lab Tests Indicating a Need for Kidney Support**

Elevated BUN  
Urine excretion/detox of metals for prolonged periods  
High creatinine levels over a prolonged period of time

## **The Pancreas**

The pancreas secretes insulin, the key hormonal regulator of blood sugar (glucose). The pancreas is critical to health restoration, because a poorly functioning pancreas can contribute to high glutamate levels, low GABA levels, decreased secretin, decreased cholecystokinin (CCK), and decreased Vitamin K, among other imbalances.

Organs function in tandem, so it is important to look at the optimal function of each of these digestive organs. If the pancreas and the liver are weak, the process of digesting food and balancing food acidity can go awry.

In addition to creating imbalances in intestinal flora, which I'll discuss in more detail later in this chapter, excess acid results in a whole unfolding sequence of problems. Without sufficient bile (relative to acid levels,) fats aren't properly digested, which lowers the absorption of fat-soluble nutrients (like vitamins A, D, and K). Further, sub-optimal amounts of secretin and CCK impact certain key areas of brain function. For example, low brain levels of CCK are correlated with anxiety and panic. For these and many other reasons, pancreatic support is vital.

### **Pancreatic Support:**

Super Digestive Enzymes (at least one with each meal)  
Ora Pancreas  
Ayur-Gymnema  
Vitamin K  
GABA  
Chromium  
Sage  
Rosemary  
CCK—Resist Fat Apex Lean (low dose)

CCK Support RNA  
Pig duodenum  
Prolongevity RNA (low dose)

### **Lab Test Results and Other Indicators for Pancreatic Support:**

Consistently elevated glucose  
Consistently low glucose  
Elevated triglycerides  
VDR Fok +—or VDR Fok + + Mutations  
Imbalances in pancreatic elastase on a CSA  
Imbalances in chymotrypsin values on a CSA  
Imbalances in short chain fatty acid (Iso-butyrate, iso-valerate and n-valerate) on CSA  
Imbalances in long chain fatty acid on a CSA

## **The Digestive Tract**

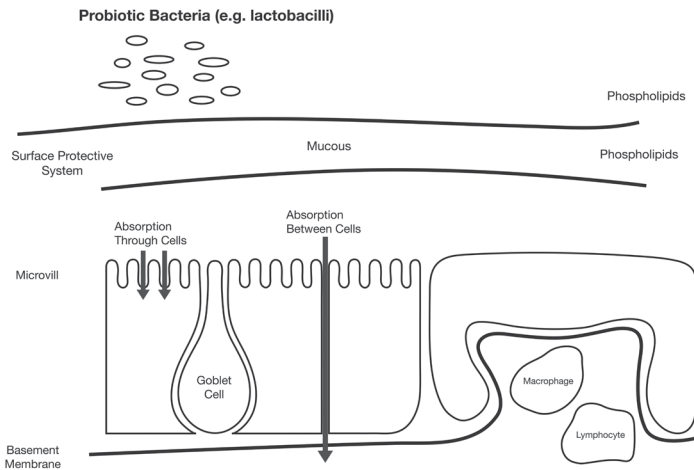
Many of the children I see have problems due to intestinal permeability, commonly referred to as “leaky gut.” Microbes contribute directly to leaky gut and irritable bowel syndrome (IBS). This is a key contributor to food intolerances, as mentioned in the previous chapter. Unfortunately, metals join opportunistically with microbes, which makes metal detox more challenging to undergo when gut health has already been compromised. That’s why working to restore gut health is an essential precursor to detox—and should be continued throughout the program. And that’s why I’ll advise that you revisit the gut support program again as we proceed through the steps of the program.

### ***What’s Going on Inside Leaky Gut?***

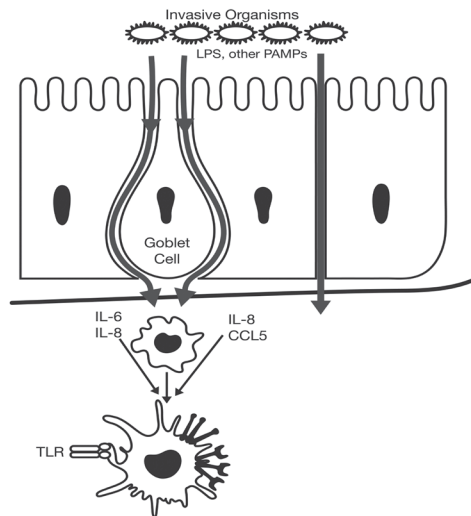
As you can see, the cells lining the interior of the gut wall are like bricks arranged side by side, with no space between them.

Because these cells or bricks stand closely and tightly together, they retain within the gut all of the material that passes through on its way out of the system. However, when gaps develop, material can seep out of the gut and into the bloodstream, where it can stimulate antibodies that trigger immune responses to foreign substances.

When invading organisms slip through, they can trigger a huge inflammatory cascade. With the secretion of the inflammatory markers TNF-alpha and IL-6 come other biochemical reactions that can affect the body in a variety of undesirable ways. These include impacts on mood and cognition, as well as an increase



in the risk of excitotoxin damage. Along with the many ways that gut imbalances impact other areas of function, note that chronic bacterial as well viral infection can produce imbalances in the thyroid hormones TH1 and TH2. I could cite many other examples, but the bottom line is that gut, bacterial, and viral imbalances create body-wide problems.



So what is the best strategy to address this?

### ***Addressing Gut Imbalances***

One option for addressing microbes is prescription antibiotics. While I don't suggest that people with severe issues go off medication, it's important to realize that some of the medications currently utilized for IBS can have other, unintended negative effects. For example, some affect glutathione levels, or inhibit a key enzyme that helps to recycle BH<sub>2</sub> to BH<sub>4</sub>, which—as you will learn later—is a key functional aspect of the methylation cycle.

That's why I encourage you to support normal flora (healthy bacteria in the gut) by supplementing with probiotics, such as acidophilus and others. To get a good mixture of helpful bacteria, you can rotate the products from preferred sources such as Suprema Dophilus as well as others mentioned in the supplement recommendations later on in this section. Again, you should not take all the probiotics mentioned but alternate them to get a good mix. By following this plan, you create an environment where the normal flora can thrive and help to eliminate the offending organisms. If you wish, at the end of each month, you and your practitioner can elect to run a comprehensive stool analysis (CSA) to confirm that the gut flora are in balance.

### ***Excess Acid***

Another key factor in intestinal imbalance is excess acid. Often, different areas of digestive dysfunction combine to create a downward spiral. For example, when there is both excess stomach acid and insufficient bile (due to decreased liver function), the overall result is acid excess and acid pH in the intestinal tract. An acidic intestine is more hospitable to the growth of microorganisms, including a variety of anaerobic bacteria, among which are a number of species of *Clostridium*. In addition, yeast, *Escherichia coli* (*E. coli*), and *Streptococcus* overgrowth are common and overwhelm the normal intestinal flora.

This imbalance in normal flora can be further exacerbated by the excitotoxin glutamate. Excess glutamate has been shown to increase the survival of enterohemorrhagic *E. coli*, particularly under acidic conditions. Ingestion of glutamate as MSG itself has been reported to cause excess acid and heartburn.

For all these reasons, countering excess acidity and maintaining healthy gut microbes (and eliminating unfriendly yeast, bacteria, parasites, *Helicobacter*, and other problematic flora) should improve digestive function, reduce the body burden of infectious agents, and help to restore immune function.



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## A Note About Vitamin K Deficiency

A byproduct of excess acidity is vitamin K deficiency. While vitamin K is a fat-soluble vitamin, it's not stored like the other fat-soluble vitamins and needs to be consumed on a daily basis. Normally when gut bacteria process leafy greens, vitamin K is produced. However, the disturbance of normal flora will often result in a vitamin K deficiency.

Why do we need vitamin K? First, it's essential for healthy calcium metabolism, contributing to the maintenance of strong bone and healthy teeth. Vitamin K reacts enzymatically with glutamate and calcium to ensure proper placement of the calcium in bones and teeth. It has also been shown that Vitamin K2 can help prevent pathologic accumulations of calcium in tissue, which is a critical factor leading to cell death. Vitamin K also impacts blood clotting to prevent excessive bruising and bleeding. The pancreas contains high levels of vitamin K, which is critical for sugar regulation. Most children suffering from autistic behavior seem to have imbalances in their ability to tolerate sugars. By supporting sugar regulation, Vitamin K helps to control hypoglycemic-related anxiety attacks. In addition to the brain, the other area of the body that is able to concentrate the excitotoxin glutamate is the pancreas, which would result in further damage to the pancreas and sugar regulation. That's why controlling glutamate and increasing vitamin K help the pancreas do its job.

## Vitamin K Rich Foods

Avocado	Olive oil
Broccoli	Peanut butter
Cabbage	Pistachio nuts
Canola oil	Plums
Carrots	Potatoes
Cauliflower	Snap beans
Celery	Soybean oil
Cucumbers	Spinach
Green peas	Sweet peppers
Kiwi fruit	Tomatoes
Lettuce	Turnip greens
Miso	Watercress

### **Key Factors for Gut Health**

In working to restore gut health, let's not forget that the immune system resides primarily in the intestinal tract. As a result, restoring gut function entails all of the following:

- Supporting gut tissue integrity and digestion
- Building a climate favorable to healthy gut bacteria and unfavorable to unhealthy micro-organisms
- Addressing all areas of unhealthy microbial overgrowth
- Strengthening overall immune function
- Addressing inflammation

On my website, I talk a lot about our herbal antimicrobial mix. I usually suggest seven different herbs, and I adjust the herbs suggested based on the sensitivity testing on the CSA. Coming from a background in microbiology, I know that if you can hit the microbes with seven different things at the same time, they are less likely to develop resistance to any single one of them. In addition, most of the herbs that I pick have other positive uses in the body. My personal philosophy is that ideally, it's best to use a little bit of a lot of different herbs, rather than just using a high dose of a single microbial support herb. Even if this means, for example, using low doses of seven of the herbs three times a day, then you will be providing a more constant dose of them and you are actually helping to kill those bacteria.

### **Prescription Antimicrobials**

With regard to prescription antimicrobials, a lot of parents will write in and say, "Oh, does my child really need to take this antibiotic?" If a child really needs an antibiotic, use it. Maybe my background of work with antibiotics and antibiotic transport makes me feel that if the herbal antimicrobials aren't working, do whatever you need to get those microbes under control and support the body. Make sure to supplement with probiotics concurrently. A chronic bacterial infection in the body along with the aluminum retention that typically accompanies a bacterial load is worse than using a prescription antibiotic, if your doctor suggests it, to get rid of that organism. Afterward, you can maintain gut health long term by using natural products. Again, I recommend that you rotate three, four five—as many as six—different normal flora. I like to mix it up so the body doesn't get so used to what it is seeing that it ignores it. We use a little bit of Toueff, sometimes, as part of our normal flora, as well as Immunfactor 5. We also include lactofer-

rin, and Microbial STRX Support RNA is a nice new tool. We also have some newer RNAs available to help more specifically with gut balance. These can be added based on CSA results. Used with the rest of the gut protocol, Stomach pH Balancing RNA can help to balance pH to reduce bacteria and maintain healthy gut flora. Bacterial infection leads to an increase in somatostatin, which can inhibit growth hormone.

<b>CCK</b>
<p>The gastrointestinal peptide hormone cholecystokinin (CCK) is a key but often overlooked player. In addition to its role in pancreatic support and brain function, CCK also appears to help address chronic bacterial loads in the body. Using CCK to address chronic bacterial issues may require a higher dose than the 1/4 tablet used only for pancreatic support. I suggest you consider starting with the 1/4 tablet along with 1/8 dropper CCK Support RNA and gradually increase the CCK tablet (Resist Fax Apex Lean) by 1/4 amounts over time to up to three tablets per day. You will get a sense over time of the maximum dose needed to help to aid in chronic bacterial issues. Perhaps because its biochemical structure is similar to gastrin, I've noticed that CCK, along with BH4, Bio Thyro, and certain prescriptions helps aluminum excretion.</p>

**Overall Gastrointestinal Tract Support:**

- |                         |                     |
|-------------------------|---------------------|
| Super Digestive Enzyme  | Suprema Dophilus    |
| Cholacol                | Ultra Dairy Support |
| Florastor               | Allerdophilus       |
| Prescript Assist        | Toueff              |
| Lactobacillus Plantarum |                     |

**Colon Health Support:**

- |                            |   |
|----------------------------|---|
| CCK (Resist Fat Apex Lean) | Special Colostrum high in sIg A (Bioactive Colostrum) |
| CCK Support RNA            | ARA 6   |
| Bowel IPS RNA 3x a day     | Immufactor #5   |
| Stomach pH Balancing RNA   | Microbial STRX RNA                                    |
| Buffer pH                  | Transfer Factor                                       |
|                            | Paradex   |

Candex	Lactoferrin
Candisol	Specific RNA supports based on CSA results
Nystatin	
Mycology Support RNA	
Immufactor #7	
Slippery Elm	

### **Supplements to Aid in Constipation:**

Mag O7	Yellow dock
Vitamin C	Cascara sagrada
Cod liver oil	Rhubarb
Artichoke	Triphala
Aloe Vera	Smooth Move Tea

### **Microbial Herb Mix:**

Oregon grape	Caprylic acid
Myrrh	Barberry
Neem	Olive extract
Goldenseal	In addition, rotate anti- microbial herbs (choice based on CSA sensitivity tests)
Uva Ursi (limited use)	
Cranberry	
Oregamax	Grapefruit seed extract

### **Lab Test Results and Indicators Signaling Undesirable Bacteria:**

History of chronic ear infections  
Maternal history of streptococcal infection  
History of bacterial pneumonia  
Streptococcus, E.coli on CSA  
Other bacterial pathogens on CSA  
Elevated kynurenic on OAT/MAP, CONFIRM with CSA  
Elevated quinolinic on OAT/MAP CONFIRM with CSA  
Elevated FIGLU and DHPPA on OAT/MAP

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Low gut pH

If CSA is “clean,” run GI Function Profile to look for anaerobes

### **Lab Test Results Signaling Yeast Imbalances:**

Elevated arabinose on OAT/MAP CONFIRM with CSA

Presence of yeast shown on CSA

### **Supports for Addressing Parasites:**

Paradex

### **Lab Test Results Indicating Parasites:**

Parasites on a CSA or GI Function Profile test

High levels or exceedingly low levels of eosinophils on bloodwork

### **Supports for Addressing Heliobacter:**

Mastica gum

Stomach pH Balancing RNA

Slippery elm

Colostrum

Buffer pH Supplement

Super K

### **Lab Tests to Determine Undesirable Levels of Helicobacter:**

Helicobacter test

### **Supports to Address Inflammation:**

Nettle

Boswellia

Curcumin (limited amounts for COMT V158M ++)

Skull cap

Chamomile

Quercetin

Petadolex (Butterbur)

Cherry fruit extract

General Inflammatory Pathway RNA

HyperImmune RNA (limited amounts for COMT V158M ++)

Cytokine Inflammatory Pathway RNA

Advanced Joint Inflammatory Path. RNA

Stress Foundation RNA

Lung Support RNA

Colostrum

Kidney Inflammatory Pathway RNA

### **Indicators of Inflammation:**

Low gut pH confirmed by CSA

Imbalances in sIgA levels on a CSA

Imbalances in lactoferrin levels on a CSA

High kynurenic or quinolinic on a MAP or OAT test

### **Strengtheners for the Immune System/Thymus/Spleen:**

Bovine Colostrum

IVIG

Ora -triplex

Immuno-forte

Peptizyde (only 1/4 to 1/2 daily for immune support)

Serenaide (only 1/4 to 1/2 daily for immune support)

Spirulina

IP6

Mycocetics mushroom w/ beta glucan

Kidney Inflammatory Pathway RNA

Transfer factor

### **Lab Test Results Indicating a Need for Immune Support:**

Imbalances on ImmunoSciences test panels

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## ***Summary of the Gut Program***

If you or your child experiences difficulty keeping the gut flora in balance, I recommend that you consider implementing these three aspects of the gut program:

1. **Change** the gut environment. Using the supports to make the gut environment less conducive to the growth of non-ideal organisms and encourage the long-term growth of beneficial organisms.
2. **Establish** normal flora through rotating a variety of sources (one each day of the week.)
3. **Eliminate** non-ideal gut microbes. You can determine the precise mixture of gut herbs best for your child by looking at test results that reveal which non-ideal microbes are present.

In conclusion, in Step One, we lay the groundwork of the gut program. In Step Two, Part Two, we will upgrade our efforts to eliminate non-ideal organisms and the metals that co-exist with them. If you have more questions about dealing with infections, skip ahead to chapter 7.

## Chapter 6. Step Two, Part One

### Optimizing the Methylation Cycle

Once you get the test results, you will most likely wish to move ahead with this program. However, before you begin to implement the suggestions in this chapter, I want to alert you to two things. First, it's important to implement suggestions in the correct sequence. Second, since detoxification can be very stressful on the body, I always advise people to take sufficient time doing the Step One recommendations before they progress to Step Two. In addition, Step One supports can and should be continued as you move ahead with the program for as long as needed. For some, that will be for quite some time, even lifelong. For others, once the major detoxification has successfully restored function, a gradual step-down in supports, with your practitioner's guidance, may be possible. However, although the goal of the detox portion of the program is to reduce the current toxic burden, please keep in mind that there is no way to permanently eliminate all future toxic environmental exposures. To maintain health, those with vulnerable genetics may need to support their methylation cycle and some of their organs lifelong.

#### Understanding Detoxification

In Step Two, you will restore methylation function and thus promote detoxification. Since improved methylation prompts the body to excrete accumulated virus, metals, and bacteria, it's important to understand that the body's natural process of detoxification differs from the kind of excretion that results from chelation therapy.

To understand the distinction, picture a revolving door (the kind you might see in an office building or hotel.) In our bodies, toxins come in and go out, just as people come and go through the revolving doors. This is an ongoing process throughout our lives, which helps us survive in a toxin-filled world. However, for those with methylation cycle mutations, the revolving door does not work so well. Toxins come in, but they don't go out easily. Instead, they accumulate.



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When you use a chelating agent, it's like taking some of the accumulated toxins out through a side door of the building—but the revolving door remains impaired. The use of chelation can enhance toxin removal, but it cannot repair the door. As a result, once you stop chelating, the toxins will again build up.

Nutrigenomic tests, on the other hand, reveal how to fix the door—by using nutrition to bypass mutations, and allowing the body's natural detoxification systems to operate properly. As a result, through this program you may experience an increased level of detoxification, especially if your revolving door has been blocked for a long time. Since detoxification symptoms can be uncomfortable to experience, people often wonder whether they are actually detoxifying or merely responding poorly to a particular supplement. I recommend that you use urine, stool, hair, and blood toxic metal tests to monitor the excretion of these metals. Test results that reveal metal excretion will confirm that you are naturally detoxifying—that, in effect, your revolving door is working again. These same tests will also allow you to track the levels of metal excretion, so that your supplementation can be adjusted.

## **Monitoring Your Minerals**

I recommend that you ensure that essential minerals are balanced before you move ahead to support mutations. Since test results often reveal a drop in essential minerals along with metal excretion, I recommend regularly testing both essential minerals (the Urine Essential Elements or UEE test) and toxic metals (the Urine Toxic Metals or UTM Test). This is especially important when test results show high levels of metal excretion. Taken at the outset, the results of the UEE test will tell you which ones are low and need supplementation.

### **Supplement Recommendations based on UTM/UEE Test Results**

#### **Increasing Calcium**

Nettle

Chamomile

Chervil

Cal/Mag/Vit D/Vit K (Calcium & Magnesium Citrates)

Bone Support RNA

#### **Increasing Other Essential Minerals**

Sodium : Aerobic O7

Potassium: Aerobic KO7

Phosphorus (Complexed Phosphorus)

Magnesium

- Mag O7
- Magnesium Citrate
- Krebs Magnesium-Potassium Chelates
- Magnesium Drops
- Magnesium Malate Forte

Zinc

- Zinc Lozenges
- Zinc Drops
- Krebs Zinc (only if MAP or OAT tests also indicate a need for Krebs support)

Copper

- BioThyro
- Cell food

Manganese

Molybdenum

Boron

Chromium Picolinate

Lithium Orotate

Selenium Drops or tablets

Strontium Support II

Vanadyl (Vanadyl Sulfate)

Track essential elements levels, and keep them in balance. For overall support, use BioNativus liquid minerals along with Cellfood. The dose is two to three drops of each per day.

## Mineral Support During Detox

Mercury excretion can affect the levels of lithium and iodine. You can rebalance iodine with 1/4 to 1/2 tablet of the supplement Iodoral (or other natural forms of iodine). For healthy lithium levels, 1/4 lithium orotate is recommended. Frequently, decreases in calcium are seen following lead excretion. Since calcium stimulates excitotoxin activity, I prefer low to normal calcium levels, especially

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for those with elevated glutamate. For calcium support (if test results show it's needed), you can utilize herbs with other calming components, such as nettle, chamomile, and chervil. If this does not bring the levels within normal range, use a calcium supplement that also contains magnesium (which prevents excitotoxin activity) and vitamins D and K (which ensure calcium transport within the body.)

Chickweed, nettle, dandelion leaf, and yellow dock are natural sources of boron, which may, like calcium, drop during lead excretion. Chickweed also helps skin rashes. Nettle helps to decrease inflammatory mediators and increase serotonin. Dandelion leaf supports the kidneys. Yellow dock supports regular bowel movements. If boron support is needed, mix small amounts of all of these, or choose one based on its other helpful properties.

For magnesium support, a very absorbable form is magnesium citrate. Aim for higher levels of magnesium so that the calcium/magnesium ratio favors magnesium. High dose zinc can trigger glutamate receptor activity, so only use 40mg (or less) of zinc per day of either zinc picolinate, or Body Bio Zinc. If MAP or OAT test results reveal that all Krebs intermediates are low, you can use a Krebs cycle zinc supplement.

As you'll learn later in this chapter, healthy molybdenum levels aid in sulfite detoxification.

Selenium is useful in binding to mercury, so use the supplements indicated to assure that you have adequate levels.

Manganese is another key mineral, which is needed to:

- Produce dopamine
- Support vitamin C to function
- Support insulin production
- Create acetylcholine, a neurotransmitter that acts on key cell receptors of both the sympathetic and parasympathetic nervous systems
- Initiate Krebs cycle activity
- Detoxify excess ammonia

Classic signs of chronic manganese deficiency include low cholesterol, elevated alkaline phosphatase levels, and depressed T-cell-mediated immune function (due to thymus issues).

Now with good mineral support in place, let's assess whether you're ready to begin Step Two.

## Are You Ready to Begin Step Two?

When is the right moment to proceed to Step Two? Here are some signs to look for:

- Improved digestion, absorption, and nutrition, an indicator that all the allied organ systems have improved function
- Reduced incidence of stims
- Improved eye contact
- Sounder sleep, and an improvement in the bowels and absorption.

To assure that you are ready to address mutations, consider doing another round of tests, including UAA, MAP (or OAT), CSA and UEE/UTM to see where things stand as compared to the baseline tests, already performed at the beginning of Step One. Make sure to continue the comprehensive supplementation program that was used in Step One. This will ensure that the immune system and other organs are well supported during the elimination process.

## Adding Supplements

For the supplements recommended for methylation cycle support, please keep in mind once again that it's not necessary to take every supplement in every category. However, for some people, it may eventually be necessary to use them all. Some people may be sensitive to an herb or supplement, making it essential to add supplements slowly, as in Step One, allowing several days to assure that the newly added supplements agree with you or your child before progressing. Yes, it will take a while to introduce them all. Again, this is a marathon, not a sprint!

The suggested dosage on any supplement is 1/2 to one whole capsule or tablet, unless otherwise noted. This is typically below the dosage suggested on the labels of the bottles. Again, my philosophy is to use multiple overlapping supplements with related function, in low doses.

Please check your Methylation Pathway Analysis Report (MPA) for the specific supplement recommendations for each mutation. Based on ongoing research and clinical experience, I will continue to adjust these recommendations. Please check the website periodically for any updates to supplement recommendations.

## Bypassing Mutations

Moving forward into Step Two, I'll guide you in implementing the program to bypass methylation cycle mutations. Given the many critical bodily functions tied to the methylation cycle, attaining adequate methylation cycle function will

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begin the process of viral, bacterial and metal detoxification. In some (but not all) instances, the detox triggered by methylation optimization will be sufficient—and nothing further is needed to promote detoxification. As detoxification proceeds, function is restored. However, in many cases, restoring methylation function does not complete the process of detoxification. That’s why in Step Two, Part Two (in then next chapter), I’ll guide you in the more advanced detox options that follow the methylation supports outlined in this chapter. These options will further promote the release of chronic viral and bacterial infection, which in turn prompts the excretion of toxic metals, as I discussed earlier.

## **A Dynamic Cycle**

As you’ve learned throughout this book, I regard the entire methylation pathway as “a biomarker” for underlying genetic susceptibility to a number of serious health conditions, including autism. In earlier chapters of the book, you’ve learned the function of this cycle and why I consider it so important. Now we’re going to take a deeper look into this unique cycle and how it works. I encourage you to study and familiarize yourself with the chemical diagrams of the cycle, here in this book and on my website. These diagrams will serve as a map for our discussion. As you come across complex scientific terms, or hear me or others in the chat room speak of specific genes, you can always orient yourself by revisiting these diagrams.

When you look at these illustrations on the page, this cycle appears to be static and flat—but it’s anything but. In fact, it’s always in motion. Different enzymatic reactions are constantly occurring between molecules and chemicals. It’s truly dynamic and alive. I often wish I could develop an animated version of it, and hope one day soon to do this.

Keeping that in mind, all the mutations you’ll read about in your test results appear and are active at specific points in the cycle. I recommend that you familiarize yourself with these various points and their activities, because that will help you understand the process into which we are intervening through this program, and will make the recommendations that much clearer.

As you will note, the diagrams look like a bit like intermeshing gears. Imagine that they are the gears of a series of interlocking water wheels. The wheels always move in a clockwise direction, pouring what they contain into the next phase of the cycle. At various points there are weigh stations, each one manned by an assembly-line worker with a specific job to perform. The worker adds, subtracts, or combines a specific ingredient into the forward flowing stream of water. If any of these workers neglects to add his ingredient, or adds too little or too much, the effects will be felt down line: The process will not result in the anticipated end products, and other workers will have to deal with that. As a result, through the

Nutrigenomic test, we are able to figure out which way stations have a problem, and pinpoint what it is. This allows us to compensate in order to assure a good result.

Whenever I use the language of biochemistry, keep in mind that in most cases the scientific term describes a weigh station, what is added or subtracted there, or what effect is produced as the “water” in the water wheels moves forward.

I sometimes also use the metaphor of a clock when discussing the cycle and its movements. When I mention twelve o'clock or five o'clock, know that this is a shorthand to allow you to easily locate the point on the clock—that is, the part of the cycle—being discussed.

### Understanding Your Test Results

I'm a firm believer in the use of the right kind of genetic information as a key ingredient in health care, now and into the future. That means that all who pursue my program are, in a sense, pioneers. Given the kind of medicine with which most Americans grew up, few people are familiar with how to follow an individualized approach to health care—and nothing is more individualized than this kind of genetic analysis and the guide to supplementation that is based on it. As a result, throughout the program you will no doubt have many questions. I try to give you a solid groundwork and answer the most common questions in this book. But the answers to many individual and specific questions can be found by searching through the chat room on my website. And if you don't find the answer, you can always write in to the chat room and ask your question. One of the experienced parents or I will answer it.

Now, let me orient you to what you will find when your test results arrive. Your Nutrigenomic profile will contain your individualized test results. This profile shows which mutations are present, so that you know which ones you will need to address. The specific supplement recommendations I offer are listed according to mutation.

Your test results contain a Methylation Pathway Analysis Report (MPA), a color-coded chart that shows which mutations—also called SNPs—you or your child has. Please review this as needed and over time, you'll become more familiar with each of these SNPs. The MPA overviews the supplements congruent for specific SNP results and details why certain supplements are recommended to support deficiencies in the methylation cycle for each SNP. I'll also explain the rationale for their use in this chapter.

In this part of the program, you will be gradually “layering in” these supplements in a specific sequence. As you familiarize yourself with the SNPs and their areas of function, the rationale for the recommendations will become clearer. Better understanding will in turn support your decision-making process throughout the

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program. This will help you determine when to add a new supplement, as well as have some familiarity with what its impact might be. All of this will serve you in tracking how well you (or your child) are progressing through the program. When it comes to taking charge of your or your child's health care, knowledge empowers.

In this chapter I will overview some of the most common and important SNPs. (More detailed information about how different SNPs function in combination with each other can be found in my book, *Genetic Bypass*.) In combination, the Nutrigenomic test and the MPA report detail the supplementation recommendations for each SNP, taking some of the guesswork out of your journey to health and wellness.

People often ask whether the genetic information found on the test is permanent or a snapshot in time. *It's permanent.* While epigenetics—gene expression—which governs whether genes are turned on or off, can change, the genes themselves do not. As you may recall, I explained this earlier in the book with a computer analogy. For this reason, the MPA is a permanent roadmap for today, tomorrow, and twenty years from now. Implementing all of the supplement recommendations based on your MPA is not something to be undertaken on Day One of the program. Accordingly, many of the supplements may not be needed now, but may be later on.

Take some time to familiarize yourself with the underlying rationale for this process. This will help you to choose the supplements needed now, next month, and in the future. Once you are ready to, you can choose your supplements and begin your journey. This program requires a commitment. When you immerse yourself in it, you will better understand it and embrace both the recommendations and the process.

## **Read it, learn it, live it...**

### ***How to Read the Nutrigenomic Test***

Each mutation or gene/gene variation is designated by a combination of letters and numbers. At first, this may seem like gobbledygook, but over time, these will become more familiar to you, and you will actually begin to understand this new language. If you take a look at the on-line chat room, you may notice that many parents list their child's SNPs after their own name. This helps all of us understand what they are addressing.

DNA molecules are made from four nitrogen-containing chemicals called bases. These are adenine, thymidine, cytosine, and guanine, commonly referred to by their initials, A, T, C, and G. Each gene has its own sequence of bases, and these letters are used to differentiate one gene from another.

In your Nutrigenomic profile and MPA, you'll notice that there are two copies of each gene, marked with either a + or a-. One copy comes from each parent. When both copies are identical (either with or without a mutation), the profile will show them as either +/+ or -/-. We then refer to them as "homozygous." However, when one copy has the mutation (as denoted by a +) and the other does not (as denoted by a-), then we refer to them as "heterozygous."

The + and—designations indicate whether or not the gene differs from what's considered "the norm." A change from the norm is termed as a + sign. No change is designated by a—sign. The parameters of the norm vary from lab to lab, depending in part on the lab's reference database. The call letter for each SNP indicates the genetic base identified by the lab.

For instance, for the MTHFR gene, we look at a particular SNP designated as C677T. This alphanumeric name reveals that at position 677 in the DNA, the lab regards a change from a C to a T as a mutation. The call letter T and the + designation signify a change from the norm—that is to say, a mutation. If there is no change, then the call letter C and the—designation indicate that this gene follows the norm; in other words, no change, no mutation.

A different lab might denote these letters slightly differently. To assure that the results are consistent and we're all on the same page, everyone following this program uses the same lab services.

### Step Two: Where to Begin

Because different parts of the methylation cycle function in ways that can trigger effects elsewhere in the cycle, it's important to address mutations in a precise sequence, especially for three critical mutations: SHMT, ACAT, and CBS. I call these the First Priority mutations. If you have SHMT or ACAT, please read about them and address them, if needed, first. And then, if needed, go on to address the CBS mutation. If you only have the CBS mutation, please address that one before proceeding to the second priority mutations later in this chapter. If you don't have any of the First Priority mutations, skip this section and start with the second priority mutations. (The names of all the mutations will become more familiar to you over time.) As we proceed to discuss each mutation, I'll orient you to:

- Its location and activity in the methylation cycle
- The biochemical changes we see when it functions properly or not
- Selected comments about the supplements that support improvements in function if the mutation is present



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- Complete supplement lists can be found in your MPA with updates on the website chat room
  - Biochemical tests that help you track markers to determine when the methylation cycle is imbalanced vs. properly balanced

Read through the sections on mutations relevant to your or your child's Nutrigenomic test results and get a sense of what you are dealing with.

However, I want to caution you that this is not a cookbook, where you just take (or give your child) every supplement on every list for which there is a mutation. This is a process that unfolds over time. I recommend that you take baseline tests and then test repeatedly to ascertain your progress. This will guide you in when to introduce supplements or add more in. And, as always work with your health care provider.

In this sequence, you will:

1. Balance minerals.
2. Balance gut and organ systems if possible. However, if you have SHMT and ACAT mutations, you may achieve better gut function after the SHMT and ACAT supports are in place.
3. Address first priority mutations: SHMT and ACAT.
4. Address first priority mutations: CBS.
5. Start the Ammonia Program: for NOS, SUOX and others who need it.
6. Begin mitochondrial support only if needed, (if muscle weakness, fatigue, or other indicators of mitochondrial dysfunction are present).
7. Provide basic support for mood and/or aggression (ACE and MAOA).
8. Add PS/PE/PC and nucleotides as support for the short route around the methylation cycle, to assure that at a minimum that it is functioning as you proceed to supplement to support long route.
9. Address second priority mutations to support both the long and short way round the pathway (depending on COMT status) gradually introducing methyl donors (MTR, MTRR, MTHFR).
10. Address BHMT.
11. Gradually increase methyl donors (unless COMT +/-).
12. Add mitochondrial support (if not introduced earlier).
13. Provide urea support.
14. Add amino acid support (if needed).

Again, more detail will follow the material on the mutations.

### **Overview of the Mutations**

#### **First and Second Priority Mutations**

**SHMT and/or ACAT mutations:** Consider addressing these first if you or your child have any of the following test results: elevated iron on a UEE test, Short Chain Fatty Acid (SCFA) imbalances on a CSA test, suberic, beta hydroxyl methylglutaric acid, or other ketone and fatty acid metabolites imbalances on a MAP or OAT test; or if there are severe gut issues or muscle weakness (which can be related to aluminum retention)

**CBS mutations:** Unless these are addressed first, adding in other methylation cycle supports can lead to increased levels of ammonia, highly elevated taurine, hydrogen sulfide, and other toxic sulfur byproducts. We address these via the Ammonia Program (see below.)

Address the rest of the methylation cycle imbalances by supporting both the “long way” around the cycle via the MTR/MTRR as well as the “shortcut” through the cycle via the BHMT enzyme.

Prior to beginning Step Two, you may also wish to run an initial, baseline urine amino acid (UAA) a MAP (or OAT) and CSA tests. When looking at these tests in conjunction with the Nutrigenomic test you can refine the supplement choices for you or your child.

#### **First Priority Mutations**

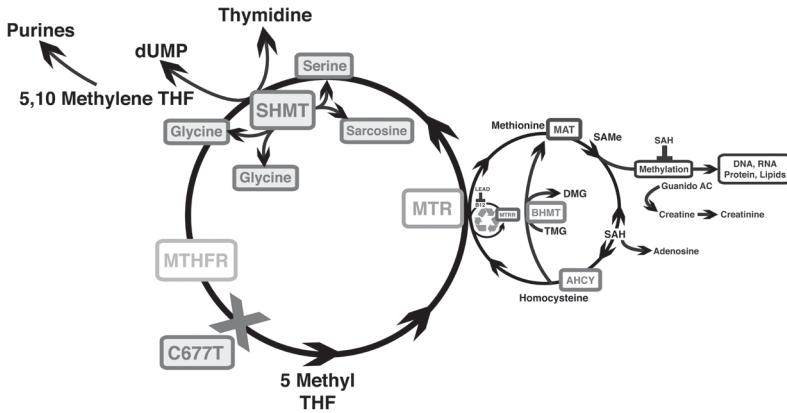
##### **Addressing SHMT and ACAT Mutations**

People with the SHMT and/or ACAT mutations sometimes have a greater tendency to experience gut dysbiosis and imbalanced flora. Until the flora are balanced, there’s a risk that the undesirable microbes will retain toxic metals. So, for those with ACAT or SHMT as well as other mutations (such as the MTHFR A1298C) that confer a greater likelihood of retaining aluminum, it is essential, prior to addressing these other mutations, to first stabilize the general gut environment via SHMT and/or ACAT support, by using supplements in the MPA received with your test results.

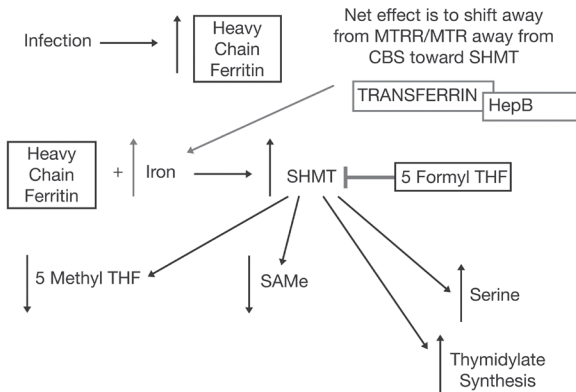
If both SHMT+ and ACAT + are present, begin with SHMT support first, and once that is in place, layer in ACAT support.

##### **Understanding SHMT Mutations**

Based on the research of Dr. Patrick Stover, I’ve concluded that the SHMT mutation often shifts the methylation cycle away from both the long and short routes through the methylation cycle into a side reaction that leads to the production of thymidine (see illustration.)



Supplementing with nucleotides, which are a form of our DNA bases, can help to both support thymidine, while maintaining appropriate methylation cycle activity. In addition, both iron and a form of folate called “5 formyl THF ” help to regulate SHMT activity. That’s why using lactoferrin (which helps to control iron levels) along with low doses of 5 formyl THF (found in the product, Acti-Folate) help shift methylation activity back to the short and long routes around the cycle.



### *Understanding ACAT Mutations*

ACAT, (Acetyl-Coenzyme A acetyltransferase) impacts critical pathways and hence functional areas of human biochemistry in several ways, including:

- Helping to form cholesterol
- Assuring lipid balance and fluidity in the cell membranes, which in turns impacts neurological function

- Contributing to energy production via the Krebs cycle and its impact on the mitochondria, which signal cellular activity and supply cellular energy
- Mediating the accumulation of oxalates, which, in excess, can contribute to kidney stones and other health problems

ACAT contributes to cholesterol synthesis and membrane lipid balance. Bile acids are first synthesized from cholesterol and next conjugated to taurine. High taurine levels (often seen with ACAT) may reflect a lack of bile acids for conjugation. Since bile salts have been shown to increase ACAT activity, they may help ACAT issues. In addition, policosanol may help with membrane lipid balance and fluidity, which impacts neurological function.

The next portion of the pathway that may be impacted by ACAT is the level of acetyl CoA, which feeds into the top of the TCA cycle (also called the Krebs cycle) at 12:00. Benfotiamine, riboflavin, and pantothenic acid support the reactions between pyruvate and the TCA cycle. In addition, a low dose of alpha lipoic acid (ALA) has been shown to replace acetyl CoA in certain reactions. Either a sprinkle of the ALA supplement or the topical ALA lotion can be used. More is not always better when it comes to support with ALA, although in some cases high dose ALA has been reported to have wonderful effects. ALA use should be based on both genetics and biochemical lab data.

A block at the acetyl CoA point of the Krebs/TCA cycle can also lead to both an accumulation of oxalates and increased levels of methylmalonic acid (MMA). To keep the cycle moving, the oxalates at 11:00 must combine with acetyl CoA coming in at 12:00. Low-dose vitamin K and lactoferrin help with that activity.

Both ACAT and high MMA levels are addressed the same way, with adenosyl B12, other forms of B12, low dose vitamin E succinate, lactoferrin, a sprinkle of actifol (ActiFolate), and nucleotides. MMA may inhibit succinate CoQ<sub>reductase</sub>, which is vital for electron transport. Vitamin K (menaquinone) and CoQ<sub>10</sub> (ubiquinone) can serve as electron acceptors in these cases.

Since high methionine levels appear to accompany ACAT mutations, S<sub>AMe</sub>, bile salts, glutathione (GSH,) and CoQ<sub>10</sub> all can help to support the conversion of methionine. Curcumin and quercetin help shift the transsulfuration pathway toward GSH. Since too much GSH can feed back and inhibit an enzyme that shunts to glutathione, I like to support the overall pathway rather than merely adding GSH.

### ***Addressing CBS Mutations***

In my opinion, CBS mutations significantly add to the challenges of treating autism, making them a first priority for those who have one or both of the two

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CBS SNPs. Typically, methylation cycle mutations lead to decreased or impaired enzyme function, but the CBS SNPs lead to increased enzyme activity (called “upregulation”). What effects does this produce?

The CBS enzyme is located right between homocysteine and the rest of the transsulfuration pathway, where it acts as a gatekeeper. With this upregulation, the “gate” is always open, sending all of the nutritional support used in this program down a road that does not lead to glutathione but instead depletes the rest of the cycle. Instead of being directed to produce glutathione, which helps the body to detoxify, our supports head out the open CBS “gate” into the transsulfuration pathway, and may end up as harmful byproducts, such as excess ammonia and sulfites.

Addressing CBS entails the following:

- Detoxifying ammonia
- Lowering excessive taurine levels
- Limiting foods and nutrients that contribute to ammonia or sulfites
- Supplying the body with nutrients depleted by this process

Since there is obviously no point in using supports only to have them drain out via CBS and create ammonia and sulfites, all of these recommendations should be enacted for at least four to six weeks prior to adding in other methylation pathway supports. However, once you have been on the program to address CBS for the above time period, you or your child will have potentially stored sufficient intermediates to manage the problem once you begin other methylation supports. However, it’s very likely you won’t be able to get just the right balance of supplements until you have methylation supports in place. That’s when we get a more complete picture of the interplay between CBS and other mutations. And that’s why I recommend that you undertake concurrent biochemical tests regularly. By doing so, you can fine tune your program. One thing is certain: anyone following the program who has any of the CBS mutations should continue to follow the CBS recommendations long term.

While you are doing the initial phase of the CBS recommendations, you can implement the gut program (see the previous chapter) if you have not already done so in Step One.

## **Balancing CBS**

This is an overview of the CBS Protocol. For specific recommendations, based on your Nutrigenomic test results, see recommendations by mutation in your MPA report. Before you begin to add in supplements, I recommend that you get an

initial baseline UAA, which will help you know where you are in regard to taurine, which is key to bypassing CBS. Begin by using Ammonia RNA (or CBS + RNA) for four to six weeks before adding other methylation cycle support. After four to six weeks of following the CBS Protocol (see below) retest taurine on a UAA. Once it's at 50% or below you are ready to add in the rest of the methylation cycle support.

Even after you add methylation support, continue to regularly use UAA testing to monitor taurine and ammonia levels to assure that taurine levels remain in the normal range. Since often the taurine will start to climb after methylation cycle support is in place, it's best to regularly use the UAA tests to track taurine levels so that you can adjust the supplements added to assure that taurine remains in the desired range at 50% or less. Those who are CBS + should run regular UAAs two to three times per year to closely follow taurine levels and support accordingly. If at any time you find that taurine has climbed, increase Ammonia Support RNA or CBS+ RNA until you've brought taurine to acceptable levels.

### **CBS Protocol**

#### **Ammonia Support RNA**

Dosage: 1/4–1/3 dropper or 0.25–0.50mL up to 3x a day with meals as based on taurine levels on a UAA.

The goal is to keep taurine at 50% or lower.

#### **Low Protein Diet**

If you or your child is on the specific carbohydrate diet (SCD) or any other high protein diet, remember to lower your protein intake gradually. Drastically reducing protein may trigger rapid detox and/or result in gut imbalances. If the SCD or high protein diet is critical to you or your child's health, then you may wish to address other aspects of the ammonia protocol first.

#### **Yucca**

Dosage: (sprinkle—1 capsule on high protein meals)

Using a sprinkle or capsule of yucca when eating protein meals is generally helpful, but to determine how much yucca to use, as well as how often to do the charcoal flush, consider testing urinary ammonia levels via a UAA test. And remember to follow the rest of the ammonia protocol—don't rely on yucca alone to help you address high ammonia.

#### **Charcoal and Magnesium Flushes**

Dosage: 1 to 2 capsules of charcoal, followed by enough magnesium citrate to produce a bowel movement within 8–12 hours. Once per week or more depending on testing and behaviors.

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A charcoal flush soaks up excess ammonia in the body. You may want to do a “trial run” with magnesium citrate the day before to determine how much you need to use to produce a bowel movement within 8–12 hours. You can do the flush on a weekend, as that may be more convenient. Use charcoal flushes if ammonia is high or needs to be kept under control, as indicated on the MPA and/or biochemical testing.

As you will see on your MPA, there are two different CBS enzymes and therefore different permutations of the basic protocols. Look at your results to see which combination you have and follow the corresponding supplement recommendations below. I recommend that people fine-tune the individual dosage based on test results (from a UAA) that track ammonia and taurine levels, also taking into consideration the number of CBS mutations.

For example, for those who have both copies of CBS C699T, the most severe CBS variation, it’s likely that you need to use the Ammonia Support RNA closer to three times per day. On the other hand, if you had a single CBS A360A, the least severe variation, you may require less of the RNA used only once a day. Biochemical testing done through my office will allow me to determine your optimal dose, but the bottom line is that Ammonia Support RNA should be on board daily with any CBS+, with the amounts adjusted based on ammonia and taurine levels. Do not stop giving it, even once these levels come down. At that point you can determine a maintenance dose that will keep taurine and ammonia in the normal healthy range. Periodic testing will help you make the necessary adjustments.

### *Limiting Sulfur*

Since the CBS mutation can lead to elevated levels of taurine and excess sulfur groups, it’s important for those with CBS upregulations to limit their intake of sulfur-containing foods. The intolerance to sulfur may be enhanced or lessened by the specific CBS SNP affected, and will also depend on whether the mutation is homozygous or heterozygous. Excess sulfur, resulting from CBS activity may also trigger chronic stress (the cortisol response), which regulates the pathway mediated by the BHMT enzyme. Normally, sulfur is bound to amino acids (such as homocysteine, methionine, SAME, SAH, or cysteine), and can’t create systemic havoc. However, with the increased CBS activity produced by this SNP, those sulfur groups are instead released into the system as *sulfites*.

To avoid that problem, I recommend that if you or your child have CBS upregulations, consult the list of sulfur donors below—and avoid foods and nutrients with high sulfur content. Garlic, an antimicrobial; DMPS, a widely used chelation agent (which helps to remove metals from the body); broccoli; and other common foods and supplemental compounds, like glucosamine sulfate (note the sulfate!) are all sulfur donors. Since those without CBS sometimes need more

sulfur donors, you may come across generic recommendations (“eat more broccoli!”) for sulfur-containing foods and supplements, another example of why it’s critical to know your genetics. Once the body is supported nutritionally to address the CBS mutation(s), you will be better able to use sulfur-containing compounds, including glutathione.

What’s more, when it comes to sulfur donors, we don’t want to “throw out the baby with the bath water” because we all need some sulfur. If sulfur is complexed in an herb or vegetable, like broccoli or milk thistle, you will get its other benefits from a low dose. With CBS upregulations (or SUOX which I will discuss later in this chapter) you should avoid MSM, chondroitin sulfate, and magnesium sulfate, at least until this portion of the pathway is in better balance, as determined by UAA testing. But you can use low doses of herbs that contain some sulfur but have other beneficial attributes, such as horsetail grass, spirulina, dandelion leaf, and parsley. In addition, methionine is key to methylation cycle function, and SAMe, which helps to create methionine, contains sulfur, as do taurine and cysteine. All three are sulfur amino acids.

### **Sulfur Containing Foods and Ingredients**

ALA	Glutathione
Arugula	Heparin
Beyond C	Horseradish
Broccoli	Legumes
Brussels sprouts	Meat
Cabbage	Milk thistle
Chondroitin sulfate	MSM
Coconut milk, juice, and oil	Mustard leaves
DMPS	Mustard/radish flowers
DMSA	NAC
Dried beans	Nuts
Eggs	Onions
Epsom Salts baths	Radish
Fish	Red hot peppers
Garlic	Watercress
Glucosamine sulfate	



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Detoxifying the sulfites produced by CBS activity requires molybdenum, a mineral that performs several biochemical functions.

## **CBS upregulation ↑ Sulfites ↑ Molybdenum ↓**

In addition to processing sulfur, molybdenum helps the body maintain the zinc/copper ratio and contributes to genetic material. When molybdenum is depleted by excess sulfites resulting from CBS upregulation, this can impact the zinc/copper ratio.

Manganese is another mineral involved in ammonia detoxification. Excess ammonia can deplete manganese stores. Classic signs of chronic manganese deficiency include low cholesterol, elevated alkaline phosphatase levels, and depressed T-cell-mediated immune function (due to thymus issues). Manganese also contributes to the synthesis of dopamine, a key neurotransmitter that helps to regulate mood. Accordingly, when higher levels of ammonia result from the CBS upregulation, manganese can be recruited to detoxify them, impacting dopamine levels. In addition, the pancreas requires manganese for insulin production. Because of the many functional areas impacted when these two minerals are recruited to rid the body of excess ammonia, I recommend that those with CBS mutations regularly monitor both molybdenum and manganese levels on an essential minerals test—in addition to monitoring both ammonia and taurine levels on a UAA test. If the test results show elevated taurine and ammonia, you and your practitioner can elect to raise the level of ammonia support.

There is one caveat in interpreting test results. While I would expect to see high levels of taurine and ammonia in all those with the CBS mutation, in actuality, sometimes that's not what the test results always show, especially prior to implementing full methylation cycle supports. So don't be misled if your baseline results don't reveal elevated levels of ammonia and/or taurine.

### ***Taurine***

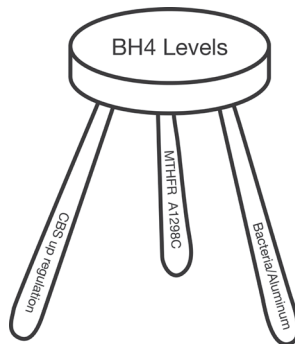
Why will the CBS mutation tend to produce higher levels of taurine? One of the roles of the transsulfuration pathway is to generate both glutathione and taurine. If the cell detects a low level of cysteine, it will favor glutathione synthesis. High levels of cysteine lead to taurine synthesis. With a CBS upregulation, more cysteine is generated, shunting the pathway toward taurine formation. Some animal studies indicate that the CBS C699T represents a forty-fold increase in enzyme activity. The CBS A360A is a less active upregulation. It's not surprising that in those with the CBS mutation it's common to see low levels of homocysteine, cysteine, or cystathionine, due to the rapid conversion to taurine.

Taurine is not just a bad guy. It's calming and helps to prevent seizure activity, so we don't want taurine levels to drop too low. Until the entire methylation cycle

is supplemented properly, it may be impossible to judge the actual taurine level. Once support is in place, if you still see low taurine levels on a UAA test, then you can increase taurine levels by using low-level B complex to stimulate the transsulfuration pathway, and finally, by supplementing directly with taurine, if necessary.

### ***The BH4 Three-Legged Stool***

The added ammonia that is generated due to the enhanced breakdown of methylation cycle intermediates will also burden the adjoining urea cycle, thereby depleting a key intermediate called BH4, which plays a critical role in regulating neurotransmitters and therefore mood. BH4 is needed for serotonin, dopamine, conversion of phenylalanine to tyrosine and language-related function. The A1298C mutation in the MTHFR gene may also impact levels of BH4.



The drawing of a three-legged stool can help you visualize how the body maintains adequate levels of BH4. One leg is for CBS upregulations. The second leg is for MTHFR A1298C, another key SNP on the methylation pathway, which you will learn more about later in this chapter. The third leg is chronic bacteria/aluminum. Stable BH4 levels require all three legs.

CBS upregulations weaken one leg of the stool by using up BH4 faster than it can be supplied. The NOS mutation can also exacerbate the CBS ammonia problem. In the adjacent urea cycle, inefficient NOS activity can lead to elevated ammonia levels, further draining BH4 limited stores. Reciprocally, CBS upregulations strain the urea cycle, where BH4 is needed to form nitric oxide. The formation of nitric oxide requires two BH4 molecules. With insufficient BH4, the body will instead produce peroxy nitrite (with one BH4 molecule), or super oxide (if no BH4 is available.) These two products can cause oxidative damage. The combination of CBS + and these other SNPs will further weaken this leg of the BH4 stool. MTHFR A1298C mutations (if present) impair the second leg by disrupt-

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ing the recycling and regeneration of BH4. Chronic bacterial infection (which can lead to aluminum retention) weakens the third leg of the stool, because aluminum inhibits a key enzyme that helps to synthesize BH4. On this program, you will ultimately address all three legs of the BH4 stool by supporting the body to address chronic bacteria/aluminum, supporting the MTHFR A1298C mutation, and addressing CBS/ammonia issues.

### ***Other Interfaces that Impact BH4***

Other mutations can also improve (or worsen) our BH4 stool's sturdiness. While BH4 helps in the formation of neurotransmitters, other factors contribute to neurotransmitter breakdown. Bacterial infections trigger a more rapid breakdown of tryptophan (needed for serotonin). Low levels of BH4 have been associated with hypertension and arteriosclerosis, as well as with more severe parasitic infections. Parasitic infections also deplete B12 levels, impacting methylation cycle function.

Lack of BH4 may result in mast cell degranulation and lead to higher histamine levels, which can produce symptoms such as red ears and other hypersensitivity reactions. Serotonin synthesis as well as ammonia detoxification also require BH4. Elevated ammonia levels can cause flapping and other over-stimulatory behaviors.

Factors that lead to more ammonia, such as high protein diets, generate more ammonia that needs to be detoxified. Each molecule of ammonia requires two molecules of BH4 for ideal detoxification. Excess ammonia in the gut may alter the pH and aggravate imbalances in microbial flora. It's obvious how these factors interact to impact ammonia detoxification as well as optimal BH4 levels for neurotransmitter synthesis. Keeping the ammonia levels under control is of paramount importance for overall health and wellness, especially for those with an MTHFR A1298C mutation, as any excess ammonia generated can drain stores of BH4. This can affect serotonin levels and to a certain extent cause fluctuations in dopamine (which translates into mood swings). Helping to restore adequate levels of BH4 should also aid in serotonin synthesis, maintaining dopamine levels as well as ammonia detoxification in a more stable manner.

### **Test Results Indicating Decreased BH4**

- High hippuric
- Increased 8 hydroxy 2 deoxy guanosine (lack of SAME or high ammonia can also cause increased 8 hydroxy 2 deoxy guanosine)
- Elevated phenylalanine, phenyl lactate, phenyl acetate, and/or phenylethylamine

- Increased ammonia
- Until we support the methylation cycle, we are not going to see the full impact of the CBS upregulations.

### *BH4 Supplementation*

Preliminary collaborative research is ongoing with a group of doctors in Japan looking at the use of prescription BH4 to help to compensate for MTHFR A1298C and CBS C699T+ mutations. The initial results are encouraging. Low daily doses of BH4 (1.25 mg) initially appear to stimulate detoxification over the first several weeks of use. After this initial detoxification effect, the BH4 appears to have a very positive impact on language for individuals with CBS C699T+ mutations. It seems it is possible to restore BH4 stores through supplementation.

## **Monitoring CBS Status with Biochemical Tests**

Because of the complexity of addressing CBS mutations, I recommend that people regularly undertake biochemical tests to assess the current status/success of the Ammonia Program. You can do a urine amino acid test (UAA) test at baseline (prior to beginning the Ammonia Program), and follow up in six to eight weeks. At that point, you should be ready to move ahead with methylation supports. However, if you're uncertain about that, the test results can help to clarify the decision as to when to move forward with the rest of the program. Once you begin to layer in the second priority supports, you should retest periodically to assure that ammonia and taurine remain at desirable levels. You can adjust if they are not. In the following section, you will see what to look for.

### **Indications of CBS Upregulations**

Any of the following values on test results may be indicators for the CBS upregulation. Changes in these values shown by periodic retesting after you begin to layer in methylation support for second priority mutations will also help you track your forward progress with CBS.

### *UAA Test*

- Elevated taurine
- Elevated ammonia
- Decreased citrulline
- Decreased methionine
- Elevated phenylalanine

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### OAT/MAP Tests

- Elevated hippuric
- Decreased fumarate
- Elevated phenyl lactate, phenyl acetate, phenylethylamine
- Decreased oxaloacetate or decreased oxalates. (Secondary to decreased oxalate you can find elevated hydroxymethylglutarate and elevated hydroxybutyrate. Elevated ammonia requires more urea cycle function, depleting oxaloacetate from the Krebs cycle. Imbalances in oxaloacetate can lead to an increase in the level of hydroxybutyrate.)
- Low CO<sub>2</sub>
- Low creatinine

### **Indications that you have addressed the CBS upregulation**

#### UAA Test

- Decreased ammonia
- Increased creatinine
- Decreased taurine
- Increased sarcosine
- Secondary to increased oxalates:
  - Increased beta alanine
  - Increased beta amino isobutyrate
  - Increased carnosine
  - Increased anserine

In addition to these tests, you can use sulfite and sulfate test strips on a weekly basis to test the conversion of sulfites to sulfates.

### **Mineral Balance for CBS**

As mentioned earlier, CBS C699T and A360A mutations can deplete molybdenum levels, since molybdenum helps to detoxify sulfur, which tends to accumulate with this mutation. Decreased molybdenum will contribute to imbalance in

the copper/ zinc ratio. You can confirm via a urine essential elements (UEE) test and supplement accordingly.

On a related note, an enzyme called xanthine oxidase (present in homogenized milk and dairy,) also requires molybdenum for activity. When xanthine oxidase levels become elevated, they deplete molybdenum levels—yet another reason for a casein-free diet. Alternatively, those with CBS mutations should consider consuming only unhomogenized dairy.

Molybdenum, EDTA, carnosine, and zinc can help balance copper/zinc ratios. Chewable zinc tablets with slippery elm also benefit the gut. Dosing begins with ¼ tablet and increases to one tablet per day. The liquid zinc, zinc capsules, or Krebs cycle zinc (once glutamate and GABA levels are balanced) are also an option. Please revisit the section earlier in this chapter on Mineral Support, placing special emphasis on supporting molybdenum and manganese for CBS.

## **Second Priority Mutations**

### ***Methylation Cycle Overview***

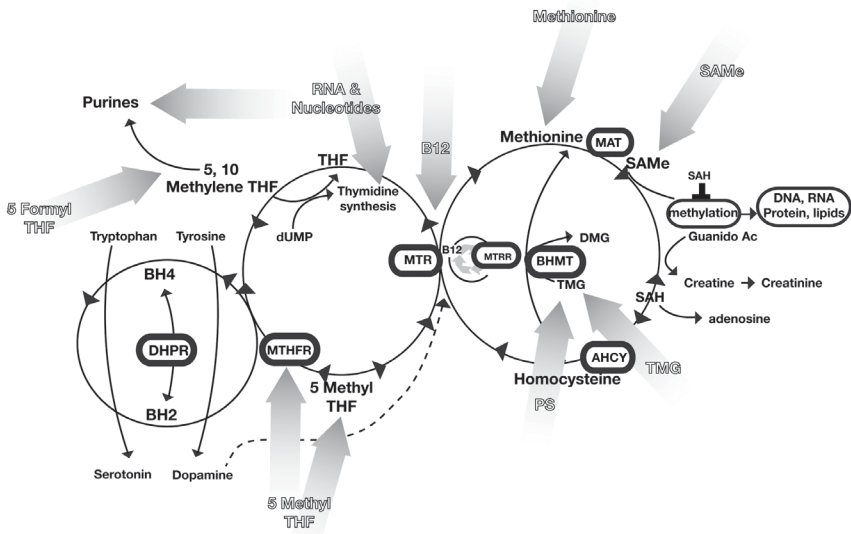
The first printing of *The Puzzle of Autism* (2004) focused on mutations in the MTHFR gene. Since that time, I have identified other genetic mutations in the methylation pathway that can compromise its function and serve as a predisposing factor for autism. Rather than assessing complete genetic profiles, focusing on key SNPs in vital areas of function led me to note what I call second priority mutations in the COMT, MTR, MTRR, MTHFR, NOS, and SUOX genes, and more recently in the AHCY, BHMT, and PEMT genes. They are second priority for treatment purposes, but not because of their function. Each one plays a crucial role, which I'll cover in this chapter.

In this section of the book, I'll guide you in using supports for these genes to:

- Support the rest of the methylation cycle imbalances
- Support both pathways around the methylation cycle—the “long way” around the cycle via the MTR/MTRR and the “shortcut” via the BHMT enzyme

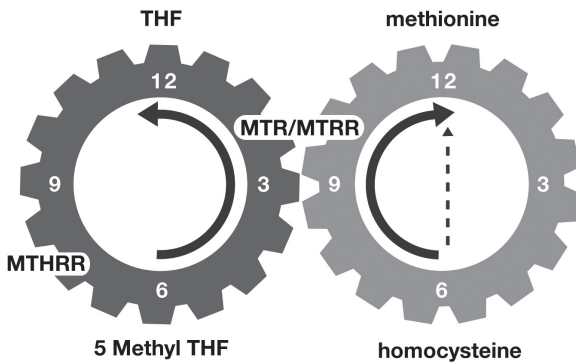
The goal of this program is to get the interlocking cycles you see below functioning and creating the proper amount of needed bodily biochemicals. To accomplish this, you will use your Nutrigenomic test results and your MPA. This identifies which mutations must be addressed (for you or your child), and with that knowledge, I'll walk you through how to supplement accordingly. First let's get familiar with the cycle itself.

By studying this diagram, you can see the three interlocking pathways which, taken together, I call the methylation cycle. First, let's focus on the pathway at



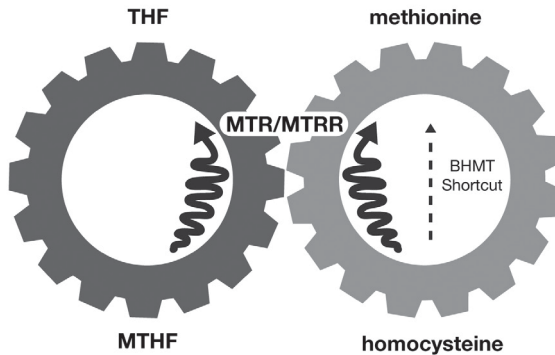
the far right of this diagram. This pathway leads through the methylation cycle from homocysteine to methionine.

The “long way” around this portion of the cycle begins with the forward reaction of the MTHFR enzyme (seen in the middle pathway) and then via the MTR and MTRR enzymes. The “shortcut” goes through the middle of the cycle via the BHMT enzyme, thereby bypassing MTR, MTRR and MTHFR. Using the clock metaphor that I mentioned earlier, the BHMT enzyme uses the biochemicals phosphatidyl serine, phosphatidyl choline, and TMG as substrates to go directly from homocysteine at 6:00 to methionine at 12:00, skipping 7:00 P.M. through 11:00 P.M. This shortcut (also called the “back-door reaction”) gener-



ates more norepinephrine relative to dopamine, leading to imbalances that have been implicated in ADD and ADHD behaviors.

Our first goal is to get the methylation cycle moving again. With mutations in these pathways, the pathway becomes dysfunctional, almost as if it has accumulated cobwebs. The easiest and fastest way to get the cycle working again is by supporting the shortcut through the BHMT enzyme.

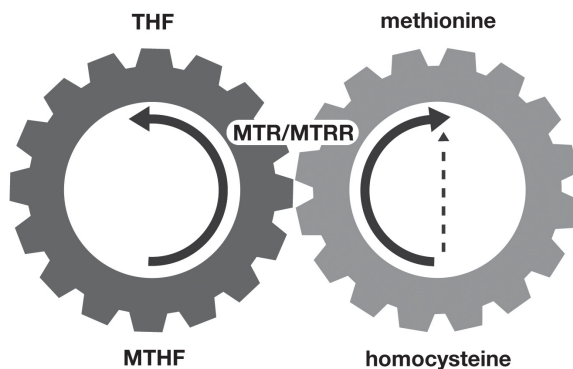


Next you can go on to support MTR, MTRR, and MTHFR C677T mutations so that the long way around the cycle will function properly. As a result, the body won't need to rely so heavily on the shortcut. After certain indicators appear in your biochemical tests, you can use the supplement DMG to help slow the shortcut, and instead favor the long way around the methylation cycle. Obviously it is essential to have supported any MTR, MTRR and MTHFR C677T mutations and to run tests to look at pathway function before making this shift. I'll discuss the testing values that signal the timing of this shift later in this section.

There are advantages to being able to go both via the shortcut and long way around the cycle. That's why I recommend low-dose supplements for all of the weak points shown by your test results.

For example, as you can see in the following illustration, going the long way creates thymidine, a building block for RNA and DNA, which is needed to repair tissues as well as expand T-cell clones in response to infection. By supplementing with specific RNA products I've formulated and with nucleotides (the base material for RNA), we make it easier to go the long way around the cycle, even if MTR and MTRR mutations make it harder for these enzymes to generate the necessary RNA and DNA building blocks. In the same way, even in the presence of mutations, 1/4 tablet of Intrinsic B12/Folate and low dose-5 methyl THF (1/4 tablet of Folapro) can supply additional intermediates that would not





otherwise be generated sufficiently when there are mutations. Folapro also helps the MTHFR enzyme to create adequate levels of BH4.

Now that you see what we are trying to accomplish, let's take a specific look at each of the mutations in these pathways.

## **COMT Status**

### **Understanding COMT V158M and VDR/Taq**

The COMT enzyme transfers methyl groups which inactivate the neurotransmitter dopamine. With COMT V158M + these enzymes are less active, and thus inactivate dopamine to a lesser extent. The VDR/Taq SNP also impacts overall dopamine levels. That's why together the VDR/Taq and the COMT V158 status are key indicators of bodily levels of dopamine. The composite of the COMT V158M and the VDR/TAQ status determines the amount of methyl donors a given individual may tolerate.

The norm, VDR /Taq—/- has been associated with higher levels of dopamine. VDR /Taq +/ + represents changes in the gene typically resulting in reduced dopamine levels. The combinations and permutations of these four SNP variations cover a wide range of dopamine levels and rates of dopamine breakdown. The supplement recommendations for each composite variation take that into account.

## **Understanding B12 Support**

Since COMT +/+ mutations slow the activity of the COMT enzyme, this variant slows dopamine metabolic activity, allowing dopamine levels to build. As a result, these higher levels then feed back and inhibit additional dopamine synthesis. For this reason, individuals who are COMT +/+ seem to have a reduced tolerance for methyl donors.

**COMT -/- = need to supply methyl groups**

**COMT +/+ = less need to supply methyl groups**

So what is the best approach to B12 use for those who are COMT +/+ as compared to those who are COMT-/-? According to published work by Dr. James Neubrandner, no toxic doses of B12 have been found, and this medical finding is supported by my clinical experience. Parents report back that “the more B12, the better.” In some cases, elevated doses of B12 (50 milligrams and above) have helped to stimulate speech in formerly apraxic children. However, those who are COMT + often cannot tolerate high doses of any methylating agents. For this reason, I tend to focus more on the use of hydroxylcobalamin B12, dibenzozide (adenosyl) B12, and cyanocobalamin B12 for those who are COMT +/+ and to use methylcobalamin B12 along with these other forms of B12 for those who are COMT-/-.

**Some Additional Supports for Dopamine**

Small amounts of the Mood D and the Mood Focus RNAs also can be used to support healthy dopamine levels. Ginkgo has been reported to help to increase dopamine uptake. A very small sprinkle of an extract from *Mucuna Pruriens* (which contains natural dopamine) can be used by those with lower levels. However, high doses are not suggested. If mood swings occur following use, then go to half the initial dose or discontinue use. In addition, a mushroom extract, (for instance the supplement *Mycocoetics*), can be used when there’s an increased breakdown of dopamine in conjunction with chronic bacterial issues.

**COMT and Methylation Status**

With COMT V158M—and VDR Taq +, the body will better tolerate methyl donors and the MPA supplement recommendations will reflect that.

However, for those with COMT V158M + or VDR Taq – SNPs, it’s best to rotate methyl-containing supplements rather than using them all on a daily basis. Alternatively, those with a lower tolerance for methyl donors can start by using ½ of each of the recommended supplements if tolerated, and then gradually increasing the dosages over time. You can also support the mitochondria (supplement recommendations are near the end of this chapter) even before methylation cycle support if you desire.

**VDR/Fok**

The Fok + status for the VDR (vitamin D receptor) impacts both vitamin D levels, and also has been associated with potential blood sugar issues. Since low vitamin D levels are related to a variety of neurological conditions, recent research suggests that it’s advisable to supplement with at least 1000 IU of supplemental

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vitamin D daily. In addition, sage and rosemary can help to support vitamin D receptors.

Low blood sugar is related to pancreatic activity which is why with VDR/FOK +, I advise supporting the pancreas. You can use vitamin K, OraPancreas, Ayur-Gymnema, Super Digestive Enzymes, CCK (Resist Fat Apex Lean), and pig duodenum. The essential elements chromium and vanadium also influence blood sugar levels. If their levels drop on an essential minerals test, add them in as supports.

Variations in the VDR Fok marker reflect differences in bone mineral density. Increased bone mineral density can reflect increased calcium absorption, but it's also been associated with higher blood concentrations of lead. In addition to blood sugar issues, decreased pancreatic activity is sometimes associated with increased levels of oxalic acid as measured on organic acid tests. Pancreatic supports may help normalize these as well. Avoid the herbs sheep sorrel and turkey rhubarb, which may increase levels of oxalic acid. When both oxalic acid and triglycerides are elevated, liver support is indicated as well. In addition to OraLiv, OraTriplex, Milk Thistle, and Dandelion Root, you can consider the liver support suggestions in Step One in the previous chapter.

## ***MTR/MTRR Status***

### **Understanding MTR and MTRR**

These following genes work together to regenerate and utilize B12 for the critical long way around the methylation pathway, helping to convert homocysteine to methionine: MTR A2756G/MTRR A66G, H595Y, K350A, R415T, S257T, A664A. High levels of homocysteine have been implicated as risk factors in a number of health conditions, including heart disease and Alzheimer's disease. As for the combined COMT and VDR /Taq status, the MTR and MTRR composite status is also important. Mutations in MTR (the methionine synthase gene) can increase the activity of this gene, leading to a greater need for B12, as the enzyme is using up B12 at a faster rate. The MTRR (methionine synthase reductase gene) helps to recycle B12 for utilization by MTR. Mutations that affect its activity would also suggest a greater need for B12.

If your Nutrigenomic profile shows a mutation in MTR and/or in the MTRR, my recommendations include a focus on B12 support. The level of B12 support will depend on the number and combination of these mutations, so look at your test results to determine all mutations present.

Remember, together and separately, the MTR/MTRR mutations will lower bodily levels of methyl B12, a deficiency that the supplement recommendations can help you to address.

Why is the MTR/MTRR pathway so important? As you recall, there are four pathways through this key portion of the methylation cycle.

Our methylation intermediates (all the biochemicals we need on this pathway) can go one of four ways:

- Down via the CBS gateway to transsulfuration end products
- Through the SHMT to create thymidylate
- Via the BHMT shortcut, or
- Through the MTR/MTRR portion of the cycle.

I find that if we limit “traffic” through CBS, SHMT, and BHMT so that we shunt the traffic through MTR/MTRR, we often see increased excretion of metals, especially mercury. Doing this means that we supply all the necessary ingredients for the MTR/MTRR reaction, while balancing the other pathways at a maintenance level. Accordingly, my supplement recommendations for CBS, SHMT, and BHMT will help you limit traffic down those pathways. In this section, we focus on enhancing MTR/MTRR, which entails increasing B12 levels.

However, before supplementing with B12, please first take into account your COMT V158M and VDR/Taq status, which will help to determine whether to focus more heavily on hydroxyl B12 or methyl B12 for support. In my clinical experience, I’ve regularly observed that those with COMT V158M + and VDR Taq – mutations don’t tolerate methyl donors well, including methyl B12. Also adults, regardless of their COMT V158M/VDR Taq status, have more limited tolerance than children for the detox triggered by methyl B12. Despite that, those who are MTR + and MTRR + can and should look at higher-dose B12 support, balancing the ratio of methyl to hydroxyl B12 based on COMT V158M/VDR Taq status. As you gradually proceed to add in B12, you can also take into account your own or your child’s personal tolerance for it. In addition to either methyl or hydroxyl B12, I often suggest the use of low doses of cyano (to support the eyes) and adenosyl B12 with vitamin E succinate, as you will see in the supplement recommendations.

One way to begin B12 support is with one chewable methyl B12 (5mg) or hydroxyl (1 or 2mg) daily, gradually increasing to two, three, or more per day if you can tolerate it. If mood swings occur, then decrease the dose of B12 back down to a more comfortable level. While a new nasal B12 is available, I don’t recommend using that exclusively. I prefer some B12 to be absorbed through the gut with the help of Intrinsic Factor, which is contained in some of the recommended supplements. In addition, the use of oral B12 sprays (available as hydroxyl or methyl,) topical B12 cream, B12 gum and the B12 patch are other means by which to

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support B12 in the body. I like to see multiple routes and forms of B12 used until I feel that the system has been saturated with B12 (see discussion of cobalt levels below). Literature suggests that oral B12 is as effective as injected B12. However, if preferred, you can consider B12 injections, making sure to use either plain methyl B12 (without any added folinic or NAC) or plain hydroxyl B12 injections. You can use the chewable B12 and the oral B12 spray on the injection “off days.”

If you plan to use injections, start with once per week, and gradually increase to three times per week. Allow your tolerance levels to determine how you can gradually increase the B12. As always work in conjunction with your health care provider.

## **MTRR11**

The MTRR 11 mutation (a call letter other than G, would represent a mutation) appears to be correlated with increased levels of toxic metal excretion. At this point, I suspect that those people who are sometimes categorized by doctors as “excretors” may in fact carry the MTRR 11 mutation. From what I see clinically, with MTRR 11 mutations, there are often lower overall amino acids on a UAA test. For this reason we look to support with higher levels of the Bowel Inflammatory Pathway Support RNA for those who have an MTRR 11 + status.

## **MTRR and Electron Transfer**

In addition to its use of B12, MTR/MTRR also contributes to electron transfer, along with two forms of vitamin B2, or riboflavin, flavin adenine dinucleotide (FAD) and flavin mononucleotide (FMN) as well as NADPH, a form of B3 (NADH and niacinamide). Oxygen inhibits the transfer process. In addition, MTRR acts as an aquacobalamin reductase to aid in the methylmalonyl CoA mutase reaction (MMA reaction).

MTRR is part of the larger family of enzymes known as diflavin oxidoreductases. Another member of this family, cytochrome P450 reductase can substitute for MTRR (Banerjee, *JBC* July 20, 2001). All in this family of enzymes (which includes MTRR, cytochrome P450 reductase, heme oxygenase, squalene monooxygenase, nitric oxide synthase, and NR1 reductase) share similar structures and domains with other enzymes in this family (Ludwig, *Plos biology* February 25, 2005).

In test tube reactions, cytochrome P450 reductase has been shown to replace MTRR function.

Indole 3 carbinol (I3C) has been reported to enhance cytochrome p450 levels (LeBlanc, *Chem Biol Interact.* August 14, 1992.) Indole 3 carbinol may therefore benefit those with MTRR mutations. On the other hand, Alpha lipoic acid (ALA) can reduce cytochrome P450 reductase activity (Dudka, *Annals of Nutri-*

tion Vol 50, 2006), so only limited ALA support is advised with MTRR mutations. In addition, given the need for NADPH and FAD/FMN for electron transfer, I recommend adding NADH and riboflavin to support MTRR activity, along with adenosyl B12 and low-dose vitamin E succinate to support the MMA reaction.

### **Other Ways to Optimize the MTR/MTRR Function**

After following the earlier recommendations in this section to improve B12 levels, you can also go back once more to rebalance glutamate and GABA levels. At this phase, GABA can be added directly. People with COMT V158M—/—usually benefit from ZEN, a supplement product that contains both GABA and theanine, another methyl donor. Other useful supplements at this stage include taurine, pycnogenol, and grape seed extract, all of which are included in the general vitamin. With the exception of taurine (which should not be used in high doses by those with CBS upregulations and/or high taurine) you can raise levels of the above indicated supplements if you notice (or experience) certain behavioral indicators, including difficulties with language, auditory processing, and anxiety levels, particularly anxiety experienced when blood sugar levels are low.

In redressing GABA/glutamate balance, keep in mind that lead inhibits a critical enzyme in the pathway for heme synthesis, resulting in an excess of an intermediate that competes with GABA. In addition, inhibition of this pathway can also cause anemia, as well as the inability to make groups that are needed for B12 synthesis. All of these exacerbate mutations in methionine synthase and methionine synthase reductase.

To address this entails adding B12 along with supplements that address lead toxicity. EDTA capsules or chewing gum, along with weekly EDTA baths or the use of EDTA soap are a gentle way to detoxify lead that are suitable for most people.

### **Proper Supplementation = Detoxification**

Once the methylation cycle is supplemented properly you may begin to see an increased level of detoxification. There may be a “honeymoon” period in which you first see improvement, but this may be followed by a regression in behaviors as the level of creatinine starts to climb. In order to monitor this and to understand changes in behavior resulting in part from this detoxification, it’s advisable to take spot urine samples and run urine toxic metal tests. The urine test results will help you differentiate between a negative reaction to a supplement, the behavioral impact of detoxification, or a mood swing due to dopamine fluxes.

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## Tracking Detoxification

What levels of B12 support are needed? That depends on the individual—and the Urine Essential Elements Test (UEE) can help you to make that determination. Once the cobalt levels found on the UEE are shown as a black line across the test results page, then you have attained the right level of B12 support. You should continue to supplement to maintain that level, while also beginning to introduce additional support to help with oxidized species. Trehalose, spirulina, quercetin, riboflavin, NADH, and ATP are all good for that purpose. On subsequent UEE tests, even as you continue to supplement the same high concentrations of B12, look out for this important indicator: When the cobalt levels drop back to baseline, as you maintain high level B12 support, this is when there are often major increases in excretion. As you can see, it's important to follow this process with regular UTM/ UEE testing and to work in conjunction with your doctor on the detoxification process.

## ***MTHFR Status***

### **Understanding MTHFR C677T +**

When it comes to autism recovery, I find this to be a less severe mutation than the other MTHFR mutation, MTHFR A1298C. However, the C677T mutation impacts the body's ability to convert homocysteine to methionine, leading to increased levels of homocysteine. High homocysteine levels have been associated with heart disease, Alzheimer's disease, and a range of other inflammatory diseases, including vascular inflammation, and "thick blood," which can lead to hyper-coagulation and inflammation.

## **High Homocysteine and SAH**

With high homocysteine levels, S adenosyl homocysteine (SAH) accumulates in the body, inhibiting several enzymes in the methylation pathway, including the COMT enzyme discussed earlier in this chapter. While inhibiting COMT can increase dopamine levels for those with COMT V158M -/-, for people with COMT V158M +/-, this very same action can lead to mood swings. SAH also inhibits key enzymes that transfer methyl groups to DNA, RNA and proteins, resulting in the inhibition of DNA methylation.

## **Addressing MTHFR C677T**

Appropriate supplementation should help to alleviate these undesirable effects. The C677T mutation serves the forward reaction of the MTHFR enzyme, reducing the ability of the body to make a specific kind of folate called 5 methyl folate. That's why it's important to supplement with this specific form of folate

and to limit to very low doses any other forms of plain folate or folinic, which compete with 5 methyl folate for transport into the body.

The medical literature is not clear and unified in its understanding of 5 methyl folate, but from my experience one thing is clear: Only 5 methyl folate will bypass the MTHFR mutation. The 5 formyl folate has other advantages, but it will not bypass the mutation. Going from 5 formyl THF to 5 methyl THF requires MTHFR. The product called Folapro is clearly 5 methyl THF. There are products on the market labeled as folinic acid that are 5 formyl THF and others labeled folinic that are 5 methyl THF. Given the confusion, it is safer to use a product based on the chemical formula, rather than to use one based on the name on the label.

### Tracking Detoxification

As mentioned earlier, a “honeymoon” period often follows putting in methylation supports. For those with a C677T mutation, as well as certain methionine synthase and methionine synthase reductase mutations, this can be one short honeymoon. In some cases, it’s no longer than a single day. In my supplement recommendations, I address some of these mutations in combination because they all occur in a pivotal location in the methylation cycle. As a result, as soon as you begin to supplement properly, you may experience near immediate detoxification as this pathway is rapidly unblocked—just as when a dam is suddenly opened. In order to monitor detoxification, you should run spot urine toxic metal tests (UTM), working in conjunction with your doctor.

### Understanding MTHFR A1298C +

If your Nutrigenomic test shows an A1298C mutation in the MTHFR gene, you will be addressing different issues than you would with the C677T mutation. The A1298C mutation has been mapped to the SAME regulatory region of the gene. Unlike with C677T, a 1298C mutation does not lead to increased levels of homocysteine. Until recently, it appeared that perhaps this mutation was not that serious. However, the scientific literature now suggests that the MTHFR enzyme drives the reverse reaction leading to the formation of BH4, which we discussed earlier in the section on CBS upregulations. Based on what I’ve observed, I believe that the A1289C mutation does indeed impact this reverse reaction, leading to an inability to convert BH2 to BH4, and thus contributing to low BH4 levels. Aluminum also negatively impacts BH4 levels, creating a kind of “double whammy” effect as the mutation impacts the ability to detoxify and limit ammonia, allowing aluminum retention, which then further lowers BH4, worsening the problem.

Both the literature and my personal clinical experience indicate that bacteria



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can harbor aluminum, which inhibits BH4 synthesis—which is already compromised with MTHFR A1298C mutations. As you progress through the program, if you have this mutation it's vital to address systemic aluminum, thereby removing a significant impediment to BH4 recycling.

If the Nutrigenomic test reveals that you or your child has this mutation, to understand the importance of BH4, you may want to revisit the discussion of the BH4 three-legged stool earlier in this chapter. While keeping the ammonia levels under control is of paramount importance for everyone, with an MTHFR A1298C mutation it's particularly important, since excess ammonia drains BH4 levels, already compromised by the conversion problems caused by this mutation.

Low BH4 levels affect dopamine, serotonin, and urea cycle function. Replenishing dopamine stores requires BH4, and as you may recall, dopamine imbalances impact mood. Moreover, the COMT and VDR/Taq status can also add to or detract from maintaining balanced dopamine levels, since these mutations impact dopamine synthesis.

## Addressing MTHFR A1298C

For all of the reasons I mention, with MTHFR A1298C mutations, the focus will be on BH4 support, aluminum excretion, and the gut program, which I introduced at Step One, but will fine tune in Step Two.

With this mutation, imbalances are often seen on a MAP or OAT test, with indicators such as elevated hippuric, imbalances in the benzoic acid ratio, as well as increased non-ideal flora on a CSA. In addition, the early portion of the Krebs cycle may be blocked due to aluminum toxicity. Since aluminum retention is related to chronic bacterial loads, the MTHFR A1298C mutations can limit the body's ability to address bacterial infection, making it important to focus on the gut program, run regular CSA tests (which indicate bacteria loads), and supplement with supports for chronic bacteria (which you'll find in the recommended supplement lists). Once first priority mutations, if present, have been addressed, you can begin with Step Two, Part One to add methylation cycle support. There will be further work to do as you move on to Step Two, Part Two, in chapter 7, where we focus more closely on bacterial (and viral) detox with accompanying metal release.

At this stage, first add in methylation support as per the recommendations later in this section. I also recommend that you add mitochondrial support, since aluminum can also impact Krebs cycle activity. Please consult the mitochondrial program in this chapter. Once natural detoxification from these supports has slowed down, you can begin to address bacteria and aluminum with the recommendations on the supplement lists.

In addition, for this mutation, low-dose CCK support (1/8 to ¼ per day of CCK

(Resist Fat Apex Lean) along with CCK support RNA) can be helpful, since CCK may help to trigger bacterial detoxification. Over time, you can increase to one tablet per day in divided doses if tolerated. Fine-tuning the gut/microbial program will support bacterial detoxification, sparking aluminum excretion, while balancing the gut flora.

## Tracking Methylation Status with Tests

As you can see, I repeatedly recommend using biochemical tests to verify current levels of toxins, as well as biochemicals that need to be raised or maintained and those that need to be lowered. By monitoring toxin and biochemical levels through the following tests, you can assess methylation cycle balance.

### Indications of Decreased Methylation Cycle Function

#### UAA Test

- Low methionine on a urine AA test
- Elevated methylhistidine

#### OAT/MAP

- Increased FIGLU
- Increased methylmalonic acid
- Low succinic
- High uracil relative to thymidine
- Elevations in beta amino isobutyrate and anserine; (can be produced by excess uracil that is not processed to thymidine due to lack of methyl groups)

Elevated methyl histidine, FIGLU, and uracil reflect imbalance in the entire methylation cycle, while high methylmalonic and low succinic reflect B12 levels. Until the methylation cycle is supplemented properly, it's harder to accurately measure B12 levels. Moreover, don't begin to use B12 at appreciable levels until the other mutations in the pathway have full nutritional support. For this reason, methylmalonic and succinic levels may at first appear to be in range, and then shift once you add all other methylation cycle support. If methylmalonic and succinic are in range, yet FIGLU is high, methionine is low, and taurine is elevated, first supplement to bypass mutations and then rerun to test for methylmalonic and succinic levels.

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If you have been supporting to bypass mutations and still find that the MMA and succinic are in range while FIGLU remains high, then it's often helpful to increase plain folate (which can be found at adequate levels in the HHI general vitamin formula.) It can also be helpful to run a CSA, since bacterial issues can elevate the FIGLU.

Folapro, intrinsic B12, nucleotides, and folinic can help to compensate for methylation cycle mutations, opening up the pathway to allow an expansion of T cells for viral elimination. It is for this precise reason that we ask you to WAIT to add these supplements, until the body has had a chance to rebalance in Step One, and then add the immune support necessary in Step Two before beginning a detoxification process.

High levels of methionine sulfoxide may indicate a need for additional ATP. High levels of methionine as well as methionine sulfoxide with sufficient ATP support may suggest decreased MAT enzyme activity and the need to support directly with SAMe, regardless of the COMT and VDR status to bypass MAT (methionine adenosyl transferase) mutations.

## Supporting the Shortcut

At the outset, it's as if the methylation cycle is inactive and full of cobwebs. If you have mutations in MTR and/or MTRR, then you may need to first support the BHMT pathway to get the methylation cycle moving.

Like the MTR/MTRR route, the BHMT pathway also forms methionine, and activating the BHMT shortcut will bypass mutations in the methionine synthase gene. Since this secondary (or shortcut) pathway uses phosphatidyl serine (PS) and /or TMG as donors, you can add these supplements to drive this reaction. Once the shortcut is activated, you can gradually layer in long route support, including folapro, intrinsic B12/folate, and other forms of B12, as mentioned earlier.

Phosphatidyl serine is available in both plain gel caps and in a chewable form with DMAE (the brand name is Pedi-Active). Since DMAE contains methyl groups, this is a good combination for people who need extra methyl groups based on their COMT and VDR test results.

However, if you can't tolerate higher levels of methyl donors, or if you experience mood swings, then stop using the Pedi-Active with DMAE.

While DMG works well to support the development of language, it also can inhibit the BHMT reaction. I therefore recommend that people add DMG only after this secondary pathway is properly supplemented with a low dose of TMG, PS/PE/PC, and plain methionine, all of which are contained in the HHI general vitamin, Neurological Health Formula (along with other valuable nutrients.) The recommended dose is one in the morning and one in the afternoon. In gen-

eral it's best to wait to add DMG until there's sufficient B12 to support the long route around the cycle.

The first goal is to keep methylation activity moving via the short cut until you are ready to make the shift to the long route around the cycle. Once the UEE test results show high cobalt excretion visible though a “black line across the page,” you can then add some DMG.

### ***BHMT Status***

#### **Understanding BHMT**

BHMT (betaine homocysteine methyltransferase) is central to the “shortcut” through the methylation cycle, again helping to convert homocysteine to methionine. This activity can be affected by stress and cortisol levels, which impact norepinephrine levels, thereby contributing to ADD/ADHD. However, each of the BHMT genes (BHMT 1, 2, 4, 8) functions somewhat differently, so let's take a closer look.

Having these three BHMT mutations (1,2, and 4,) +/- can produce UAA test results similar to that of a CBS mutation—even if you don't have a CBS up-regulation, suggesting that these three BHMT mutations result in higher level intermediates in the transulfuration portion of the pathway. Using Ammonia Support RNA and limiting taurine can help. Adjust your dosages based on urine AA testing. On the other hand, the BHMT 8 mutation often seems to increase MHPG levels relative to dopamine breakdown (HVA), resulting in attention issues. These levels can be tracked on a MAP test. Elevated glycine (indicating emphasis on the shortcut pathway) is common with BHMT 8 +/- . The use of the Attention Support RNA along with NADH, SAME and DMG (once sufficient B12 is in place) may be helpful for attention issues related to BHMT8 + status. Since this is an open-ended area of clinical discovery, please check into the chat room for updates as my understanding of BHMT is a work in progress.

### **Other Important Genes**

#### ***Mao A***

The MaoA gene codes for the enzyme active in serotonin breakdown. With a Mao A + status, decreased enzyme activity lessens the ability to degrade serotonin. As with COMT V158M +, with Mao A +/- status, serotonin cycling from high to low levels may result in mood swings or even aggressive behaviors. The Behavior RNA can help with aggression. In addition, as discussed in the section concerning the gut and bacterial issues, chronic infection can deplete tryptophan stores. This can be confirmed via an organic acid test (OAT) and urine amino acid tests (UAA), which indicate high levels of 5 hydroxy indole

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acetic acid (5HIAA). Obsessive compulsive disorder (OCD) behaviors are also a symptom. Lack of BH4 due to aluminum toxicity, increased levels of ammonia, and/or MTHFR A1298C mutations all impact serotonin levels. The use of frequent low doses of the Mood S RNA and the supplement 5HTP may help balance serotonin, if needed.

As with the ACE deletion (discussed later in this chapter), the Mao A gene is not inherited via standard Mendelian genetics. The Mao A gene “travels” with the X chromosome and is considered a dependent trait. Since the X chromosome in males can only come from the mother, this means that the father’s Mao A status does not contribute to the son’s Mao A status. For females, since one X chromosome comes from each parent, the genetics will tend to reflect both parents with respect to the Mao A SNP.

## **SUOX**

I rarely see a SUOX +/+ mutation on the Nutrigenomic panel. Imbalances in this enzyme activity can lead to increased amounts of toxic sulfur byproducts, because SUOX helps to detoxify sulfites and turn them into a less toxic form called sulfates. Test results for those with SUOX +/- often reveal low levels of manganese, boron, and strontium. A similar pattern may occur in people with very low levels of B12, sometimes creating what I call a “functional SUOX deficiency.” In other words, without actually having the SUOX mutation, people may have other methylation pathway mutations that combine to burden this portion of the cycle and produce a similar effect.

Since the SUOX enzyme uses molybdenum as a cofactor, depletions in molybdenum may result. Decreased molybdenum levels may result from SUOX mutations, CBS activity, or ingestion or use of sulfur-containing compounds. All of these factors can also contribute to food and environmental sensitivities, in part due to the lack of aldehyde oxidase, which I’ll discuss below.

## **The Crucial Role of Molybdenum**

Why are low levels of molybdenum a problem? Molybdenum helps balance the zinc/copper ratio so that copper does not predominate. Excess copper can cause fatigue, depression, insomnia, rashes, and adrenal burnout, among a variety of other symptoms. With SUOX and/or CBS C699T+ mutations, regular UTM and UEE tests are helpful in monitoring essential minerals status. This information helps you track detoxification of heavy metals, while also allowing you the zinc/copper ratio.

Low molybdenum will also tend to decrease xanthine oxidase and aldehyde oxidase activity.

Xanthine oxidase is found in homogenized milk, one reason that dairy intolerances may occur with SUOX +/-status (or with CBS + due to increased burden on the SUOX). Aldehyde oxidase is needed to detoxify aldehydes, including acetaldehyde. Acetaldehyde is a fungal waste product generated by candida. Aldehydes are also found in perfumes, certain foods, and environmental toxins. Food sources of aldehydes include vanilla, cinnamon (including cinnamon flavored toothpaste), cumin, and tarragon. Aldehydes also occur when alcoholic beverages break down.

The urine essential elements test (UEE) will help you track molybdenum levels. You can supplement molybdenum directly or with certain foods.

### **Foods High in Molybdenum**

Barley	Yams
Beef kidney	Oat flakes
Beef liver	Potatoes
Buckwheat	Rye bread
Hot cocoa	Spinach
Eggs	Sunflower seeds
Legumes	Wheat germ
	Green leafy vegetables

Limiting intake of sulfur-based compounds is the simplest way to address the SUOX mutation. *It's important to avoid sulfites in foods because you have a limited ability to convert them.* Sulfites may contribute to the extreme acid reflux that people with the SUOX + status sometimes experience. Dried fruits and aged meats are often sources of sulfites. Certain brands of tuna contain sulfites, and salad bars often use sulfites to prevent the lettuce from turning brown.

### **SUOX and Acid Reflux**

In some of the cases I've seen, people with SUOX +/-status have also complained of severe acid reflux. The reflux did not respond well (or at all) to standard medications for gastroesophageal reflux (GER). These medications target the mechanism that triggers excess acid in the stomach (called histamine 2 blockers). With SUOX, excess sulfites may lead to allergic/asthmatic reactions that have a secondary effect on acid reflux. GER often occurs with asthma. Medical research confirms this association, though it's not currently known whether asthma causes acid reflux, or vice versa. High sulfites are known triggers for asthma, and certain contributing factors in asthma may lead to excess acid production. Ordinar-

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ily, histamine reactions, such as those contributing to asthmatic symptoms, are viewed as allergic responses. However, histamine receptor overactivity is also tied to the excess acid production observed in GERD. According to Pneumological *Aspects of Gastroesophageal Reflux* (edited by Dal Negro and Allegra):

Gastroesophageal reflux (GER) refers to symptoms and events that result from abnormal regurgitation of gastric contents into the esophagus. Respiratory diseases, in particular bronchial asthma, can be exacerbated by multiple triggers, including GER. The relationship between the occurrence of gastroesophageal disorders and changes in respiratory function has been known for over a century, but the mechanism by which esophageal acid regurgitation can produce respiratory symptoms is still debated. The reasons for these concurrent pathological events are also not fully understood. *Determining, for instance, whether reflux itself initiates or exacerbates asthma, or whether asthma or its treatment primarily causes GER is a matter of current investigation.*

This work supports the working theory that acid reflux seen in individuals with SUOX mutations or with CBS upregulations may be related to the excess sulfites in their systems. Maintaining adequate levels of molybdenum, limiting sulfur donors, and the use of the Lung Support RNA, Respiratory Support RNA, as well as the Stomach pH Balancing RNA and Stress RNA may help to balance the acid reflux. Quercetin can be used to limit mast cell degranulation for those individuals who are COMT—/—or COMT +/- . In addition, Petadulex (butterbur) may be helpful in balancing allergic/histamine reactions.

Adequate magnesium has been shown to be helpful in addressing asthma and may therefore benefit those with high sulfite levels. In one study of asthmatic children, magnesium given intravenously prevented hospitalization and reversed asthma attack symptoms in the children who were unresponsive to three prior doses of bronchodilators. (Ann Emerg Med. 2000; 36:181–190.). That's why I advise testing both urine essential element testing (UEE) and urine toxic metal (UTM) on a regular basis.

Acid reflux may also result from both metal toxicity and chronic viral infection. Since Cimetidine (Tagament), an OTC medication for heartburn, has been demonstrated to be effective against herpes virus, it's possible that chronic viral infection also plays a role in acid reflux.

Finally, high-level B12 has been reported to alleviate sulfite sensitivity. Improvements in asthma have also been reported with high-dose B12 support. Lack of B12 may increase stomach acidity, actually exacerbating acid reflux, which is an indirect way of saying that those with SUOX mutations, with sulfite sensitivity,

or with asthma may want to consider high-dose B12 support as described in the sections for MTR and MTRR, even if MTR or MTRR mutation is not present.

### **NOS**

The NOS (nitric oxide synthase) enzyme is located in the urea cycle, where it helps with ammonia detoxification. With NOS +/-, there is reduced enzyme activity, producing an additive effect with CBS upregulations to result in the generation of higher levels of ammonia.

Some research in the medical literature suggests that omega 3 EFAs may limit NOS activity so I recommend using an EFA mixture with omega 3:6:9 only every other day, and alternating it with a different source of omega 3 fatty acids, such as DHA. These essential fatty acids optimize membrane fluidity, and by alternating them, you limit excess omega 3 which can interfere with the NOS enzyme. Since inefficient NOS activity can strain the urea cycle, leading to elevated ammonia levels, this method provides the fats you need without impacting NOS. Those without NOS mutations can consume omega 3's daily. In addition, consuming a lower protein diet and Stress Foundation RNA (once or twice daily) also helps to support the urea cycle.

I suggest alternating the fatty acids the body needs, because in my clinical experience I've noticed that with NOS + there is difficulty processing lipid donors. We all need certain lipids for a variety of bodily functions, so the key here is to use the donors mentioned below in moderation or as recommended in the supplement lists, not to eliminate them altogether.

### **LIPID DONORS (limit for CBS+, NOS+)**

- Transdermal creams
- Lipoceutical EDTA
- Lipoceutical glutathione
- High doses of EFA
- CoQ10
- ALA
- Idebenone

### ***The ACE Deletion***

Deletions of genes affect the activity of the ACE (angiotensin converting enzyme). This causes upregulations in activity of this enzyme leading to a higher rate of conversion of angiotensin I to angiotensin II. High levels of angiotensin II increase the level of aldosterone. In animal studies, high levels of angiotensin



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II were correlated with increased anxiety and decreases in learning and memory. High levels of aldosterone also tend to increase the activity of AHCY.

Remember, the ACE gene is a deletion of that gene and not a SNP. As such, it may not be inherited in families in the same manner as single-based genetic mutations. While SNPs result from a single base change, a deletion results from the presence (or in some cases, the absence) of a small piece of DNA.

## **Sodium and Potassium**

High levels of aldosterone lead to decreased excretion of sodium in the urine and increased excretion of potassium in the urine. This suggests that low sodium and high potassium on a UEE test may reflect aldosterone excess and may indicate ACE upregulations, a helpful indicator for those who have not run a genetic test. In addition, UEE test results can confirm the impact of your supplement program. Elevated excretion of potassium relative to sodium is a strong indicator for the ACE deletion in the absence of appropriate supplementation. After supplementation, urine essential element test results can be used to verify that you have had a positive, balancing effect on potassium and sodium excretion with your supplement program.

In essence, aldosterone is a stress hormone, since it's released into the bloodstream following stressful situations. Consequently, even in the absence of an ACE upregulation, chronic stress can produce high aldosterone levels, causing sodium retention and increased potassium excretion. However, the potassium is excreted only if the kidneys are functioning properly. With compromised kidney function, potassium may be retained in the body.

While high aldosterone will initially prompt both sodium retention and increased potassium excretion, over time the adrenals become fatigued. As a result, they can no longer release adequate amounts of aldosterone and/or cortisol. At that point, potassium will rise and sodium will fall, resulting in increased retention of potassium. When these sodium and potassium imbalances occur, consider adrenal and kidney support. It's also helpful to reduce stress, since aldosterone functions as a stress hormone.

ATP can also help balance sodium and potassium levels. Certain toxic minerals, such as thallium, are reported to negatively impact ATP levels. In my clinical experience, it's often difficult to balance sodium and potassium without adequate ATP support—until sufficient excretion of thallium has occurred.

## **Addressing ACE**

Support for ACE mutations in this pathway can include Kidney Inflammatory Pathway Support RNA, OraKidney, Ora-Adren 80, Stress and Anxiety Support RNA. BioNativus multiminerals can be used for general mineral support.

Even without specific ACE mutations, many people can benefit from general adrenal and kidney support, which includes OraKidney, Ora-Adren 80, Stress Foundation RNA, Kidney Inflammatory Pathway Support RNA, and ATP support—particularly if test results show high levels of toxic metals (such as thallium.)

On a related note, numerous supplements (and even teas) contain licorice. However, it should be avoided by those with stress, anxiety, and similar imbalances, since licorice inhibits the enzyme 11 beta hydroxysteroid dehydrogenase that break down aldosterone and cortisol, leading to increased aldosterone levels. Licorice can also increase the craving for salt, resulting both in potassium loss and increased water intake. Grapefruit juice also inhibits the activity of this enzyme. If UEE tests reveal imbalances in sodium and potassium excretion, you would be well advised to avoid licorice and grapefruit juice.

Hormones, such as progesterone and estrogen, are also capable of affecting the levels of aldosterone. Progesterone tends to decrease the effects of aldosterone, which would suggest that it may be beneficial for those with the symptoms of elevated aldosterone. These include excess fluid retention or increased excretion of potassium. Conversely, estrogen appears to enhance the level of aldosterone.

### **PEMT**

**PEMT** (phosphatidylethanolamine N-methyltransferase) is a gene that bridges the connection between the methylation cycle and estrogen. Research has shown that the PEMT gene is increased by estrogen. In the methylation cycle, PEMT helps to convert phosphatidylethanolamine to phosphatidylcholine. Individuals with the ACAT SNP (discussed earlier in this chapter) show imbalances in ethanolamine levels on biochemical tests, suggesting that there may be a relationship between PEMT polymorphisms and the ACAT mutations. In addition, PEMT is itself affected by methylation cycle mutations as it is a methyltransferase, requiring the adequate presence of methyl groups to function. For this reason, BHMT, MTR, MTRR, COMT, and CBS mutations would have a related and possible cumulative effect on PEMT, because they help to supply the methyl donors needed for PEMT activity. As we begin to look into the role of PEMT, I'm hoping that we will gain further insight about the role of hormones in autism, as well as CFS and other conditions.

This is an important area of inquiry, since there is a predominance of autism in males as compared to females. That supports other indicators that hormones contribute to autism. Looking at PEMT SNPs may offer further understanding of the mechanisms involved. In addition, in most cases females affected by autism have a more severe presentation than males. People with autism tend to have increased seizure activity, and estrogen has a direct effect on seizures.

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## **Strengthening All Parts of the Cycle**

In addition to addressing specific mutations, there are major areas of the greater methylation cycle that nearly all people need to support, which I'll discuss in this section of the chapter. Doing so has many benefits: it increases energy levels, and provides a strong foundation for methylation cycle function by assuring that key intermediates are available.

### ***Revisiting Gut Support***

With respect to the gut, as with all aspects of this protocol, there is no “one size fits all” approach. Sometimes it is difficult to know where to start with support, and there is no easy answer. The following is a compilation of suggestions for overall gut health, taking biochemical testing and Nutrigenomics into account. As always, work closely with your physician.

After you get your test results, you can also fine tune organ support for the gut using vitamin C, herbs, Biotene products, xylitol, papaya enzyme, and other supports that you will find in the gut protocol in the previous chapter.

In addition to supporting the overall methylation cycle, B12 levels also impact the gut environment. As you gradually layer in B12 support over time, it will also help to support a healthy gut.

### ***Mitochondrial Support***

To support both detoxification process and energy, people of all COMT V158M and VDR/Taq types should assure that they can get through the adjacent Krebs cycle (also known as the tricarboxylic or TCA cycle), which is responsible for generating energy via reactions that take place in the mitochondria. Just as with the methylation cycle, we need a whole host of intermediates, which can be accessed via what I call a “mitochondrial support cocktail,” whose ingredients can be customized based on test results. These results will reveal where deficiencies lie so that the support can be added.

As you look at this diagram, you can pinpoint where low levels of key intermediates indicate that you are stuck. For example, if by running a MAP or OAT test, you discover that you're stuck at 6:00 or 8:00, you can supplement with ATP, NADH, and low dose riboflavin.

Typical ingredients in the cocktail are L-carnitine, CoQ10, idebenone, NADH and a low dose of the Muscle Support RNA. Many of these ingredients contain methyl groups. That means that some people would do well to slowly layer in mitochondrial support and/or to rotate the use of these supplements.

Since decreased mitochondrial energy can lead to fatigue, low muscle tone, muscle weakness, and fine and gross motor issues, certain key supplements contained in this cocktail help both energy production and the detoxification process. Make sure to add them gradually to allow detoxification to occur gradually. A mitochondrial cocktail can be added after you've been using methylation support to keep detoxification at a manageable level. Or if there is severe muscle weakness and/or fatigue issues, you can use the mitochondrial support cocktail first.

As you can see from the diagram above, the Krebs cycle connects to our complete methylation cycle via fumarate and aspartate. These two biochemicals are also part of the urea cycle. Low levels of fumarate (resulting from excess ammonia, OTC mutations, or NOS mutations) negatively impact the Krebs cycle. Supplementing directly with L-carnitine fumarate can compensate for low fumarate due to urea cycle issues.

You can also add supports based on organic acid test results of Krebs cycle intermediates, such as:

- **Succinate**—can be supplemented with vitamin E succinate
- **Malate**—can be supplemented with malic acid
- **Citrate**—can be supplemented with magnesium citrate

On the diagram, you will see that the conversion of methylmalonyl Co A to succinyl CoA requires B12. With MTR and MTRR, there are often decreased levels of B12, such that for people with these mutations, supplementing with these intermediates will support the Krebs cycle directly.

Krebs cycle support can also include supplements known as “Krebs cycle intermediates,” (provided they do not include glutamate, aspartate, or their derivatives.) You can test first to determine which supplements to use.

Sometimes, elevated oxalic derivatives combine with high pantothenic and high citric. When this occurs it may indicate that you are not converting pyruvate well, which produces problems entering “the clock.”

Since pyruvate is the link between oxalic and citric, poor conversion of pyruvate can lead to both a buildup of oxalic derivatives and an increase in citric.

Lack of B12 can also have a significant effect on the Krebs cycle. In particular, intermediates in the later part of the cycle (11:00 and 12:00) such as oxalate and fumarate have been reported to increase with a lack of B12. Conversely, intermediates in the beginning of the cycle (1:00, 2:00, 3:00) can build up from excess aluminum in the system. This may be a particular issue for those who are female, have MTHFR A1298C mutations, ACAT mutations and/or chronic bacteria in their systems. I have observed that extreme muscle weakness can be alleviated

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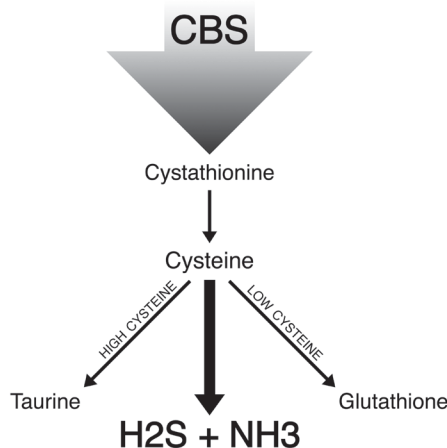
with aluminum excretion from the body, confirming the theory that aluminum negatively impacts the Krebs cycle. With higher levels of the earlier intermediates, focus on layering in both aluminum support and the mitochondrial cocktail earlier in your program.

## ***Decreased G6PDH Activity***

Some people have a deficiency in an enzyme called glucose 6 phosphate dehydrogenase (G6PDH) which helps to recycle glutathione, a key detoxification output of the methylation cycle. Both G6PDH and NADH levels can be depleted by high sulfur detoxification and/or a CBS upregulation. It's also possible that a lower than optimal conversion of pyruvate contributes to G6PDH issues. Since taking NADH will reduce oxidized glutathione, NADH may help to compensate for decreased G6PDH activity.

Sulfur donors can decrease G6PDH activity. Since excess sulfur is more problematic for those with SUOX+ and/or CBS+ mutations, if left unaddressed these mutations can lead to decreased G6PDH activity. Among the varied symptoms of decreased G6PDH activity are the following:

- Fragile red blood cells, which rupture easily leading to anemia
- Problems with sulfur donors such as DHEA or sulfur based chelating agents (like DMPS) in transdermal and other forms
- Symptoms of sulfur toxicity, including broken capillaries, excessive bruising and bleeding, and nose bleeds. Impaired sugar regulation and decreased bodily levels of 5 carbon sugars are other indicators.



Since red blood cells have a half life of 120 days in the body, it can take several months for the excess sulfur to build and produce a cumulative effect on the G6PDH levels. If you're using sulfur-based products, watch for signs of sulfur toxicity that manifest over the course of several months, such as broken capillaries, increased bruising, or decreased kidney function. If you experience any of these symptoms, take a break from sulfur-based products. When the G6PDH enzyme does not function well, higher levels of free glucose leading to insulin bursts may result. This sequence increases inflammation. To support decreased levels of G6PDH, in addition to NADH, consider thyroid and adrenal support, alternative sources of five carbon sugars (such as ribose), and The Right C form of vitamin C with ribose .

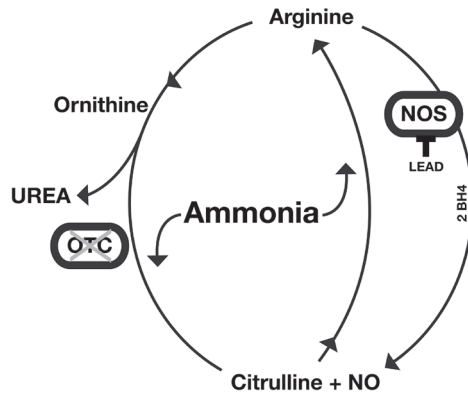
### ***Glutathione Support***

Glutathione (GST) is vital to detoxification. Even when mutations in the methylation pathway impact the GST enzyme, it still makes sense to support healthy glutathione levels, as GST is a key player in reducing metal accumulation. The transsulfuration pathway generates both glutathione and taurine. The cysteine level will determine which one is produced. Low cysteine levels favor glutathione synthesis. High cysteine levels lead to taurine synthesis. A CBS upregulation (C699T + or A360A +) generates cysteine so high that the pathway is shunted toward taurine formation. Animal models indicate that the CBS C699T represents a forty-fold increase in enzyme activity over the CBS A360A +, which is not as strong of an upregulation. It's not surprising that, with CBS people, appreciable levels of homocysteine, cysteine, or cystathionine are often lacking, as there is a rapid conversion rate to taurine. In many cases, an amino-acid test result showing very high levels of taurine and ammonia can be the best indicator of CBS upregulation.

While I do not object to adding glutathione, I prefer first getting this portion of the pathway in balance. That's why prior to introducing glutathione support for CBS people, I recommend first looking at taurine levels on a UAA. Once those levels have come down and the methylation cycle is in better overall balance, the glutathione levels will increase on their own. At that point, consider additional glutathione supplementation to enhance natural glutathione levels.

At the crossroads between the cysteine dioxygenase(CDO) and glutamate cysteine ligase (GCL) reactions, cysteine levels help to favor CDO activity (leading to increased taurine levels) or GCL activity (leading to increased glutathione rather than increased taurine.) With higher glutathione levels, there is often an increased excretion of toxic metals. As result, the interplay of CDO activity and GCL activity is consistent with some observations by Dr. Jill James on glutathione and detox in autism.

Curcumin helps shift the emphasis toward glutathione rather than taurine. Once taurine and ammonia levels are under better control, the use of GSH can directly support glutathione levels as well as help in the early steps of the TCA/Krebs cycle. GSH moves the cycle past citric and isocitric. Since glutathione contains both sulfur and glutamate, more is not necessarily better. Moreover, NADH will help to recycle glutathione. Low dose EDTA also shifts the emphasis from CDO and taurine formation toward GCL and glutathione synthesis.



Recall that glutathione is a sulfur-containing compound and excessive sulfur can decrease glucose 6 phosphate dehydrogenase (G6PDH) levels. Rather than going with the philosophy of the “more glutathione the better,” keep G6PDH in mind and don’t go overboard with the number of sulfur donors. There are many options, including topical glutathione, oral glutathione (an oral lipid based glutathione for enhanced transport), glutathione lozenges, and IV glutathione. Use NADH to recycle glutathione, as recycling issues can result from G6PDH deficiencies. NADH also keeps added glutathione in the reduced form.

To maintain and regenerate healthy glutathione levels, without adding too many sulfur groups, consider using low dose N-acetyl-cysteine (NAC,) vitamin C with rose hips (500mg two to three times per day), vitamin E with mixed tocopherols, and selenium. The HHI Neurological Health Formula general vitamin includes low doses of several sulfur donors such as taurine, broccoli extract, and garlic, which are beneficial.

Curcumin supports an enzyme contributing to glutathione synthesis via the transsulfuration pathway. However, with a COMT V158M + status, curcumin is a double edged sword, since it’s a methyl donor.

### **Urea Cycle Support**

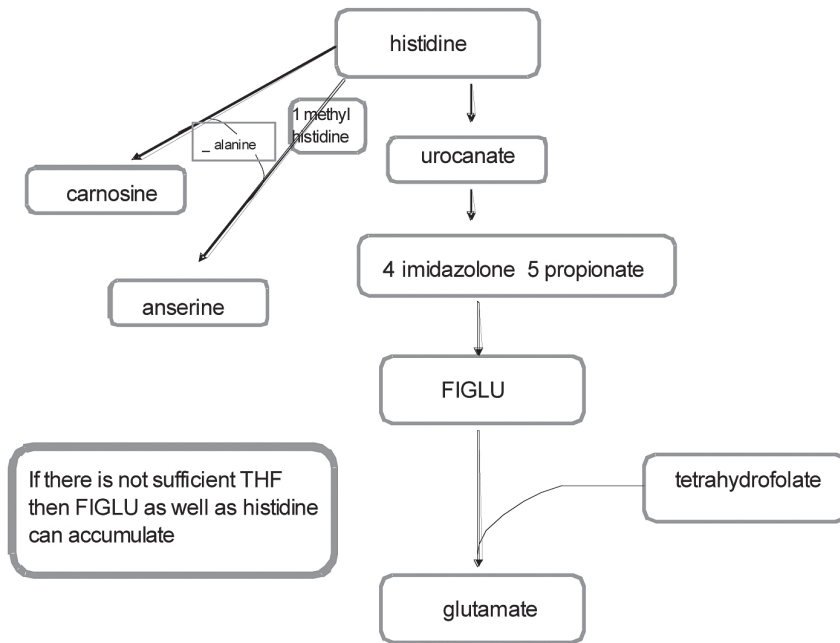
The urea cycle detoxifies ammonia, both the ammonia generated by protein breakdown from the foods we eat as well as that generated by CBS upregulations. Several of the genes in the methylation cycle impact urea cycle function because their activity uses up BH4 stores. These include MTHFR A1298C mu-

tations, aluminum due to chronic bacteria, or CBS upregulations and the NOS enzyme. As a result, it's advisable to support the urea cycle in doing its job.

Another key enzyme in this cycle is OTC (ornithine transcarbamylase).

OTC function can be affected by the status of the methylation pathway. Methylation cycle function controls the ability of this enzyme to turn on and off. For this reason, there is often decreased OTC function prior to comprehensive methylation cycle support.

As you can see, the OTC enzyme “sits” between ornithine and citrulline in the urea cycle. When OTC activity is compromised, UAA tests will often reveal low



citrulline yet high ornithine levels. Reduced OTC activity will back up in the urea cycle, producing mid to high levels of arginine and low levels of aspartate. Finally, this cycle also generates fumarate for the Krebs cycle. As mentioned earlier, the urea cycle and the Krebs cycle are linked through aspartate and fumarate. Low citrulline, mid range arginine, mid to high ornithine, very high fumarate, low to very low aspartate, and decreased malic acid as seen on MAP/OAT and UAA test results indicate decreased OTC activity. In these cases, supporting with low doses of citrulline, malic acid, BioThyro and ¼ Krebs cycle intermediates (if aspartate is particularly low) can help. Once the methylation cycle gets into better balance, then the OTC issue will usually resolve. Normalization of



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the methylation cycle function is seen when test results reveal normal ranges on FIGLU, methylmalonic acid, taurine, and succinic.

## **General Amino Acid Support**

Maintaining healthy levels of amino acids is important to make the proteins and enzymes needed for many bodily functions. These can be measured on a UAA test and, if low, can be supplemented. In supplementing amino acids, it's important to ensure that amino mixtures don't contain glutamine or glutamate. One good source is the product, Amino Care, available as a tablet or gel cap (the dose is ½ per day) as well as a topical lotion. Designed to support amino acids without increasing glutamate, this mixture has also been used by cancer patients, since high glutamate can be an issue for cancer, too.

As discussed above, the amino acid citrulline is key to the urea cycle, since it contributes to ammonia detoxification. If measured as low on a UAA test, you can add low-dose citrulline. This is suggested whether the citrulline is low due to reduced OTC function or excessive urea cycle activity as a result of CBS up-regulations. In addition, branched-chain amino acids can also be beneficial. The mixture I prefer includes only leucine, isoleucine and valine, with a suggested starting dose of ½ capsule. Make sure that there is no maple syrup smell in the urine following supplementation, and if there is, discontinue use. BCAA can also help keep glutamate in check. If proline is very low, you can add ½ capsule or less. L- Alanine may be helpful for issues related to DPT. Again, the suggested dose is ¼ to ½ capsule.

For those with low overall amino acids, the combination of Bowel Inflammatory Pathway Support three times a day with one OraAdrenal seems to improve this issue tremendously. This is very helpful for those with MTRR 11 mutations (for whom low amino acids are often an issue) as well as for anyone with low amino acids on UAA tests.

Finally, if histidine, carnosine, and anserine are all low, then it is worth considering histidine support. To be metabolized properly, the histidine requires a functional methylation cycle. The amino acid methionine is supported directly by the HHI general vitamin (Neurological Health Formula.) Additional support for the rest of the methionine/folate cycles will help to support the remainder of the pathway.

## **Indications of Decreased Urea Cycle/OTC Activity:**

- High fumarate
- Midrange/high ornithine

- Midrange/high arginine
- Low aspartate
- Low malic acid
- Low citrulline

Low urea cycle/OTC activity can result from decreased methylation cycle function. If FIGLU is high, methylmalonic is high, succinic is low and methionine is low, this also indicates that methylation cycle support is needed in addition to OTC support.

OAT tests and MAP tests are extremely valuable tools in helping to monitor how well nutritional support is working to bypass mutations in nutritional pathways.

### **Looking Ahead**

Through balancing the methylation cycle, detoxification will have already begun and may produce sufficient levels of detox to help restore health, balance, and function. So allow that process to run its course. However, to proceed further with detox, you can move ahead with Step Two, Part Two in the next chapter.



## Chapter 7. Step Two, Part Two

### Increasing Detoxification

In Step Two, Part One, I covered the process of restoring methylation cycle function by supplementing to bypass the SNPs revealed by the Nutrigenomic test. As methylation activity is progressively restored, parents of children with autism will often report that they begin to see improvements in behavior, function, speech, digestion, sleep, mood, and other markers. In addition, on this program, biochemical testing is used to verify the excretion of metals, which in my clinical experience is often accompanied by a reduction in the body burden of infectious microbes as well, as confirmed by a CSA.

However, while one person may recover completely through the use of methylation supports, another may need to step up detoxification in order to recover fully. If that's the case, you can consider undertaking the Metals Program, which will be covered in this chapter.

Supporting to bypass mutations as we do in Step Two, Part One, is foundational to both recovery and health. When it comes to the infectious disease component that we'll address more in this chapter, the first thing to recognize is that bacterial and viral infections play off of each other, and contribute to metal retention. This interplay leads to a greater environmental toxic load, in which people retain more metals in the body. In many instances I've looked at the genetics of healthy people, including the relatives of children with autism. What's clear is that many of us have these same genetic markers but without any presence of diagnosed disease. It's the infectious disease burden in combination with genetics that produces the more severe health issues.

#### When to Undertake the Metals Program

The timing for undertaking the Metals Program depends on several factors. While it can be undertaken at any time, in order to minimize both cost and moderate the potential for increased detox reactions, I generally advise people to wait until they have fully supported and balanced the methylation cycle via

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individualized Nutrigenomic supplementation, and followed the testing process to monitor biochemical levels as described in chapter 6. In addition, it's advisable to support the mitochondria and Krebs cycle in order to have things in better balance prior to an additional boost of detox. At that point, if excretion plateaus or if you fail to achieve the health restoration you wish, you can add in the Metals Program while maintaining most of the Phase One and Phase Two, Part One supports that you already have in place.

In theory, you can add in the Metals Program at any time, and some doctors advise that you do this concurrently with layering in the Step Two, Part One methylation supports. This can accelerate metal excretion, but it can also bring about greater detox regressions. That's why I prefer that you wait until you have allowed Step Two, Part One to run its course. This will lower the body burden of metals before you start the Metals Program and may save you time, detox reactions, and money. But again, this is a question for you and your doctor to determine.

To understand why you may need to increase detoxification with the Metals Program, let's first do a brief review. For a more in-depth review, please revisit chapter 3, in which I discuss the basis of this detoxification program at greater length.

## ***Metals and Microbes***

As you know there is an interrelationship between elevated levels of systemic microbes and metals, including mercury, aluminum, nickel, thallium, and others. Viruses and other microbes are able to sequester metals in the body where they cannot be readily released, accessed, or measured. As a result, many people, and even their practitioners, are misled by tests that fail to identify the presence of these metals. I've seen cases in which testing suggested that an individual was not carrying a mercury load. However, after the use of the comprehensive program to address chronic virus, the mercury began to be released and appeared on test results. Often with use of the Metals RNA metals at this phase of the program, the Urine Toxic Metals Tests (UTM) will show more and more metals being excreted. As they are released, improvements in function also occur. To see a sample of tests showing excretion levels, you can view my PowerPoint presentations and the DVDs that we offer.

For many of the children, especially the older ones or those with a higher viral burden, to get to the heavy metals, we must first help the body address the viral load. To release aluminum, we focus on addressing the bacterial load. You will recall that while virus holds onto heavy metals, bacteria tend to hold onto aluminum. I've seen several cases where the aluminum excretion was the defining factor, with mercury excretion following it, long after the child was well on the way to recovery. That's why the specially formulated Metal RNAs used in this facet of the program address both specific microbes and the attendant metals concurrently.

For doctors working with autism and other neurological ailments, understandably, there has been an emphasis on mercury, lead and aluminum. However, toxic levels of other metals can also be dangerous. For example, cadmium has the ability to enhance the toxic level of lead. I've also seen cases where children excrete exceedingly high levels of uranium and tin. One can only speculate as to the cumulative effects of these metal levels in conjunction with even minor levels of mercury. We therefore need to address the total metal body burden.

As you may know, different practitioners use different agents and products to promote the release of metals from the body. While I won't be going into the pros and cons of any of these methods, I recommend that in undertaking this program you use the Metals RNAs and other products and methods I suggest and not add in any others.

### **Preparing for the Metals Program**

Prior to beginning this phase of the detoxification program via the Metals Program, I would expect that you have already been through Step One support and the first part of Step Two methylation cycle support and have run MAP, UAA, UTM/UEE, CSA and the GI Function Profile. If you have not, and are going directly into the Metals Program in conjunction with your doctor then I would recommend getting the following tests as a baseline. MAP, UAA, UTM/UEE, CSA and GI Function Profile. I don't recommend that you proceed aggressively without having gone through Steps One and Two with all the recommended testing. But I mention this in case someone were to elect to do proceed more rapidly, and again, in such a case, you would be well advised to work with a doctor who understands detoxification protocols.

Remember that you will be continuing your pre-existing Step One and Two supports. In particular, you should revisit the following:

First of all, revisit mineral support as covered in previous chapters, since the excretion of metals can cause the body to release minerals concurrently, and you want to maintain proper levels of key minerals.

Next, make sure that you have gut support in place to help the immune system and excretion pathways release non-ideal flora and microbes. The gut can be a reservoir of chronic bacterial infection. Herbs and herbal mixtures containing any or all of the following can be helpful: neem, myrrh, golden seal, cranberry, Oregon grape, barberry, and uva ursi. You can use ½capsule of each three times per day for one month. Cranberry is also excellent for addressing E.coli while neem helps to address both bacteria and parasites. Once again, low levels of BH4 can result both from high aluminum and certain mutations (MTHFR A1298C + or CBS C699T +), creating a vicious circle that leads to more severe parasitic infections.

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If a CSA test indicates that the undesirable organisms are resistant to some of the natural herbs you use, replace a few of them with caprylic acid or Oregamax. Using a mix of seven or more herbs simultaneously will be less likely to lead to resistance than using single herbs. I have also recently added in some specific RNAs to help with bacterial issues. Based on the results of a CSA and GI Function Profile you may want to consider Microbial ECX, Microbial PCX, Microbial KLX, Microbial STRX, Microbial STAX, Microbial SALX, and/or Microbial CLX RNA as part of a more complete program to address bacteria in the system.

In earlier chapters I mentioned the use of CCK for pancreatic support. It may also help to address chronic bacterial loads. The proper dose depends in part on the systemic bacterial load, and that may be higher than the ¼ tablet used only for pancreatic support. To ascertain the right level of support, increase the dose slowly beginning with 1/4 tablet per day, along with 1/8 dropper CCK RNA Support. Eventually you'll be able to judge the maximum dose necessary.

You can find more supplement recommendations for organ support in chapter 5.

In addition, here are some recommendations for supplements with specific antiviral and/or antibacterial activity which you can use along with the Metals RNAs to promote the release of microbes.

## ***Supplements to Promote Detoxification***

### **Viral Immune Support:**

Elderberry	Melissa (lemon balm)
OraTriplex	Transfer factor
Immuno Forte	Policosanol
Moducare	Metals I RNA
Garlic	Metals II RNA
Higher dose/multiple forms EDTA	Metals III RNA
L-Lysine	Metals IV RNA
Cat's claw	Specific IMF's
Olive leaf extract	Paradex

### **Bacterial Support for Aluminum and Lead Excretion:**

Refer to CSA and Full Gut Protocol	Adenosyl B12
EDTA Chelator Complex	Chitosan (provided there are NO shellfish allergies)
Malic acid	Microbial ECX RNA as needed
Horsetail grass	Microbial PSX RNA as needed
CCK	Microbial KLX RNA as needed
Garlic	Microbial STRX RNA as needed
EDTA soap and/or EDTA soak	Microbial STAX RNA as needed
Bio Organ and/or BH4	Microbial CLX RNA as needed
Bone Support RNA	Microbial SALX RNA as needed
Vitamin E succinate	

Note: If supplements are listed in more than one category, you should only use a single dose of that supplement. The listings show the multiple uses of the individual supplements.

### ***RNA Formulas***

There are many approaches in use to detoxify metals, but in this program I recommend a combination of natural herbs and supplements along with special RNA products that I have formulated to help rid the body of microbes, and hence the metals that remain sequestered in the body in a symbiotic relationship with them. Although it is possible to detoxify without them, if you've gotten to this stage and want to increase detoxification, then the use of the RNA Metals is recommended.

You may have already availed yourself of other RNA formulas at earlier stages of the program, but since this phase strongly relies upon them, I want to say a little about the RNA formulas overall. You can find a more complete explanation in my book, *The Power of RNA*. RNAs are nucleotides, made up of similar bases as our DNA, and they guide how the body uses DNA. One significant aspect of my work in molecular genetics and biology was in the realm of RNA research and development, and I have used and further evolved that knowledge in formulating these products.

Although much of how I do this is proprietary information, what I will say is that I devised a format in which the RNA stays intact in order to have a positive effect on the body. This is important, since RNAs break down easily. Although each of the RNA formulas offered on [www.holisticheal.com](http://www.holisticheal.com) focuses on the specific



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need mentioned, it's also good to know that when RNA breaks down into its component nucleotides, these are beneficial when absorbed by the body. Since one task of the methylation cycle is to generate the building blocks for DNA and RNA, adding nucleotides also helps to support the methylation cycle in its functioning. For both children with autism and others who have methylation cycle mutations, this is helpful. In addition, most children with autism (and their families) are under stress, which stimulates the cortisol response, which in turn depletes RNA levels.

Finally, although taking plain nucleotides (which I recommend for bypassing certain mutations) supplies overall building blocks for the 10,000 or so kinds of RNA in the body, I have been able to formulate the RNA products used on this program to the specific functional areas—and clinical experience demonstrates that they do indeed address the specific area intended.

## ***Immune Factors***

Many parents have found it helpful to “layer in” transfer factor products called ImmunFactors (IMFs) right during the process of going through the Metals Program. Because the immune factors serve as a source of specific antibodies for various infectious agents, there seems to be a benefit in combining the Metal RNAs and the IMFs. When we seek to induce chronic virus to leave the body, key antibodies can aid in the viral removal process. Each one of the IMFs addresses a specific group of microbes and thus helps to promote excretion of that group. However, this is an option, not a necessity. After the following overview of the basic Metals protocol, I'll go into the IMFs more specifically so that you can consider whether to include them in your use of the Metals Program. For those with CBS C699T+, it's best to use only one capsule of IMF per day due to the difficulty in tolerating lipid donors. The IMFs contain lipids.

## **Starting the Metals I Program**

The Metals I, II and III programs are for metal detox. If your child has never had the MMR vaccine, you may want to skip to Metals IV. Start with 1/3 dropper Metals I RNA only 1X/day and continue at this low dosage for two to three weeks.

After the first two to three weeks, you can begin to gradually increase the frequency of the Metals I RNA to 1/3 dropper 2X/day for several days, then to 1/3 dropper 3X/day, and so forth up to 7–8X/day. **I cannot over-emphasize the importance of proceeding gradually.** The dosage and number of times you should deliver the Metals RNA should be individualized to the response of your child. As always, work with your doctor when participating in any type of detox program.

As you increase the dosage of the Metals I RNA, you will notice that test results show increases in the creatinine followed by increases in the metal excretion. The color of the urine will begin to get darker during excretion and then may clear as the metals are released. Once you have reached a dosage of Metals I RNA of 7–8 X/day, keep this up and continue using the UTM to track excretions. If, after several weeks, test results no longer reveal the excretion of metals, drop back to a maintenance dose of 1/3 dropper 1X/day.

### **Tracking Detox**

During the Metals Program, you should regularly track creatinine levels on a UTM to ascertain the progress of detox.

#### **↑ Creatinine ↑ Virus excretion ↑ Metals excretion**

The compounds generated by creatinine breakdown, such as methylurea and alkylurea products, act to rid the body of the chronic virus sequestered in the system, along with the attendant metals. However, to generate the creatinine, you need to get all the way through the methylation cycle, yet another reason to bypass methylation cycle mutations.

People sometimes wonder whether it's the Metals RNA or the supplements producing the release of microbes and the accompanying change in creatinine levels. When I first began this program, I had the luxury of using individual supplements or RNAs and observing the effect of them one at a time. But as the program developed, I found that combinations of supplements and RNAs were more effective, and once I knew that, I did not feel comfortable leaving out supplements or RNAs that would be helpful, simply to get cleaner data. So, at this time, we use combinations of supports to try to give you the most comprehensive program. However, if your doctor wants to look at more isolated “cause and effect” to view changes in creatinine, then you could consider using only the metals RNAs, one at a time, and follow the changes in creatinine and excretion of metals on a UTM.

Occasionally, a child will appear to be “stuck” at a given phase of detoxification. The urine remains dark, the creatinine continues to be high, and a very low but steady excretion of metals is seen on the urine tests. This is okay; every child is unique and may respond somewhat differently to the program. Just hang in there, don't feel rushed; continue until you finally see the urine clear and the metals begin to flow. While the average time for using Metals I at 7–8X/day is only a few weeks, we have seen children who required several months of this dosage level. This is not an “all or nothing” phenomena. You will see gradual changes in function and health status as you progress through the program.

The tables below summarize the basic routine. I recommend that you follow the UTM/UEE results and work with a doctor who can help you modify the program as needed.

<b>The Metals I RNA Program: Basic Steps</b>			
<b>Step</b>		<b>Dose</b>	<b>Duration</b>
1.	Begin with basic dose (for COMT++, use ½ the basic dose)	1/3 1X	2–3 weeks
2.	Look for signs of detox: rash, fever, mood changes, crabbiness, loose bowels, vomiting. Discontinue immediately if symptoms are severe.		
3.	Use other RNA to alleviate symptoms (General Inflammatory Pathway Support RNA, Stress Foundation RNA, Nerve Calm Inflammatory Pathway RNA, Cytokine Inflammatory Pathway Support RNA, and Mood RNA.)		
4.	Monitor urine toxic metal tests weekly. Urine will darken and creatinine levels will rise.		
5.	Urine begins to get lighter. Increase frequency of RNAs.	1/3 2x	Several days
6.	Gradually increase RNAs again.	1/3/ 3x	Several days
7.	Increase again	1/3 7–8 x	Few weeks usually, but possibly up to several months
8.	Drop back to maintenance dose when there is no longer metal excretion.	1/3 1x	

### ***Interim Between Metals I and II RNA Programs***

After you feel you have exhausted Metals I, take a two- to three-week break, remaining on the maintenance dose of Metals I during this time period. During this break you may still continue to see some increased excretion of metals. The ongoing use of Folapro and Intrinsic B12 as well as other supplements for mutations in the methylation cycle will also stimulate metal excretion during this time. After the break, you can continue on to Metals II.

Again, it may be tempting to rush through the program once you begin to see metals and virus flowing, but it's better to give the body time to rest between

detoxification phases. Regressions in behavior and speech during detoxification are to be expected. In taking a break between phases, many parents report that the behavior and the language will “bounce back.” Keep all of these caveats in mind, and when you are ready, you can proceed to the Metals II RNA Program.

## The Metals II RNA Program

This next phase of detoxification proceeds in basically the same fashion as the first phase. Continue with a maintenance dose of Metals I RNA at 1/3 dropper 1X/day. You can then add the Metals II RNA, starting with 1/3 dropper only 1X/day. You will continue at this low dosage for two to three weeks. After two to three weeks of 1/3 dropper once a day, you can gradually increase to 1/3 dropper 2X/day for several days, then to 3X/day, up to 7–8X/day. As you increase the dosage of the Metals II RNA you will again notice increases in the creatinine (and color of the urine) followed by increases in the metal excretion. After you have reached a dosage of Metals II RNA of 7–8X/day and you are no longer seeing any excretion of metals, drop back to a maintenance dose of 1/3 dropper 1X/day. At this point you will be using a maintenance dose of both Metals I RNA and Metals II RNA. Urine should be monitored during this second phase of detoxification as it was during the first phase. Again, at this point it is a good idea to give the body a rest for two-to-four weeks before going on to the Metals III RNA Program.

<b>The Metals II RNA Program: Basic Steps</b>			
<b>Step</b>		<b>Dose</b>	<b>Duration</b>
1.	Continue with maintenance dose of the Metals I RNA (for COMT+/, use ½ the basic dose.	1/3 1X	ongoing
2.	Add Metals II RNA.	1/3 1x	2–3 weeks
3.	Increase dosage.	1/3 2x	Several days
4.	Increase dosage.	1/3 3x	Several days
5	Increase dosage. Look for increases in the creatinine (and/or color of the urine) followed by increases in the metal excretion.	1/3 7–8	Several days
6.	Drop back to a maintenance dose when no metal excretion is observed.	1/3 1x	ongoing
7.	Continue maintenance doses of both I and 2.		ongoing

## The Metals III RNA Program

The third phase of detoxification proceeds basically in the same way as the first two phases. After allowing the body to rest for two to four weeks, continue with a maintenance dose of Metals I RNA and Metals II RNA at 1/3 dropper 1X/day for each. You can then add the Metals III RNA, starting with 1/3 dropper only 1X/day. You will continue at this low dosage for 2–3 weeks. After two to three weeks of 1/3 dropper once a day, you can gradually increase to 1/3 dropper 2X/day for several days, then to 3X/day, up to 7–8X/day. As you increase the dosage of the Metals III RNA, you will again notice increases in the creatinine (and/or color of the urine) followed by increases in the metal excretion. After you have reached a dosage of Metals III RNA of 7–8X/day for several weeks and you are no longer seeing any excretion of metals, drop back to a maintenance dose of 1/3 dropper 1X/day. At this point you will be using a maintenance dose of Metals I RNA, Metals II RNA and Metals III RNA. Urine can be monitored during this third phase of detoxification as it was during the first two phases. Again, at this point it is a good idea to give the body a rest for two to four weeks before going on to Metals IV RNA.

<b>The Metals III RNA Program: Basic Steps</b>			
<b>Step</b>		<b>Dose</b>	<b>Duration</b>
1.	Continue with maintenance of the Metals I RNA and Metals II RNA (for COMT <sup>++</sup> , use ½ the basic dose).	1/3 1X (each)	ongoing
2.	Add Metals III RNA.	1/3 1x	2–3 weeks
3.	Increase dosage.	1/3 2x	Several days
4.	Increase dosage.	1/3 3x	Several days
5	Increase dosage. Look for increases in the creatinine (or color of the urine) followed by increases in the metal excretion.	1/3 7–8	Several weeks
6.	Drop back to a maintenance dose when no metal excretion is observed	1/3 1x	ongoing
7.	Continue maintenance doses of I, II & III.		ongoing

## The Metals IV RNA Program

After a sufficient rest following Metals I, II, and III, it is time to progress to Metals IV. At this point you will be using a maintenance dose of Metals I RNA,

Metals II RNA, and Metals III RNA. This next phase of detoxification using Metals IV proceeds in basically the same fashion as the previous phases. Continue with the maintenance doses of Metals I, II, and III RNA at 1/3 dropper 1X/day. You can then add the Metals IV RNA, starting with 1/3 dropper only 1X/day. You will continue at this low dosage for two to three weeks. After two to three weeks of 1/3 dropper once a day, you can gradually increase to 1/3 dropper 2X/day for several days, then to 3X/day, up to 7–8X/day. After you have reached a dosage of Metals IV RNA of 7–8X/day and you are no longer seeing any excretion of metals, drop back to a maintenance dose of 1/3 dropper 1X/day. During this final phase of detoxification, metals are often excreted in the stool as well as the urine. Stools should be monitored (via the CSA test) during this final phase of detoxification. UTM tests should be continued to monitor excretion results. Stool toxic analysis has proven useful at this stage of detoxification to reveal increased levels of toxic metal excretion. In addition the skin rash can be more visible at this time.

<b>The Metals IV RNA Program: Basic Steps</b>			
<b>Step</b>		<b>Dose</b>	<b>Duration</b>
1.	Continue with maintenance dose of Metals I, II, and III RNA (for COMT +/-, use ½ the basic dose).	1/3 1X	ongoing
2.	Add Metals IV RNA.	1/3 1x	2–3 weeks
3.	Increase dosage.	1/3 2x	Several days
4.	Increase dosage.	1/3 3x	Several days
5	Increase dosage. Look for increases in the creatinine (or color of the urine) followed by increases in the metal excretion.	1/3 7–8	Several days
6.	Drop back to a maintenance dose when no metal excretion is observed; skin irritation may occur.	1/3 1x	ongoing
7.	Add stool examination. Introduce frequent baths, using EDTA, malic acid bath, and oatmeal or Aveeno. Include General Inflammatory Pathway Support RNA and apply Hyper-Immune and Topical Skin RNA, and creams. Use saunas.		
8.	Continue maintenance doses of both I and II.		ongoing

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## Immune Factors

As mentioned, the immune factors (IMFs) reportedly contain specific antibodies for various infectious agents. Derived from colostrum (sometimes called “first milk” or “immune milk”) which comes from animals that have been injected with specific microbes, this colostrum is considered to contain antibodies specific to certain microorganisms. This makes them more potent than more generic transfer factors. Each IMF is specifically formulated to target certain bacteria, viruses, and other organisms. IMF 4 should be helpful for measles, mumps, and rubella related viruses. IMFs 1, 2 and 6 should be helpful for herpes related viruses. You might consider IMF 7 for multiple strains of candida yeasts.

If you decide to layer in the immune factors during the Metals Program, I suggest you consider the following:

Concurrent with Metals I–III, you can use IMF 4, since it deals with childhood viruses, such as measles, mumps, and rubella. If CSA results or other indicators point to gut imbalances, you can also add IMF 5, which deals with bacterial infections, strep, staph, and e coli. This may also help with aluminum. Measles, strep, and herpes interact together which is why I often suggest the use of IMF 5 along with some of the supplements that support viral excretion.

The use of IMF 5 in combination with CCK and BioThyro can be helpful in addressing strep to prompt an attendant release in aluminum. High aluminum and strep tends to be more of an issue for girls. In addition, Microbial STRX RNA, horsetail grass, low dose EDTA and malic acid also help the body to release high levels of aluminum.

When you go on to Metals IV, I would suggest you consider rotating IMF 1, 2, and 6.

Looking ahead to after you’ve completed this phase of the program, you might want to consider the possibility of the presence of chronic Lyme infection in the body. Lyme disease has been implicated in a number of neurological conditions. Cat’s claw is reported to be helpful for viral issues as well as for Lyme. In addition, Tick Support RNA, and IMF 2 can help to support the body. While most bacteria require iron for growth, *Borrelia burgdorferi* (Lyme) is unique in that it utilizes manganese.

As a result, I have observed that the IMFs can cause a temporary shift in metal excretion from the urine to the stool for some children. If you are using an IMF, and notice little change in a weekly spot urine, it may be that excretion has shifted for a while from the urine to the stool. If this is occurring, you may also notice that the stool looks off color (and has a noticeably bad odor.)

The use of IMF 9 may be helpful for mycoplasma infections that are sometimes

detected on the GI Function Profile.

IMF 10 along with the Wart Support RNA may be useful for those who have concerns about HPV.

Immune Factor	Targets
ImmunFactor-1	HIV, HHV 6 (A), herpes 1, herpes 2, Mycobacterium avium, Candida albicans, human tuberculosis, bovine tuberculosis, Epstein Barr virus, cytomegalovirus, cryptosporosis, pneumocystis carinii
ImmunFactor-2	Antigen-specific transfer factors against Epstein-Barr Virus (EBV), cytomegalovirus (CMV), Chlamydia pneumoniae, Borrelia burgdorferi (cell-wall deficient Lyme), human herpes virus 6 (HHV6), Babesia, and ehrlichia
ImmunFactor-3	Hepatitis A, B and C viruses
ImmunFactor-4	All childhood illnesses, flu viruses or rabies including measles, mumps and rubella.
ImmunFactor-5	Multiple strains of staphylococci, streptococci and E. Coli
ImmunFactor-6	Multiple strains of Herpes 1, Herpes 2, and Varicella Zoster
ImmunFactor-7	Multiple strains of candida yeasts
ImmunFactor-8	CMV, EBV, Lymes, Chlamydia, HHV6, MMR, and 23 seria from the blood of children with autism. The protocol used for this condition is to use 1 and 4 each for 3 months, then use 8. Clinical and anecdotal reports have been very positive.
ImmunFactor-9	various strains of mycoplasma
ImmunFactor- 10	Human papilloma virus (HPV)

## Managing Detox

When using the Metals RNA, watch carefully for signs of detoxification. These may include a rash, mild fever, mood changes, crankiness, and loose bowels. Although the timing can vary with the individual, when the creatinine levels peak, the children may exhibit some of their most difficult behaviors. This is



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all a part of the detoxification process. Every child is unique. Some exhibit the worst behaviors just before they excrete high doses of metals, and once the metals are flowing, the behaviors really improve. For other children the behaviors are at their worst during maximal excretion and do not calm down until after the metals have stopped flowing. A third group that I often see includes children who have the worst behavior associated with higher creatinine levels. Once the creatinine drops, the behavior improves, regardless of metal excretion.

There is no way to get the metals and virus out of the body without having it take a toll as it leaves. The more slowly you detox, the less obvious the effects and the milder the regressions. With children who are only mildly affected, I prefer to let detox proceed more slowly, so that a high-functioning child does not have to experience discouraging regressions. If detox symptoms become severe, it's fine to stop giving the Metals RNA and allow these symptoms to subside. You can always go back to the program at any point and restart. Simply begin again at the smallest dose and gradually work your way up again. Remember to work with your doctor or qualified practitioner.

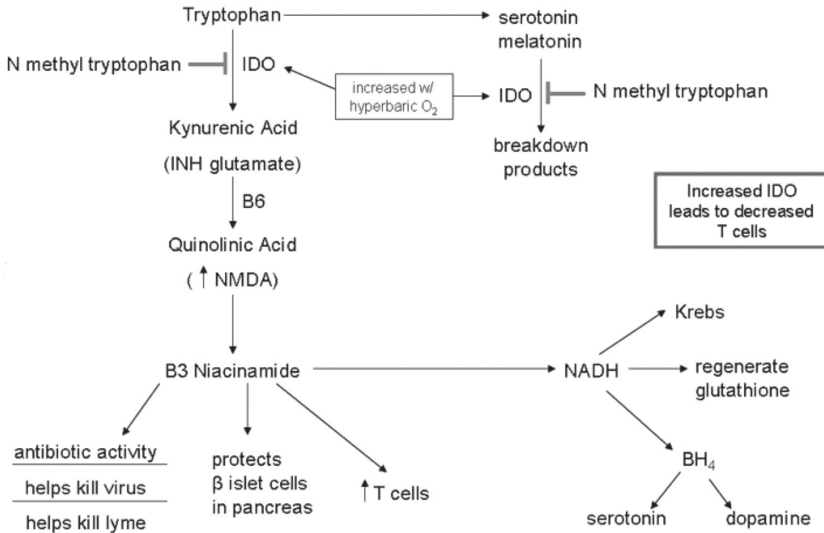
Several of the other RNA formulas may help to alleviate some of the discomfort associated with detoxification. It is fine to increase the dosage of the General Inflammatory Pathway Support RNA, the Stress Foundation RNA, the Cytokine Inflammatory Pathway Support RNA, and the Nerve Calm Inflammatory Pathway Support RNA, or to use the Comfort Support RNA. It's also fine to use one or more of the Mood RNA to address changes in mood that sometimes occur during detox. If you have questions during this phase of the program (or any other phases) please take advantage of the chat room at [www.holistichealth.com](http://www.holistichealth.com). Again, I recommend that you work with a qualified practitioner while following this protocol.

## ***Supports for Symptoms***

Frequent baths are a good idea at more advanced stages of detoxification. The bath should contain EDTA and may also contain malic acid and oatmeal or Aveeno to relieve itching. The General Inflammatory Pathway Support RNA as well as the Hyper-Immune RNA may also be useful if used topically at this point. For topical use, you can also consider the Topical Skin RNA, and/or topical creams that contain any of the following ingredients: glutathione (this is a sulfur donor, so it may not be appropriate for CBS+), horse chestnut, aloe, and MSM (this is both a methyl and sulfur donor, so use only if indicated by CBS and COMT status.)

There have been mixed reports concerning the use of Vitamin A to aid in eradicating chronic viral infection. Some choose to add 100,000 IU of Vitamin A every other day for a period of two weeks as a concentrated approach to aiding

in recovery from virus. In addition, some protocols use prescription antivirals such as Valtrex in conjunction with the Metals IV portion of the detoxification



program. It is also worth considering the use of Valtrex in conjunction with the use of Depakane (valproic acid). Valproic acid can be used to treat seizures. There is literature to suggest that valproic acid may exacerbate measles viral infection. Subsequent research has found the combination of Valtrex in conjunction with depakane to be beneficial.

In animal models, vitamin B2 (riboflavin) has been shown to speed the clearance of bacteria from the body and to lower mortality rates from bacterial sepsis. In addition, riboflavin is reported to be helpful in reducing inflammatory mediators. Another B vitamin, vitamin B3, is often depleted in individuals with chronic bacterial infections. You may also want to consider niacinamide (1/2 per day) as this may help to stem the breakdown of tryptophan that is often seen with bacterial infection. Kynurenate is part of the breakdown pathway for tryptophan. As the body breaks down tryptophan for this purpose it will also deplete serotonin. Lack of serotonin combined with streptococcal infection can lead to perseverative and OCD behaviors in addition to other effects.

The final breakdown product of the tryptophan pathway is niacinamide. This B vitamin has been reported to have antimicrobial effects. Perhaps the body is breaking down tryptophan into niacinamide to help with infection. As mentioned, chronic bacterial infection also affects tryptophan breakdown, which is why those with chronic bacterial issues and CBS up regulations should limit

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intake of P5P. I've noted that in certain instances, the use of high dose B6 or P5P is not always helpful, and may cause overstimulatory or OCD type behaviors. While kynurenic acid is a calming neurotransmitter, it's converted by B6 or P5P into quinolinic acid, which is an excitotoxin that can aggravate the nervous system. Increased levels of quinolinic acid have been implicated in Alzheimer's disease and in excitotoxic damage of nerves. Quinolinic acid was found to be substantially elevated in patients with *Borrelia burgdorferi* (Lyme) infection and has been postulated that it contributes to the neurological and cognitive defects associated with Lyme disease.

## **The Clean-Up**

Again, it is normal to see symptoms during detoxification. At any point that you are concerned about behaviors or physical symptoms, simply stop the program and those symptoms will subside in several days. You can then start again later.

Some parents have used a combination of detoxification supports as a final "clean up." This combination includes the use of Metals I, Metals IV, and Microbial Support RNAs along with Valtrex. Gradually increase the amount of the Metals I and IV and Microbial Support over time in a manner similar to that described above. Remember that this combination approach is only used after each of the Metals RNAs has first been used individually.

Again, detoxification should always be conducted in conjunction with your health care provider.

## **Visual Inspection**

Although it is always gratifying to see progress, weekly urine tests can get expensive. If you're on a budget, watch the urine itself, and observe when it gets dark and then light again. Send in the clear samples to get a measure of the metal excretion. This will be easier on the pocketbook, However, remember that this will not monitor creatinine and potential viral excretion, and you may miss some metals. A number of parents have also taken advantage of creatinine test strips. These will not give you a quantitative measure of creatinine but they will give you a sense of the trend, and whether it is increasing or decreasing, and you can use them in conjunction with biweekly, or every third week, spot urine tests. Another reason not to rely solely on the creatinine test strips is that, unlike mercury or lead, aluminum excretion appears to be independent of the creatinine levels. Sending in spot urine samples should be done on a regular basis, even if the creatinine numbers have not dropped. In addition, testing for essential minerals (UEE) along with the toxic metal excretion is very important. As I have mentioned, essential minerals can be excreted along with toxic metals, and mineral depletion can be a cause for concern. For this reason alone, you should perform occasional spot urine tests regardless of the creatinine number and also include

a check of essential minerals. The use of periodic hair testing can help to give a sense of “historic” excretion if you are not able to run more frequent UTMs.

### ***The Kinetics of Metal and Mineral Excretion***

In reviewing many cases, I have noted some interesting kinetics in terms of metal excretion in urine. It often occurs that nickel precedes mercury, and that cadmium precedes lead.

#### **Nickel → Mercury Cadmium → Lead**

I have also observed that lithium and iodine levels tend to drop along with the excretion of mercury. In a similar manner, calcium, strontium, and boron tend to decrease with the excretion of lead.

#### **Mercury Excretion ↑ Lithium ↓ Iodine ↓ Lead Excretion ↓ Calcium ↓ Strontium ↑ Boron**

Therefore the excretion of nickel can be used as a sign to anticipate excretion of mercury and remind you to keep an eye on lithium and iodine levels. Similarly, the excretion of cadmium predicts the future excretion of lead and suggests that you monitor the levels of calcium, boron and strontium more closely.

### ***Graphing the Results***

As you begin to experience detoxification, you will notice the urine getting darker. This can be monitored by weekly urine toxic metal tests. Pick a day and time of the week to monitor and stick with it (e.g., Tuesday at 5:00 pm). The creatinine numbers on the urine test will increase as the urine gets darker. Another reason it helps to know the creatinine value is that we see significant changes in behaviors and language, and even aggression, when the creatinine is high, and you want to verify why that’s happening.

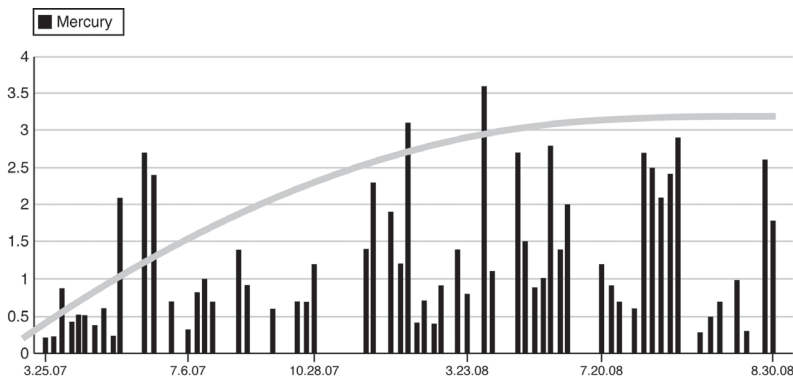
As you proceed through the Metals Program, keep a graph on which you plot the metal excretion for each metal after each set of test results. As you mark down your results week after week, over a certain period of time, it’s very likely that you will see what I call the “bell shaped curve” (see below.) This curve shows a rise, continuation, and then drop-off in metal excretion. Tracking this allows you to follow the sequence at which the different metals are released over time to assure that you have successfully detoxified them. Usually, an improvement in behavior, speech, eye contact, etc., will also occur following detox over time. When you see

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the curve, this is an indicator that you may be done with that particular phase of the Metals Program, and can then take a break before beginning the next one. If you are just climbing the slope of the curve, then I would suspect you are still on the upside of the detox and would not recommend a detox break yet. You might even want to push harder on detox, especially if you are reaching your limit.

It's important to recognize that the graphing of the curve happens over an extended time period.

Don't be concerned if some of the test results you get back are duds. Given that you're testing random spot urines, rather than provoked urines (in which a substance is given to promote rapid metal excretion), it could be that the child has



already urinated five times that day. As a result, you either get lucky in finding a urine where metal release occurs, or alternatively you would have to collect and test every single urine for that day and week. To avoid that inconvenience, most parents on this program collect random samples, and given that, you have to be prepared to occasionally get a dud.

Some individuals may stay on a Metals RNA for a month, others for six to eight months. Graphing the data tells you exactly where you are in the process.

### **Ammonia and Creatinine**

With many of the children with CBS up regulations, there can be a challenge in raising creatinine levels, reflecting the fact that there are greater issues with chronic viral infection. Once the body is supported such that ammonia is less of an issue, increases in creatinine will often follow. Ammonia is a factor in the pH shown on the urine pH strips. While you may save some money using the pH strips instead of a urine test, more comprehensive information is revealed by the excretion in the urine. If ammonia is high, creatinine will tend to be low, because they share components of the same pathway. Typically, once we get the ammonia level down, the creatinine will come up. This is an important benchmark, which is why I recommend tracking it.

### ***Other Tests***

It's important to note that you also can't rely on a negative provoked urine test, that is, a test following the "provoking" of metal excretion through chelation, to tell you whether you should begin the Metals Program. If you have a child whose regression is severe and has really high viral titers, chances are that child is loaded with metals, even if you are not seeing them.

It is also best not to rely on porphyrin testing, because lead, insufficient levels of B12, and (according to work coming out of Vanderbilt Medical School), chronic infection by the bacteria Chlamydia can result in low porphyrin levels. Sometimes those whose porphyrin tests show they have no metals in their system still excrete an amazing amount of metals once we have the proper support in place.

On the other hand, if a child is basically recovered and a porphyrin test comes back abnormal, that is useful information that suggests to me that we needed to continue to address metals and virus in the body, regardless of the fact that the child appeared to have recovered. Those metals could become a problem later, in other ways, even if they did not cause regression over time. Having that data would make a difference in terms of how we would move forward.

### **Additional Factors**

#### ***Addressing Strep***

I'm often asked what causes chronic microbial issues leading to metal retention. Sometimes, streptococci present in the mother are transferred to the child at birth. Lower gut pH breeds an environment where opportunistic organisms thrive, while normal flora are disadvantaged. Even though people often need

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antibiotics to address bacterial infections, chronic antibiotic use can undermine gut flora, ultimately allowing the growth of clostridia. Chronic clostridia can lead to language problems, and also create a vicious cycle in which normal flora, appropriate levels of stomach acid, and bile levels are compromised.

Both genetics and blood type can be predisposing factors. When, as a result of methylation cycle mutations, there is decrease in the T cell response relative to the B cell response, this undermines the DNA repair cycle, increasing the likelihood of autoimmune reactions as well as chronic infection. Since the same receptors are used by strep, measles, and herpes, bacteria and viral infection can occur concurrently because the presence of strep will also promote the spread of viruses. Chronic strep also impacts serotonin levels and decreases myelination. If there are obsessive-compulsive disorder (OCD) symptoms, a contributing factor can be chronic bacterial infection in the gut.

Strep also increases the level of the inflammatory marker TNF alpha, and can be a contributing factor in issues such as PANDAs, stims, OCD, Tourette's syndrome, perseverative speech, and leaky gut. Streptococcal infection in the gut can also reinfect the sinuses. Leaky gut can also lead to decreased weight gain or slower growth.

Xylitol nasal spray can help to eliminate nasal strep and reduce ear infections. It has also been reported to help with leaky gut, most likely by decreasing the flow of streptococci from the sinuses into the gut. Biotene gum, toothpaste and mouthwash also contain xylitol. It's available as a sugar for cooking as well.

Papaya enzyme and increased doses of vitamin C support the elimination of chronic sinus infections and strep in the gut. Dose these supplements according to what the body can tolerate without causing loose stools. Along with ImmunFactor 5 (every other day) use the Microbial STRX RNA on a daily basis to address bacteria. The supplements IP6 and benfotiamine may help to reduce stimulatory behaviors and OCD behaviors associated with chronic streptococcal infection. Lactoferrin helps to address streptococcal and other bacteria by limiting iron uptake. Lactoferrin can also help reduce elevated levels of red blood cells and high hematocrit values. Many microbes require the presence of iron for growth and/or virulence.

## ***Infections and the Thyroid***

Periodic thyroid tests and CSAs to assess the status of bacterial infection and its effect on thyroid function are suggested for individuals who have issues with chronic bacterial infection, sinus infections, dental issues, or a past history of ear infections. Strep infection can increase peroxides, diverting from BH4 synthesis, leading to a depletion of BH4. In addition, high levels of peroxide can impact thyroid function because thyroid hormones require a bodily mechanism

also used to detoxify peroxide. It's therefore important to find out if the thyroid is functioning properly and support the thyroid if necessary.

The amino acid tyrosine is a precursor for both thyroid hormones and dopamine synthesis. An enzyme activated during chronic bacterial infection can deplete tyrosine levels, which is why there is an association between low thyroid function and chronic sinus infections. Iodine also affects thyroid function which is why I recommend monitoring iodine and lithium on essential mineral tests. You can supplement if values are low. One option is an iodine-containing product called Iodoral, which both supports the thyroid and may be helpful with respect to mercury excretion. If you supplement with Iodoral, make sure to watch lithium levels.

Thyroid/tyrosine (Metabolic Advantage) supplements can also help. The use of the herb guggul (Ayur-Guggulipid) may help to balance T3 and T4, two thyroid hormones. After four weeks of nutritional support, run a follow up thyroid test to confirm that thyroid hormone levels are in the normal range. An essential mineral test (or a topical iodine test) can confirm when you've achieved healthy iodine. The thyroid hormone iodination cycle is tied to glucose 6 phosphate dehydrogenase (G6PDH) levels which are also affected by sulfur groups. Addressing thyroid issues helps to clear chronic bacterial/sinus infections.

### ***A Few Pointers About Aluminum***

As I mentioned in the previous chapter, aluminum interferes with the production of BH4, and therefore affects levels of both serotonin and dopamine (with or without an MTHFR A1298C mutation). Malic acid, EDTA and horsetail grass may be helpful in supporting aluminum excretion from the body. In addition as chronic bacterial infection is addressed, it can help to aid in aluminum excretion.

In addition, aluminum retention leads to chronic stimulation of the immune system via certain auto-antibodies. The long-term consequence of aluminum accumulation is self-destruction of the immune system. An added difficulty is that many vaccines contain aluminum used as what is called an "adjuvant" to stimulate the immune system so that it responds to the other substances in the vaccine. However, if, due to chronic bacterial infection (or other causes), your body can't get rid of that aluminum, the aluminum becomes trapped in your system, where it may over-stimulate the immune system.



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## **A Caution About Aluminum for Adults**

Without realizing that there is any problem, many teenagers and adults use deodorants and antiperspirants that contain high levels of aluminum. If there is chronic bacterial infection, the body will retain the aluminum. I suspect that aluminum, chronic bacterial infection, and A1289C mutations are strongly contributing to Alzheimer's susceptibility.

Aluminum also inhibits points of interaction between the methylation and Krebs cycles to undermine Krebs cycle activity, needed for mitochondrial energy production. That's why it's vital to release aluminum before we can move ahead to Step Three to remyelinate the nerves.

### ***A Word On Detox***

Detox can be like a roller coaster ride, with lovely increases in language and behavior, followed by aggression and regressions, only to find that the cycle repeats again. Take your time, and move at a pace that works for you or your child. Work in conjunction with your health care provider. And remember this is a marathon, not a sprint. If you need to slow the pace down, then move more slowly.

There is no rule that says that you need to rush through detox. Each person is an individual, with his or her own genetics, microbial burden and toxic metal burden. One of the beauties of this program is the ability to tailor it to suit specific needs. So take advantage of the flexibility in the program to customize it to your own situation.

## Chapter 8. Step Three

### Remyelinating the Nerves

**T**he major focus of this final phase of the program entails implementing a program of supplementation to support remyelination of the nerves and to foster left/right communication in the brain. This is essential because many of the symptoms seen in autism and other forms of neurological inflammation result from the demyelination of the nerves that is produced by the assault of virus, metals, and other factors. Most people are pleased to get to this phase, and I want to congratulate you. It's been a lot of work and a long wait.

However, I also want to caution you that your journey is not quite over. This phase also takes time, dedication, and work. The process of remyelinating the nerves can take up to nine months, and that is only the first part of this step. Once the nerves are remyelinated, then they are ready to launch a “pruning” process, essential to normalizing nerve function. This process also takes time—except for children who are COMT +/+, also sometimes referred to as “over methylators,” for whom pruning will occur much more rapidly.

Methylation is directly involved in the ability to both myelinate nerves and to “prune” nerves. Myelin is a sheath that wraps around the neuronal wiring to insulate and facilitate faster transmission of electrical impulses. Without adequate methylation, the nerves can neither initially myelinate nor can they remyelinate after viral infection or heavy metal toxicity. Inadequate methylation therefore decreases both myelination and the subsequent “pruning” of the nerves. Why is pruning necessary? Pruning helps to prevent excessive wiring, or unused neural connections, and reduces the density of synapses to allow proper transmission. Without adequate pruning, the brain cell connections can become dense and tangled, causing poor or misdirected signals.

#### Beginning This Step

Even after detoxifying virus and metals, many underlying factors still remain and will persist over time, as I discussed in the earlier portions of

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this book. Your goal is to maintain sufficient long-term supplementation to prevent the likelihood of accruing a toxic and microbial burden that would instigate inflammation and dysfunction once again. No one wants that to happen! So, while you may be tempted to limit supplementation to the recommendations I'll offer in this chapter for Step Three, Nerve Growth and Myelination, remember where you have been. It's easier to keep taking needed supplements on a daily basis than it is to run the risk of glutamate, viral, and metal toxin buildups occurring again.

## ***Suggested Protocol to Support Nerve Growth & Myelination***

### **General Vitamin/ Organ Support:**

Neurologic Health Formula (HHI general vitamin)	Nerve Calm Inflammatory RNA
Liquid trace minerals	General Inflammatory Path RNA
Ora-Liv	Stress Foundation RNA
Ora-Pancreas	Nerve Coat RNA
Ora-Triplex	Cytokine Inflammatory Path RNA
Immuno-Forte	Bowel Inflammatory Path RNA
Cod liver oil	Stomach pH Balancing RNA
Zinc	
Potassium chloride (depending on levels)	

### **Support for Nutrient Transport to Brain (taken with supplements):**

Vitamin C

### **Supports for Methylation (increases myelin):**

Curcumin  
SAmE  
B12 (balance of methyl/cyano/hydroxy cobalamine)  
Intrinsic B12/folate

FolaPro (5 methyl folate)

Folinic

Nucleotides

DMG

B Complex

Selenium (up to 100–200mcg/day incl. complete vitamins)

Amino Care amino acids

MSM (depending on CBS status)

### **Supports for Myelination/ Cell Membranes Fluidity:**

DHA (100–600mg/day) For those with NOS+, please take every other day Phosphatidyl Serine PS/PE/PC complex

Nerve Coat RNA (1/2 dropper 2X/day or as needed)

EFA

Policosanol

Chondroitin sulfate (LIMIT OR OMIT for CBS+)

Glucosamine sulfate (LIMIT OR OMIT for CBS+)

Sphingolin

Spirulina

### **Supports to limit ROS (which triggers macrophage digestion of myelin):**

CoQ10

Alpha Lipoic Acid (LIMIT OR OMIT for CBS+)

Idebenone

Vitamin E +mixed tocopherols

Quercetin (LIMIT OR OMIT for COMT+)

### **Supports to Limit Macrophage Digestion of Myelin (MAY be an issue for phenol sensitive):**

Flavinoids:

Lutein/bilberry

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Quercetin  
Pycnogenol  
Grape seed extract  
Elderberry  
Cranberry  
Green Tea or L-Theanine

### **Supports for New Nerve Growth/ Support Nerves:**

Ashwaganda  
SAmE  
B12  
Milk thistle  
B complex  
Colostrum  
HGH  
Taurine  
Ora-Placenta  
Ginkgo biloba  
Carnosine  
Rosemary  
DHEA (monitor with hormone test and only supplement if levels are low)  
Synthetic B1 (benfotiamine)  
Shark liver oil (nervonic acid)  
Vitamin K (or vit d/k/ca/mg depending on calcium levels)  
Vitamin D (or vit d/k/ca/mg depending on calcium levels)  
Magnesium (or vit d/k/ca/mg depending on calcium levels)  
Calcium (only if test results reveal levels to be consistently low)  
L-tyrosine  
Glutathione (LIMITED for CBS+)  
Choline, or lecithin, or huperzine (depending on the child)

**Supports for Progesterone for Nerve Growth:**

GABA

Sublingual GABA Calm/ glycine

Zen

**Supports for Oxygenation/ Energy for New Nerve Growth:**

Oxydrene

ATP

L-carnitine/acetyl-carnitine

Vinpocetine

NADH

Cell Food

Magnetico Magnetic Mattress (north only, 20 gauss)

Body Fields OMT Magnopro

Ionic Breeze (Sharper Image)

Penta water

Hyperbaric oxygen

Nariwa water

O2 Plus

**Supports for Mood:**

Mood-S RNA

Mood-D RNA

Mood Focus RNA

Dopa 400

**Supports for Language:**

DMG

Fenugreek (start with 1X/day increase to 3X/day)

Gotu kola

Bacopa

Piracetam

B12-cyano/methyl/hydroxy cobalamines

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Black Cohosh

Dong quai

Indole-3 carbinol (discontinue if a fish odor emanates from the body)

Neuro Support RNA

### **Supports for Left/ Right Communication:**

Gotu kola

Bacopa

Nootropics:

    Piracetam

    Aniracetam

Fenugreek

Creatine

### **Supplements to Keep Virus in Check (IF still an issue):**

Transfer factor

Moducare (may increase gamma interferon)

Glutathione

Metals I, II, III, IV RNA Formulas

***Note:** If supplements are listed in more than one category, please take only a **single dose** of the supplement per day. They are listed in applicable categories to give a sense of the multiple uses of the individual supplements.*

### **Changes in Mood and Behavior**

The methylation pathway is also tied into the pathways for neurotransmitters. As a result, you may see changes in mood and behaviors as you go through this phase. Initially, many parents will comment that the child is “no longer autistic” but “acts more like a child with ADD.” This makes sense, as dopamine levels, which are in part regulated by methylation activity, have been implicated in ADD.

One or more of the Mood RNA (S, D, or Focus) can be very helpful at this stage, depending on the particular child (and his or her genetics.) To ascertain this, you can start with 1/3 dropper of one of the formulas for several days, then make a decision on that formula before switching to a different formula or adding a

## Chapter 8. Step 3 Remyelinating of The Nerves

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second formula for a combined effect. Also, some parents have had good results with small amounts of supplements containing natural dopamine.

Also, as I mentioned earlier, imbalances in the level of norepinephrine relative to dopamine can cause some of the hyperactivity and attention issues which are commonly seen. Balancing the support for the “long way” around the pathway relative to the “short cut” through the methylation cycle can help to improve the behaviors. The use of the Attention Support RNA along with shifting to “long route” support seems to make a positive difference for attention issues, especially for those who are BHMT 8+.

At this point, depending on the calcium levels seen on a urine essential element test, you may want to look at supplementing calcium to aid neurotransmission. Remember, however, that too much calcium can still be a problem. One approach is to use a calcium/ magnesium/vitamin D/vitamin K supplement, and substitute it for the individual magnesium, vitamin D and vitamin K supplements. Again, this will vary depending on the child and on the level of calcium in the system.

Higher dosages of some of the supplements that support myelination will accelerate the myelination process somewhat. Some parents have used up to four SAME per day with two B complex. In addition, they have used two curcumin and doubled up on some of the other methylating agents. While this may speed up the process, watch carefully for potential side effects such as mood swings or vision issues. If this occurs, back off on the dosages. Do NOT increase the levels of 5 methyl folate, intrinsic B12/Folate, folinic, or the nucleotides. Due to the MTHFR mutation in virtually all of the children, this could create problems. You are better off to just keep the door open on this MTHFR pathway, rather than flooding it with supplementation.

B12 deserves special mention in terms of dosage. So far, as mentioned earlier, according to published work by Dr. James Neubrandner, no toxic doses of B12 have been found. The more the better seems to be what parents are finding. In some cases, going to highly elevated doses of B12 (50 milligrams and above) has helped to stimulate speech in children that were apraxic. However, it is always possible that your child will be the one child who will react adversely to high doses of B12. Again, progress slowly, use caution, and consult with your health care practitioner when utilizing this or any other program.

Knowing the Nutrigenomic profile is very useful in determining the right kind of B12 support, such as whether hydroxy or methyl B12 will be more suitable. Nutrigenomics will also help you to gauge the amount of B12 that may be needed to achieve balance. In terms of B12 use, one exception is children with COMT +/- status who cannot tolerate high doses of any methylating agents. When supplementing these children with methylating agents like B12, use caution and proceed slowly.



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## Additional Therapies

In this phase of the program, it also makes sense to integrate other therapies that enhance nerve growth and maturation, for example, magnetic therapy. While I haven't found that it enhances metal excretion, I have seen a significant effect on subtle cognitive function. Recent work by Dr. Dean Bonlie confirms that electromagnetic therapy is safe and effective for a wide range of neurological problems, including regenerating and repairing damaged nerves and enhancing the body's natural stem cells. Magnetic energy may also increase the oxygen-carrying capacity of the blood, improving the assimilation of nutrients and oxygenation of tissues. The use of Nariwa magnetized water and Penta oxygenated water may also be useful adjuncts to any program to enhance nerve growth and demyelination.

The March 2004 issue of the *Journal of Neuroscience* describes environmental influences on the levels of BDNF (brain derived neurotrophic factor), which promotes neuronal growth and survival and regulates communication between neurons. An enriched environment (in which there is helpful communication, visual, auditory, and other stimuli) fostered significantly higher levels of this factor. Dr. Cheri Florence, a medical speech/language pathologist, has described tremendous personal success with her own son. She has made use of strategies that may help to create an enriched environment, such as enhancing visual thinking to help promote language.

Dr. David Steenblock, Dr. Barbara Brewitt, and Dr. Luis Aguilar have pioneered the direct use of certain brain growth factors for stroke as well as autism. Insulin like growth factor (IGF) has been found to stimulate enzymes in the methylation pathway in addition to its effects on neural development. Fibroblast growth factor (FgF) has also been found to have activities beyond its effects on nerve growth. FgF has been reported to increase dopamine levels, as well as to decrease seizure activity.

Dr. Edward Traub has developed CI (constraint induced) Movement therapy, which has proven to expedite recovery times after stroke. The basis of the therapy is helping the brain to overcome "learned non-use". Some of these therapies may be applicable to autism in the future to help to accelerate recovery after the biochemical imbalances have been addressed.

Music therapy has been reported to be successful in helping to enhance speech in children. A number of scientific journals have found that music affects regions of the brain involved in cognitive, affective, and mnemonic processing. The entire July 2003 issue of *Nature Neuroscience* was devoted to music and neuroscience, as was the March 2004 issue of the *New York Academy of Sciences* magazine. Recent research from the University of London

suggests that many children with autism have outstanding abilities in tone memory and discrimination. Music therapy may be an avenue worth exploring to help enhance language skills during this point of the program.

### **In Conclusion**

Obviously, understanding and implementing this program will not happen overnight. It's a slow process. As you immerse yourself in all of the science and begin the initial steps, know that you will be supported, helped, and guided by other veteran members of the support community on my website chat room. This will make the learning process smoother and easier.

This program is more than a laundry list of supplements for you to take. It's a process that you must take the time to read, then reread, understand, and embrace in order to really obtain the benefit. Knowledge empowers. The information contained in this book better positions you to use all of what I have offered as tools for health.

But make no mistake about it. This program requires you to take charge of your own, or your child's health. I'll offer the tools and the support you need to get there, but you are going to have to do the work. Beyond this book, there are other books and DVDs. If you can, come to conferences and search and read older posts. Basically you need to do your homework, but along with the chat room families, I will be right there to support you along the way. That's why the motto that we all share is:

### **Read it, learn it, live it....**

My goal is always to empower you. I am blessed to work with the many committed parents and adults and dedicated practitioners who have served children with autism, as well as other people on their pathways to recovery. Whether you are a veteran of this program, or a newcomer to it, you are healers, every single one of you, and I salute you and offer you my commitment to the goals of healing we all share.

I hope this book has given you a clear path to follow and, more importantly, a sense of hope about the potential for recovery. Please understand that reading this book is just one tool to help you on the pathway to recovery. I urge you to take advantage of the DVDs in which I share many fine points of the program. I also invite you to join the discussion group. In both places, you will find critical information to help you on your journey. The discussion group (chat room) is particularly important, as it offers both emotional and informational support.

I recommend that you start reading the "positives," that is to say, positive experiences that are posted on the website and in Part III of this book. These are unso-

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elicited posts by parents and adults about their progress on the program. I invite people to share their positive experiences because so many others have said how much support and hope they derive from reading them.

One principle of the site and of this work is to “pay it forward.” That way, each of us can ask for help when we need it and offer help when we are able to provide it. On that note, I would like to invite you to finish this book by reading a few of the many touching and powerful stories that parents and others have submitted. Please take the time to receive these shared words and thoughts on the pathway to recovery, and may they support you and your family on the journey to health.

With love and hope for recovery,

Dr. Amy

### **III. Walking the Pathways to Recovery**



## Chapter 9. Stories of Hope Rewarded

### Jonathan's Story

When our son, Jonathan was born in March 2002, he was a perfectly healthy 7 lb., 4 oz. boy with wide eyes and a loud cry. That first night in the hospital, he breastfed all night without any problem. The next day, the nurses took him away to give him the hepatitis-B vaccine. Little did we know that that would begin a difficult life. That night he lost the ability to latch onto the breast. I fought for weeks to help him and saw several specialists until Jonathan relearned how to nurse again at week five. Despite his rough beginning, Jonathan seemed to develop normally. He was very happy and always smiling and engaged. But I came to believe that he is one of those children susceptible to vaccine injuries because each time he got a vaccine, his behavior changed. Often, he got very sick. After the diphtheria/tetanus shot (DTAP), he developed low muscle tone and couldn't control his body well. He crawled at ten months and walked late at fifteen months. At nine months, he developed pneumonia. During his four day stay at the hospital, he received intravenous (IV) antibiotics. A week later, he received a flu shot. Within a few days, he developed a very strong anxiety towards people and did not want to be touched by anyone except us.

When Jonathan turned 13 months, he received the MMR vaccine. That same day, he lost the ability to nurse. He became obsessed with numbers, letters, and Baby Einstein movies. His play skills changed. He had no pretend play. Actually, he didn't seem to know how to play. But he would still connect and laugh with us and had good eye contact, and would point at things he wanted us to give him. At 18 months he became obsessed with numbers and letters in a toy computer. He had no speech.

We took him to his pediatrician who assured us that he was fine. "Boys are normally late," he told us, urging us to be patient and wait. Jonathan first spoke at twenty-three months. His first word was "down." By the time he was twenty-six

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months, he was so obsessed with numbers and letters, he had little vocabulary. But he could count until 10, and he knew the entire ABCs. He was obsessed with opening and closing doors, flushing the toilets, and turning light switches on and off, but didn't care to play with other kids.

At twenty-seven months, he received his second flu shot and at twenty-eight months, his language and behavior regressed tremendously. He developed horrific tantrums. They were so severe it was impossible to take him anywhere. No one could touch him. Loud noises would bother him. He became an extremely picky eater. His cute repetitive/odd obsessive behaviors became even more intense. He didn't want to play with other kids and seemed like a loner. He would not respond to his name, nor would he look at us straight in the eyes anymore. But the biggest issue was that he could no longer understand spoken language.

We had lost him. Jonathan was diagnosed with mid to severe autism at thirty months by a pediatric neurologist.

At thirty-three months, we began our journey into alternative medicine following the Autism Research Institute's Defeat Autism Now! (DAN!) protocol. However, Jonathan seemed to be a tough child and was not advancing as fast as we wanted. At forty-two months, a friend of mine introduced me to Dr. Yasko's *Puzzle of Autism* book and I got curious. Particularly because he could not tolerate methyl B12 shots like most kids did and Dr. Yasko's book seemed to have an explanation for that. I decided to do the genetic test and learned from her DVDs as much as I could. I implemented her ammonia protocol before I got the genetic results back. Then the moment of truth: I gave him methyl B12 shots and amazingly enough, he could tolerate it.

Not only did he tolerate it, but a week later, he came to our bathroom and looked at his daddy brushing his teeth and said "Daddy, what are you doing". His dad almost had a heart attack. That day, we became "Yasko" believers and we have been following her protocol since. Jonathan has made huge improvements, particularly with the Strep Protocol, the Ammonia Protocol, the organ support and her Step 2 (detox). Although I did not have the means to do weekly tests, I know by looking at his urine that he was detoxifying (crystal clear for a few days then back to normal) like never before. Early in 2007, we decided to do hyperbaric oxygen therapy. It was a tremendous intervention and has brought Jonathan to yet another level. Jonathan has completed 160 hours in a hard chamber. I am convinced that his positive reaction to HBOT was due to all the detox and healing that his body experienced due to Dr. Yasko's protocol.

Today, he is six and a half years old, attending a public school in mainstreamed first grade with one hour support a day. He is doing great; he is social, happy

and very engaged. He is a purple belt at Tae Kwon Do, he rides a bike, he loves to climb, loves to play pretend with sister, and he is very sweet and loves to give us hugs and kisses. We do things as a normal family: restaurants, friends' houses, parks, amusement parks, movies, and the reading program at the library. He still has language problems and some attention problems that we are continuing to address using Dr. Yasko's methylation support, but I know that he will have a future now.

I could not thank Dr. Yasko enough for giving us her knowledge and understanding. Her protocol is very effective. This protocol requires dedication and patience, and a higher level of biochemistry understanding, but it is the best integrative approach. Particularly for the kids that need more than a diet to recover. Thank you Dr. Amy. We could have not done it without you.

Jonathan's Family

### **Luke's Story**

Luke was our first child, and like all parents, we had so many hopes and dreams for him. We were so excited every time he achieved another developmental milestone—rolling over, sitting, crawling, and walking. I remember purchasing a baseball tee and bat for him, wanting to share my love of baseball with him. At 12 months old, he was a beautiful, happy, giggly little boy. One of my favorite photographs from that time was him peeking his head around a doorway with a big smile on his face. He was playing peek-a-boo with us from the next room.

A few months later, his behavior began to change. He no longer answered us when we called his name. Instead of playing appropriately with his toys, he would assemble them in a line, and then run circles around the toys for minutes at a time. Luke would often throw tantrums, and most times we could not determine the reason. While his little neighborhood friends were talking more and more, he had no language. He seemed to be in his own little world.

During this time, we voiced our concerns to his pediatrician and to anyone else who would listen. Over and over again, we received the same message: He's just a boy, boys develop later than girls, and let's wait and see where he is in six months. I felt so helpless. As a mother, I felt responsible for his delays, and continually wondered what I was doing wrong and what I could do to help him.

It wasn't until age three, after we convinced his pediatrician that he needed some help, that she agreed to refer us to a speech therapist. Finally, he began to use some words on a regular basis. We hoped that he just needed this jumpstart, and that soon we would experience a burst in language. I thought maybe his meltdowns were simply a result of not being able to communicate with us, and that an



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increase in language would resolve that problem. But those hopes faded quickly when his language and communication skills failed to develop and were well below normal levels for a three-year old. His younger sister, at seventeen months, was speaking at a higher level.

Luke qualified for our school district's Early Childhood program. He made some small gains in speech, but his inability to handle transitions, play with his peers, and communicate with us drove us to seek help. A neurologist diagnosed him with autism, but didn't give us any direction in how we could help him. After another disappointing doctor's appointment where Luke screamed and cried the entire time, a wonderful neighbor of ours dropped off a couple of books on autism that she found in the "new book" section of our library. One of them was Dr. Amy's book, *The Puzzle of Autism*. After reading it, I was filled with so much hope.

We began Dr. Amy's program when Luke was five and a half years old. While waiting for his genetics results, we began some basic Step One supplementation. After a couple of months, teachers were beginning to make comments about positive changes in Luke's behavior at school. Besides an improvement in his speech, he was calmer, less anxious, and better able to handle changes to the "routine" schedule. The excitement we felt when he took his first steps at eleven months old was nothing compared to the excitement of seeing our little boy taking his first steps toward recovery.

We spent nine months on Step One, regularly testing and tweaking his supplementation based on Dr. Amy's recommendations. Luke was improving, but we knew that beginning Step Two of the protocol would bring some regressions. The detoxification of virus and heavy metals in Step Two, and the associated regressions were very difficult to handle. By testing regularly, however, we were able to see first hand the way his body began excreting metals. It was fascinating to see little to no metal come out of his body at first, followed by increasing levels as the supplementation increased. Associating the metal excretion to the behaviors made the tough times a bit easier. After two years on Step Two, we are now beginning the final phase of the program.

Today Luke is a different child. In second grade, he is learning without the help of a teaching aide. Instead of playing with a stick or staring at passing trains at recess, he looks to the other kids for interaction, socializes, plays team games, and explains what's on his mind both at recess and after school. He joined the Cub Scouts and can't wait to play baseball for the first time in the spring. His speech improves every day.

Dr. Amy gave us the tools to heal our son. She traveled the long and difficult road with us, reviewing numerous test results, answering questions, and leading us down the path to recovery. We are so grateful because today we have a happy

boy whose thoughts and abilities have finally been released from the limitations of autism.

Matt and Marcy Walsh

### **Lake's Story**

I may never be able to find the proper words to express the gratitude I feel towards Dr. Amy and her work. She has truly changed our lives! When my son was three years old, he suffered from a multitude of medical issues, which included vaccine injuries and harmful environmental exposures. I feared that I could never understand enough about the science of the human body to move the mountains and help him. Though sometimes I longed to wake up and discover it was only a bad dream, I realized that I had an unstoppable will to undertake all efforts to make him better.

After a series of local doctor appointments, I recognized that if I wanted him to get better, I would need to take charge of Lake's healthcare. Having neither the time nor energy to go to medical school, I searched for someone brilliant that could supply the healing wisdom as well as the dedication to help me help my son. Dr. Amy was an angel sent to me from heaven above...truly! Dr. Amy's program supplied everything needed to help him with his multiple health issues—both the expertise and the knowledge to heal my son, and the motivation and tools to help other family members and friends. The information, knowledge and encouragement I gained from studying at LNYU (Late Night Yasko University) will be with me for the rest of my life.

Witnessing how much Lake has changed, I still am amazed. At age three and a half, he was non-verbal, had issues with crying, screaming, GI/bowel, eating, gross motor, and social problems. To heal all his issues with Dr. Amy's protocol, we started from the top of his head and worked down to his toes. By the age of five, Lake had entered into a regular education kindergarten class and he has thrived. Today, he is a typical kid in the second grade and he is making A's & B's. He enjoys karate, basketball and Scouts. We continue to support Lake's methylation pathways with Dr. Amy's nutritional formulas, and will forever be grateful to her and her wonderful staff for providing us with the support and the tools to return our precious son to optimal health and healing!

With the utmost gratitude!

Marisha Taylor (Lake's Mom)

### **Heathar-Ashley's Story**

My daughter Heathar-Ashley is twenty-two years old, and we have been following Dr. Amy's protocol in the UK for about four years now. Heathar-Ashley

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contracted encephalitis when she was just eight months old, resulting in paralysis, hearing loss, and a dreadful seizure disorder. The latter haunted her for such a long time. It wasn't until we started to look at diet and supplements and found the Yasko protocol that my beautiful daughter shed away all those years of hospital visits and doctors surgeries and countless weeks in the abyss of drugs.

She had never uttered a word in her life, and we discovered how to help her type out her thoughts and feelings. Now... after a relatively short period of time in the grand scheme of things, she is at university, loves learning and is learning how to talk, and making amazing progress! My gorgeous daughter has made tremendous strides towards a life of fun and laughter. We need to travel a little bit further on, but I am so happy that we are on the Yasko pathway. “

Sandra Barrett

## **Alivia's Story**

Alivia was born in the States, and received her first vaccines here, but we skipped the hepatitis B, chicken pox and MMR. She developed horrible eczema, but after we moved to Finland, when she was one year old, her skin condition had improved drastically with the natural Scandinavian lifestyle, including the daily sauna routine. For three years, we were just a happy family living a happy life. We were doting parents who were madly in love with our charming children whom everyone adored, wherever we went.

Two months after Alivia's fourth birthday, we moved back to the States. The beautiful, bright, cheerful, thoughtful, sweet, calm, healthy, bilingual child was now a big sister to a two-year-old little brother and I had a third child on the way when we returned and moved into a new home.

As we planned a home birth, I continued to enact the best health and wellness advice for our children. I made all of the baby food, and we ate only organic at home and rarely ate out. We had no chemicals in our home. Even when we got those beloved summer snow cones, I would ask for only a “teensy” drop or no syrup at all.

After we went to enroll our children in the wonderful preschool that our friends' children attended, we were told that Alivia would need to receive the MMR shot. I put it off and made excuses. I just had this gnawing, strange feeling. I told her pediatrician that I was certain she had it in Europe even though I knew that she hadn't had it. I recall that back in Finland, my Finnish pediatrician made jabs and sly remarks about the American vaccine schedule, telling me how happy I should be that I was raising my children in their country.

A month after she started pre-school, I got a letter telling me that Alivia would be kicked out if I didn't comply by giving her the MMR. I took her to the pedia-

trician, expressed my concerns, and asked if there was any way around it.

“Of course not,” he said, adding that I was being ridiculous and irresponsible for not having her vaccinated with the MMR, and so I complied.

When they vaccinated her, she did well and didn’t even cry. She thanked the pediatrician and nurse, and spoke some Finnish and Italian. They just loved her and were so happy to have her in their practice. So relieved that she seemed okay in the days that followed, I pushed away my concerns and focused on a normal life filled with play dates, swim clubs, bike rides and ice cream.

Over the next weeks, Alivia started having horrible eczema and other strange rashes all over her body. They appeared constantly and she scratched them until they were bloody. She seemed generally miserable and fatigued. She became spacey and hyperactive. She began acting completely irrational. She would scream at the sight of once beloved flies or ladybugs. She was aggressive with a few playmates—something I had never seen... and we lost a few friends. I just couldn’t put my finger on what was going on with this child. Maybe the moving, the new preschool, or the fact that mommy was about to have a new baby.

The baby was born six months after the MMR. It was time for preK to start up again and Alivia needed, of all things, an MMR booster. I explained to the pediatrician that she had just had her first MMR 6 months before—not when she was one year old. The pediatrician assured me that there was absolutely no reason for concern, that it would only offer her the protection that she needed. She stated that she could have a booster today, tomorrow, next week and one next month... even days after an initial MMR.

I wish that I had put some of those initial symptoms together and figured it out then, but I didn’t. She had the booster at age four. That booster sent her tanking! Now she was a sick child. She blew up like a balloon; she became ghostly pale, she developed dark, dark circles under her eyes. She broke out in warts that covered her fingers, toes, knees, and elbows. She reacted to every food she ate, either behaviorally, or with rashes, bloating, or discomfort.

I was desperate! I looked everywhere for clues and answers. I read book after book after book. I started biomed immediately. I took basically everything out of her diet and she was a new child after five days. We saw improvements with the DAN! protocol but she still looked sick. Like many parents, we felt that we were in a holding pattern. I was scared that her recovery had plateau-ed.

After reading about it for five months, we began the Yasko protocol. At the outset, I expected that she would recover overnight but it wasn’t like that. It was more like the layers of an onion. There are so many layers to these children. There are so many layers of this protocol. It’s individualized and fine tuned to the children and their genetics.

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Alivia recovered in a way that I had only hoped and dreamed of. She is healthier than before she tanked. She is physically well. She is emotionally, neurologically, and nutritionally well. She is happy! She is a star in every role she takes on. I am so grateful for Amy Yasko—her brilliance, her fortitude, her strength. I wake up every morning feeling infinitely blessed.

Alivia's Mom

## **Anne's Story**

By the time I ran across Dr. Amy's program, I'd had chronic fatigue syndrome (CFS) for fifteen years. I'd lost two jobs because of my health. My life was in the tank. I'd spent the previous couple of years obsessively researching CFS on the Internet. I'd seen a half a dozen doctors, including some pretty pre-eminent ones. I'd flown around the country consulting various specialists. I'd tried a laundry-list of pharmaceuticals. But after all that, I was still housebound, hopeless and so sick I could barely get out of bed or think straight.

I have to admit that at first I struggled to get my mind around Dr. Amy's program, but I was willing to give it a shot, so I started with the essentials. I noticed improvements almost immediately. Within a few weeks of starting on the program, I was able to get off the sleep medications I had become dependent on since getting sick.

For the first time in over a decade, I was getting refreshing sleep again. Hallelujah!

That encouraged me to keep at it, even when I began to experience some of the more unpleasant symptoms of detox. Slowly, I began to experience other gains: My low blood pressure normalized, so did my body temperature. My extremities weren't as cold and my periods weren't so anemic.

It took a lot longer to see improvements in my cognitive function. I sweated that for months. Progress was patchy and often it was a case of one step forward and two steps backwards. But at this point, almost 21 months into this "marathon," as Dr. Amy likes to call it, I feel I've made solid gains there too. I feel cautiously optimistic that the brain can be repaired as well as the body.

It's a tough program, no question, but I'm beginning to feel like my old self these days. I feel an ease in my body that I haven't felt in years, and I feel pretty optimistic about the prospects for a full recovery.

Anne

## **Drake and Blaise's Story**

I have six children ranging from six months old to ten years. Our third and

fourth children, Drake and Blaise, had severe vaccine reactions. Drake disappeared from us after his fifteen- and eighteen-month vaccines. Blaise had a severe, overnight, pediatrician-documented reaction to his six month shots. We followed the DAN! protocol for two years, and both children regained several motor skills and some speech. Still, they had a lot of anxiety and had trouble socializing. Blaise began to regress again because his gut was full of yeast—he was getting skinnier and pale and was covered with fungal patches all over his body. Both were not tolerating DMSA chelation, and they seemed much spacier than before. Despite the chelation, they really weren't excreting many metals anyway.

I cautiously decided to give Dr. Amy's protocol a try for three months. I decided to go "cold turkey" off the DAN! supplements and add in sprinkles of all the "Ora" supports (Ora-Kidney, Ora-Liver, etc.). They began detoxing large amounts of metals just from this! I could not believe that simply supporting their organs and stopping supplements that were excitatory would actually cause mercury to pour out of them!

Today, Drake attends kindergarten at a parochial school with no supports. He is social and very smart. He plays baseball and soccer and he recently began piano lessons. He attends birthday parties by himself, and I can relax knowing that he's "OK." No one at his school has any idea that he was ever autistic.

Drake continues to detox. I still frequently see the cycle of dark, cloudy urine followed by clear urine. As he gets older, I will probably still keep an eye out for social issues, but I know in my heart and mind that he will have every opportunity available to him. I believe he is recovered!

Blaise attends the special education preschool in our school district. His teachers and therapists have witnessed the huge transformation in him. He is still very lean, but not skinny and sickly looking. Blaise is incredibly social at school and at home and is teaching himself to read. He really enjoyed soccer last fall and will be playing T-ball for the first time this spring. All his teachers at school consider him recovered at this point, and so do I. I fully expect him to start kindergarten at the same parochial school my other children attend with no supports.

Dr. Amy's protocol is very comprehensive, but we scaled it down for our two oldest children. Erica and Kelsey were fully vaccinated. They are definitely not on the spectrum, but their immune systems took a big hit. We support their immune system, add some hydroxy B12, and do charcoal flushes to keep down ammonia. I feel like we can help prevent autoimmune disease in their future because of Dr. Amy's protocol.

My children would not have recovered without Dr. Amy's program. I feel that God led our family to Dr. Amy, and we are so grateful! Thank you so much, Dr. Amy!!!!

Cheaney (& Mike, Erica, Kelsey, Drake, Blaise, Britta, and Joel)

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## Mit's Story

My precious Mit came into this world neurologically different. Although outwardly “healthy” at birth, he emerged from the womb with that all-too-familiar blank stare in his eye. Developmentally delayed from the beginning, Mit began therapy at 11 months. At 12 months he was hospitalized for “suspected meningitis” ten days after his MMR and thus began his “failure to thrive.” In the following 12 months, Mit went from robust 50th percentile on weight to a sickly 5th percentile.

At 18 months, Mit was diagnosed with autism. We moved to get Mit into an intensive ABA program at 23 months and put him on a strict gluten-free casein-free (GFCF) diet. We crisscrossed the country from Texas to New Hampshire to California consulting with experts in Autism, ABA and Verbal Behavior gurus, DAN doctors, and chelation specialists.

We tried Sara's Diet, the Body Ecology Diet, Raw Milk, the SCD Diet. We studiously followed the DAN protocol for several years. We did DMSA chelation, transdermal DMPS, glutathione, allithiamine, and methyl B12 shots. You name it, we did it.

Each seemed to help initially, then progress would stop, and the brain fog would return. Although Mit was obviously bright, his ability to learn in therapy was diminishing right before our eyes and more than one renowned ABA and verbal behavior consultant gave up on him.

During these years, I heard of the “new Yasko protocol” but failed to understand it. Unfortunately, we were slow to make the switch. Finally, as Mit approached his tenth birthday in June 2006 basically at the same point he had been at approaching his 5th birthday, I began to study Dr. Amy's protocol.....and the light bulb started to go on.

We started Mit on Step One in October 2006 and have seen remarkable improvements. We layered in the glutamate/GABA balancing supplements followed by organ supports (including the awesome pancreatic protocol), general nutritional support, neurological inflammation reduction, and then the aluminum protocol. We tackled bacteria and began to see phenomenal aluminum excretion.

His Nutrigenomic tests explained why the other approaches did not have lasting effects. It helped me choose appropriate supplements in all areas—and most importantly let me know what types of supplements and foods will be problematic for him. Thanks to Dr. Amy's brilliant work, the Nutrigenomic panel is Mit's lifeline to health.

His health has improved dramatically.....and he gained 25 lbs in 24 months (up to a whopping 80 lbs!). His brain fog and hyperactivity are greatly diminished.

His attention span is improved His gut is healing. His body is excreting metals and toxins are a regular basis. What's more, every single day, Mit is connecting with the world in new ways.

On his own, Mit can fasten his seat belt. He can now follow two-step directions with ease. The development of his fine motor skills has been amazing. He's mastered the "childproof" switch on the fire starter. For the first time in his life, he has started playing—driving his red pedal car and his Gator, running to the swingset to swing after teaching himself to pump his legs, and playing with a toy fire truck he has had (and ignored) for years!

Mit has also developed new emotional attachments in recent months. Occasionally, he now even prefers Dad to me—a bittersweet milestone but an important one. His communication is becoming more purposeful—signing, the occasional verbal approximation after years of silence, and the ability to use a new communication device. As we approach his thirteenth birthday, I am stunned at the amount of progress he's made since we began this protocol.

We have a long journey ahead of us and for the first time in many years, we have hope. Our goal is recovery, and we celebrate each small step in the emergence of our son from the dark veil under which he has lived. Mit has many mutations that will have to be bypassed. He has years of built-up bacteria, viruses, and metals to be "peeled back." But we know we can navigate that journey, using the Nutrigenomics and health testing as road maps, with Dr. Amy as a brilliant guide.

Thank you, Dr. Amy, for your dedication to our children. You're making a world of difference to children throughout the world.

Mitt's Family

### **Cameron's Story**

Cameron was diagnosed with what is referred to as "autism" in April of 2004. Through our research and discovery, my husband and I believe that Cameron suffers from an inability to detoxify heavy metals and control viral loads due to a genetic predisposition in an increasingly toxic environment.

Like most parents, when I first heard the diagnosis, I felt numb and complete despair. It was very surreal and painful. I was eight months pregnant at the time with my next child, and it was all I could do to keep the stress away from the developing baby inside. During that moment of devastation, I slumped over in my chair and buried my head in my hands and began to sob. Seated at a doctor's office in a very sterile and cold room, with all eyes on my reaction, my son, walked over to me and began to stroke my back.

Later, one of the therapists would tell me that his reaction is something that you would not normally see on the spectrum. This is where I would have my very first



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experience of professionals placing these beautiful children in a limited box. This only reinforced our deep belief that there was something else was going on and there began our search for something else, something that addressed his needs, and offered answers and recovery.

That very day, I made a conscious decision to cry at night and get busy researching during the day. I spoke to so many wonderful and strong mothers about their protocol, to include therapies, schools, diet and resources. We followed all of the recommended therapies and, at just twenty-four-months old, enrolled Cameron in a therapeutic school for children on the spectrum. Simultaneously we put Cam on a GF/CF/SF/Sugar Free diet.

As Cam progressed on the diet, we started him on the DAN! Protocol and followed it for over a year. The same mother (who I call my angel) who told me about the diet also shared a very cutting edge protocol by Dr. Amy Yasko. For the last three years, we have followed this brilliant protocol for our son and have seen stellar results. We look back on videos and are amazed at how far he has come without drugs, but only natural supplementation, in a customized protocol designed to accommodate his genetics.

Cam has entered into our world because of Dr. Amy. If it were not for her brilliance, her compassion, and dedication combined with extremely dedicated parents, Cam would not be in recovery.

When we first started the protocol, Cam's language was very limited. In addition, he struggled with transitions. He'd have load and physical tantrums both in public and at home. These were anxiety-producing for all of us. When I posted my experience on Dr. Amy's support forum, I immediately received many incredibly supportive emails with wonderful ideas on how to remedy the situation for Cam. I was able to add more supplements to Cam's protocol and the very next day, we saw the behavior completely disappear. So far it has been sustainable and we have been able to go anywhere with Cameron without a tantrum. This has been an incredible experience for us, and I am so thankful for the advice I received from those many supportive mothers and from Dr. Amy.

Two years ago, when I took Cam to his four year health check up, it was a very difficult experience for both of us. Due to his screaming and kicking, the doctor was unable to get his vital signs. He wanted to escape the situation and I had to restrain him. It was a common but painful experience. A year later, for his five year health checkup, Cameron went to the same doctor's office. With total joy and pride, I can say that Cam was totally engaging, happy to be weighed, measured, poked, and prodded. He fully cooperated and was quite silly with the nurses and the doctor. In fact, our new doctor entered into the office and did not know that Cam was diagnosed with autism. He only realized this when I mentioned that Cam was taking about 55+ supplements. Then he paused and

referenced his chart. He told me that he was quite impressed with Cam and that he wanted to learn more about Dr. Amy's protocol. He indicated that he had his reservations about biomedical and its effectiveness. Once he saw Cam, he wanted to know more about Dr. Amy's approach. This was one of the proudest and most exhilarating moments I have had in a very long time.

In addition to the doctor's visit, Cam had a perfectly flawless experience at the dentist's office the prior week. These appointments are fun now. We, especially Cam, have worked very hard to get to this place and it has been worth every tear, tantrum, and struggle.

Our family, friends, educators, therapists, and physicians marvel at his progress. When they see him, they often say things like, "I am amazed at his progress," "He looks and sounds so good," "He is so great at transitions now," "He is a gentle soul," "He is initiating conversation with his friend during breakfast," and my favorite, "Why was he diagnosed with autism?"

In addition to behavioral successes, Cameron has surpassed all of his IEP goals and this year Cameron successfully transitioned to Kindergarten. He has joined his Neurotypical peers in a very progressive mainstream school. His principal pulled me aside the other day to tell me how much they love Cameron and how happy they are to have our family at the school. She also added that Cameron is a "rock star" and that he is the most popular kid in the class. It only took a few minutes for the principal to share this with me and the impact it had on us is immeasurable. His teacher and his paraprofessionals continue to tell me that he is initiating play with his peers, he follows the daily routine, he works hard to do his work, and he is on track for first grade.

The last four years have been an incredible and emotional journey. My husband and I believe that our son, Cameron, chose us as his parents because he knew we could not only recover him, but also be a catalyst for new and alternative thinking and recovery in the world of autism.

Dr. Amy, Erin Griffin, and many of the forum members have been instrumental in Cam's beautiful progress as well as serving as a critical support system for me during this journey. It is truly a testament of teamwork. We, as parents, grandparents, aunts and uncles, are totally dedicated and committed to recovery. No matter how much we feel we don't understand, we work together to see each other through the journey to recovery.

My husband and I and are witnessing a biomedical transformation in Cameron. We are experiencing a success story that can not be compared to any other personal accomplishment. He is high functioning and on his way out of this disorder. He has worked so hard and I am so proud of my six year old. He is a wise soul with a sweet and compassionate disposition. As we were moving fast along the journey, my husband reminded me to enjoy every minute of our son for where

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he is at that moment of his life. I love the journey we are all taking together. We all have a role and I am grateful for that.

Thank you Dr. Amy. You have given Cameron a chance to fully experience this world and you have helped us get our son back.

Victoria Roberts

## Joey's Story

If I had to choose my own quote to describe our journey on Dr. Amy's protocol, it would be this one by Carl Sandburg, "Life is like an onion. You peel away the layers and sometimes you weep." This protocol is not a quick fix, it's a slow process, peeling away the layers of virus, heavy metals, bacteria that accumulated to result in our son's state of neurological inflammation. The weeping is of sadness when we experience the behavioral and social regressions that accompany the detoxification process. However, the weeping is also of joy when yet another missing piece of our beloved little boy emerges. This is the push/pull, the yin/yang of life. Nothing good comes without time, patience, hard work and tears... there is no magic bullet.

Both of my children were bubbly as babies. In fact, we nicknamed our Joey, "Joey Tribiani" after the flirtatious character on the TV sitcom, *Friends*. He would look at you and smile as if to say Joey Tribiani's famous line, "How you doin'?" He developed normally, achieving milestones until his eighteen-month vaccinations. With these he ran a high fever and was hospitalized on IV antibiotics. We would later learn that our son had a severe immune deficiency that likely contributed to his decline.

Our little boy was gone. We refer to the next year in our home as the "dark ages" as we achingly watched the bright flame of love, desire, and personality dim in our little Joey. He went from calling me in the mornings to get him out of his crib to completely silent and huddling in the corner of the crib when we would go in to get him out.

Finding Dr. Amy's protocol was nothing short of a miracle for us. I admit that I was overwhelmed at first. The following is a quote from one of my positive posts only weeks after starting the protocol:

You even find yourself on autopilot from time to time, both mind and vision blurred from fatigue and worry...you find yourself at a stoplight getting honked and pointed at by the man in the truck next to you, only to look down to realize that the shirt you "threw in the dryer" is still in the dryer and you are cruising off to occupational therapy wearing just a bra, and not a nice one at that.

This was definitely different than anything I had ever read about, in fact I had never even seen the word nutrigenomics. It even took me six months to be able

to say it correctly! Dr. Amy's phrase, "It is a marathon, not a sprint," couldn't be more true. We were in Step One of the protocol almost seven months before moving on. The amazing thing about this is that I did not have to understand "everything" when we started. I only had to focus on the beginnings of Step One. By the time I had a good handle on the basic glutamate/GABA balance and vitamin/mineral supports, the structural foundations of the protocol, our nutrigenomic results arrived. At this point there was more to layer in as part of Step One and more to learn. We were advised by members of the forum to go "low and slow" with our addition of supplements. A sprinkle of a new supplement every three to four days at best. The nutrigenomics and biochemical tests would now serve as our guide for unpeeling the layers of damage and they still serve this role today.

A year into the protocol our son was on his way back to us. He started calling us in the morning to come and get him, attending a typical preschool with an aide, verbally expressing his wants and needs, sleeping in a big boy bed, and potty training. Gone were the days of the little boy who would scream violently if I did not drive the car in a straight line or if I dared to go into a grocery store with him. We were well on our way. This is an excerpt from a positive post just over a year into the protocol:

Joey started summer school this week with my neurotypical daughter, Emma. We are sending an aide with him because he is not ready to be on his own, but I wanted to share a few of the high points from the week.

As they went in on Tuesday morning, my stomach ached. I thought for sure there would be screaming—new environment, new children and difficulty with transitions. However, there was no screaming. According to his teachers he "went with the flow." He is finally sitting nicely during story time.....something we spent all of last year working on in school....Joey has a hard time sitting still period, let alone for a story. Today was the absolute icing on the cake. A year ago Joey could not be without socks (only a few exceptions, like in the tub/pool.) For instance, if his sock came off after we put him to bed, he would scream violently until we put it on him. He would never even consider walking on grass, even with shoes on, until last summer. He has, or should I say had, huge sensory issues. Today he took his own socks and shoes off to let the teachers paint his feet for a Father's Day gift. Not only did he not cry, he did it voluntarily and was used as an example for the children who were scared to do it. I want so badly to share this with my husband, but I think it will make a better gift if I just enclose this positive with his gift.

Our gains have been slow and steady. We've had lots of ups and downs, twists and turns—and I am sure we will have many more. We have been working hard at increasing our B12 and SAMe (up to 1/2, yeah!) and have to do this slowly

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because it triggers detox/illness for us. We are also addressing clostridia issues and continuing all of our Steps One and Two supplements. It's a long journey, and we have a long way to go, but weeks like this really help to keep me going when the times get tough."

The following is input from Joey's teacher for his Kindergarten transition meeting:

Joey is a very engaging boy. He is quick to smile. He has been observed to identify the emotions "happy, sad, surprised and angry," when presented with photos or pictures of people. Joey uses feeling words when prompted. He has demonstrated empathy towards a peer during class. He asked, "What happened?" as he handed a crying peer a tissue. Joey demonstrates curiosity, asking many questions in class. He demonstrates a sense of humor and looks to see if others share his understanding of the situation. Joey names most of the peers in class.

So much has changed for our family over the past few years. We kept some friends, we lost some friends, we made new friends. Our family did not have autism, then we did, and now we still do, but somehow everything has changed. Things are better now than they have ever been. I never thought I would see it this way and, if I could have a "do over" I still would not choose autism, but if we had to have autism, I see the meaning and the value in the path we have taken. When we started this journey over three years ago, we were working primarily on acquiring language and eye contact amidst a myriad of behavioral and attention issues. We did many therapies in addition to this protocol, including ABA, OT, ST, DT, vision therapy, listening therapy, chiropractic...I'm sure I am forgetting some. We were meant to do all of these and Joey has/does benefit from all of these therapies. As we heal his body with this protocol, his therapists work to catch him up socially, academically, and behaviorally. Joey has responded very well to Dr. Yasko's protocol and because of this, his therapists are grateful for the benefits that biochemical healing has brought to their work with Joey. Today, Joey has recently begun attending his "typical" preschool independently. He regularly engages in "arguments" with me about where he wants to go and what he wants to do....real verbal back and forth exchanges. I've actually caught myself getting annoyed with the barrage of "w" questions that he asks of anyone who will continue to answer....and as I catch myself in that annoyance, I am overcome with joy. At this point in the protocol, his detox is very predictable and quite easy to identify. As a family we handle the flow and adjust accordingly. I don't push him as hard now as I used to. It isn't because I don't want him to "recover" it's just because we are really enjoying *now*. I never dreamed that we would get to where we are and so, for me, this is a "recovery," even though we still have the diagnosis. He evolves daily and I am constantly overjoyed by his progress. The slow and steady detox is bringing him to where he was intended to be. He is a quirky kid, but the difference between mommy back then and mommy now is that I realize the amazing effort and work that it took for him to be who he is today.

We can live our lives now as a family. We can eat out and go to play dates and walk into Target. A huge part of Joey's therapy for awhile was to not tantrum violently upon entering a store. Now he pushes the "kid cart" at Trader Joes. The changes have been life-altering....I can live with quirky....in fact, I love it. I am grateful to Dr. Amy, Erin, Joey's therapists and teachers, and our family and friends. We have all worked tirelessly as a team to bring Joey where he is today. He is having a wonderful life. He is happy, playful and articulate. These are the moments I thought I would only live in dreams. Hold on to your dreams...healing is possible.

Sam, Melissa, Emma, and Joey Higgason

### Chris's Story

As I was running today, I composed a letter in my mind that reflected all the feelings I have felt on this journey of healing, truly the marathon of all marathons. There are so many parallels between this marathon of healing our children and a physical marathon. I know because I have trained and run in the New York City Marathon.

I began running this marathon because of my son. Running gave me a purpose, plan, and goal. I learned how to pace, how to train with sprints, long distance stretches, and rest. I learned to accept help from complete strangers, and to train with like-minded positive people. It also became crystal clear to me that you really need a supportive spouse/family structure behind you, with the understanding that "No, you are not crazy when you go out in the pouring rain, sleet or snow to run." Running the 26.2 miles of the New York Marathon was one of the happiest days of my life. The finish time I made was simply the icing on the cake. It truly is about the journey.

During this same time period, my son was diagnosed with so many different labels, I couldn't keep them straight, much less the library of books I had collected about these subjects. As soon as I felt I understood all about Aspergers, it was onto another label that certainly explained why my son did the things he did. I tried the mainstream approaches, and I went down the path of mainstream medication. Nothing ever felt right, and most certainly we never got the results we were looking for. This was a dark, dark period, in which running was my only escape to normalcy.

Fortune had it that I met a woman whose son was one of the first patients of Dr. Amy's. Like me, she is a very private person. I felt safe speaking with her and I felt truly inspired by what she told me about Dr. Amy's approach. I blindly and naively dove into the protocol. Like sprint training, I stayed up all night, and spent days, weekends, studying everything I could about the process, about the layering. Initially, I felt lost and confused; however, I kept digging away, because

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for the first time in nine years I knew this was the right, holistic approach for my son. Like I do for a marathon, I paced myself. Even with this in mind, I encountered so many obstacles that brought me and my family to places I never signed up for. Like a runner that has been injured, I cried and screamed and yelled. However, with the help of this safe website, and the incredible, unrelenting, unwavering support of Erin Griffin and others I was able to continue, albeit, at a walk.

Like training for a marathon, taking a break is so important. We have taken a break for the entire summer, and I don't plan on resuming the protocol until Thanksgiving. This is our third year, and I can't emphasize enough the need to pace yourself, to peel the layers away slowly.

I want to share with you some highlights of my son's progress. He is completely mainstreamed, he is on the football team this year, his grades have never been better (he's in sixth grade), and after four years of running for student council he won this year. I know there will continue to be those thunderstorms and bumps in the road. I know there will be another marathon after this one, however, with people like Dr. Amy and the other parents on this website, I will find the support and strength I need to continue.

Just remember this—stay the course. Know that this journey will challenge your relationship with your spouse and will only make you stronger. Remember your other children and give them the support they need. Surround yourself with positive, encouraging people that support what you do—and stay the course.

Chris' Family

## **Brendan and Kyle's Story**

Our first son, Brendan, was born in 1992 and received all the standard vaccinations including Hep B within hours of birth. He was diagnosed with autism in 1996 and at that time we were confused and relieved. Confused about what autism was but relieved to know that this was not just our imagination. Being first time parents we were clueless - we didn't know what to do for him or how to help. When our second son, Kyle was diagnosed with autism in 1998 after a period of regression following his 15 month vaccinations, we were devastated. We tried some of the same traditional interventions that we used with Brendan and thought that what helped him would be good for Kyle (Speech, OT, ABA therapies). But what worked for one didn't work for the other. They both were verbal but not communicative and had little interest in each other. We prayed every night that they could be *normal*.

After attending the DAN 2002 conference in Boston, we found a local doctor to help us get started with the biomedical stuff. We saw some initial changes from

the GFCF diet and several rounds of DMSA chelation, but both boys were on almost identical supplements and there was still no social talking or sharing of thoughts and ideas and not much pretend play. Their communication was not purposeful; our lives were still being controlled by autism.

In January of 2003 we found Dr. Yasko and we were filled with hope and optimism but leery when she would say this is a 'Marathon not a sprint ' because we wanted solutions yesterday. We were sprinting!

Through the protocol we learned how to control exposure to toxins in their environment, how to properly support their organs and how to individualize their supplements. We learned the tools that we needed to heal them. We did not have a magic bullet but we were seeing great strides. We talked about how close we were to the end of the marathon and thinking that this is it, this is how life is going to be for our family. We were lucky to be where we were and the progress they each had made. We were jogging!

In the spring of 2005 we customized their supplements according to their genetic mutations; slowly but steadily we made more progress. Still no magic bullet, but closer to the end of the marathon. Brendan and Kyle were now able to make friends, fight over the front seat, have a sense of humor and personality, make the honor roll, play ice hockey, have conversations, talk about girls, and talk, talk, talk.

In 2007 we did the add on panel of genetics including SHMT, BHMT etc, and began addressing more specific gut bugs. We continued to see the excretion of heavy metals from their bodies along with the personal gains this fostered. This past fall Brendan played football for his High School team and recently passed his drivers license permit test. We dream of them being happy, healthy, and independent. We are enjoying them for who they are and who they will become. We are now walking!

It truly is a marathon! Thank you, Dr. Amy for walking with us to the finish line.  
Michael and Erin Griffin, Parents of Brendan age 17 and Kyle age 14



## Flow Chart for Microbes

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Specific microbes

Environment

Nutrigenomics

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•**Address specific microbes**

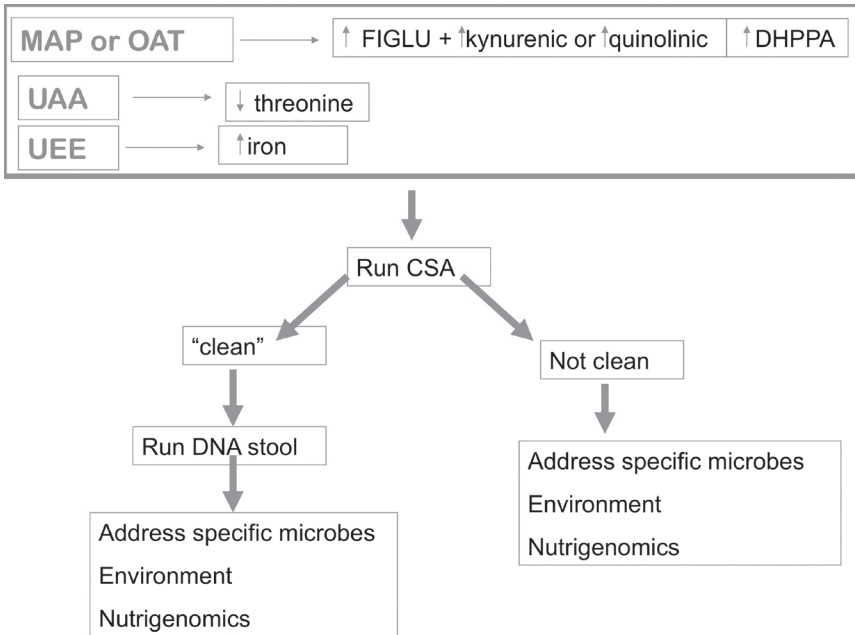
- Run CSA and DNA stool test so you know what organisms you need to address specifically. Choice of herbs, supplements, RNA, antibiotics. Look at combination approaches, work with your doctor.

•**Environment**

- We are talking about the “gut environment”.  
Work on gut pH (stomach pH, low dose CCK, buffers)
- B12 support
- Bowel Formula and other supplements to help with inflammatory pathways
- Normal flora, general gut herbs

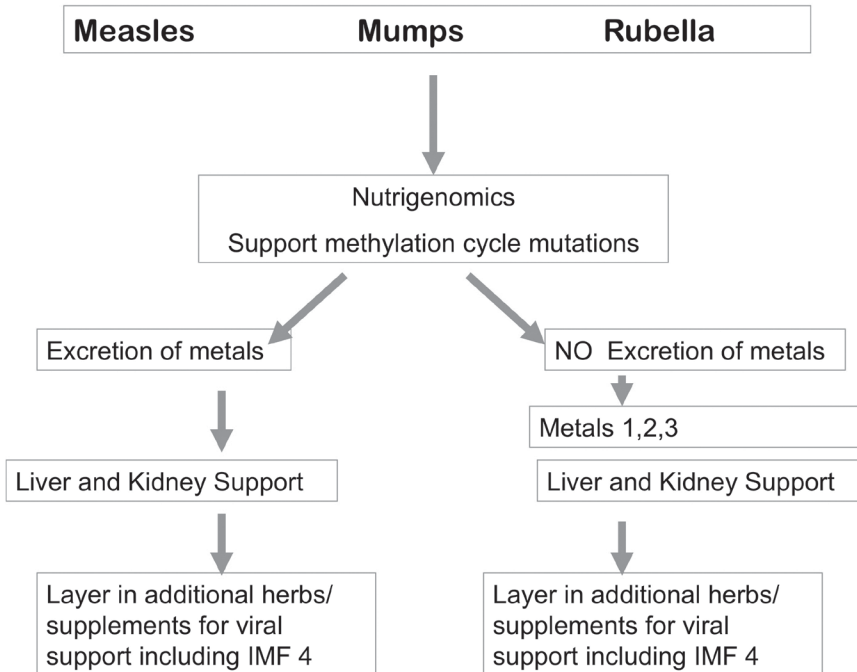
•**Nutrigenomics**

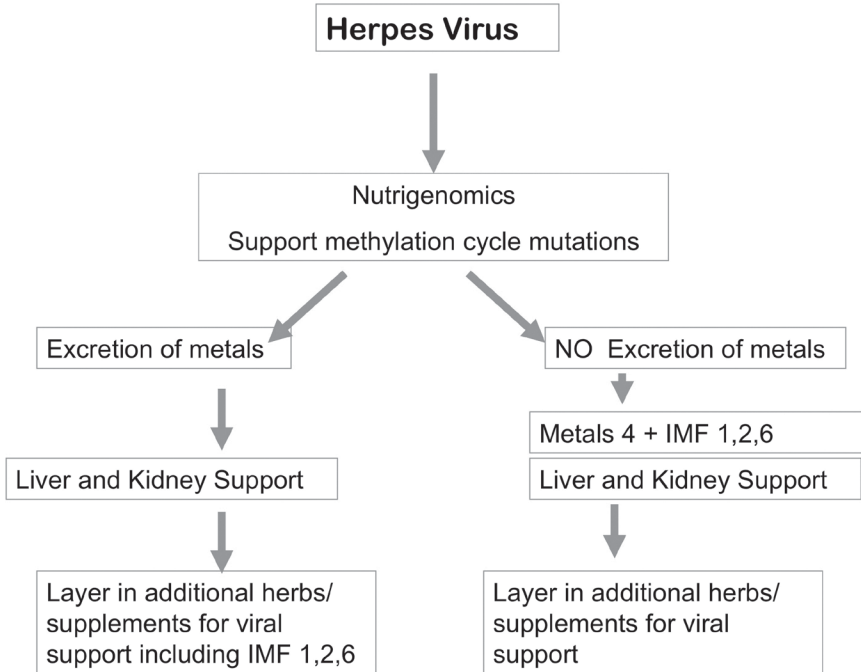
- SHMT support list
- ACAT support list (BHMT 1,2,4)
- MTHFR A1298C support list

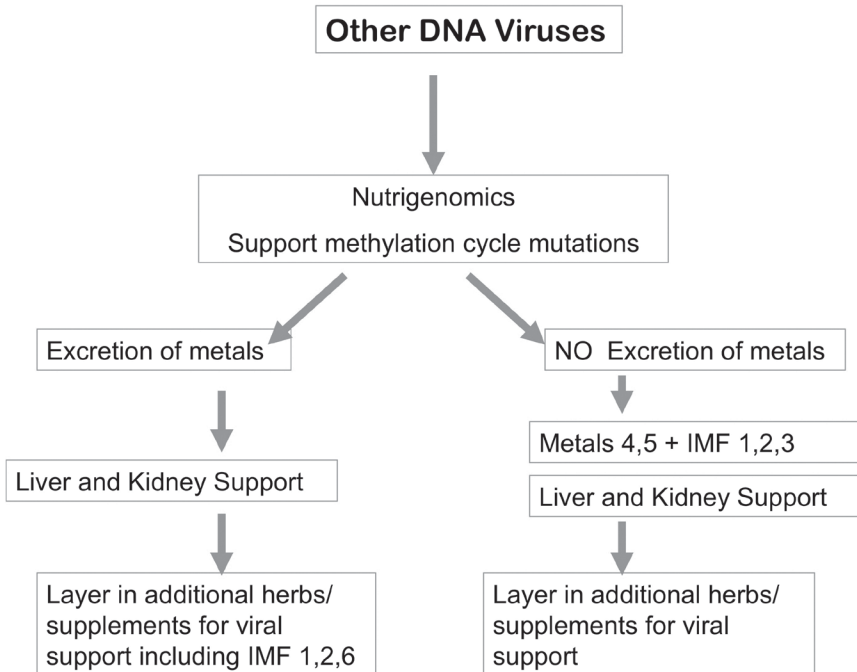


## Appendix: Flow Chart for Microbes

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*“The excitement we felt when Luke took his first steps at eleven months old was nothing compared to the excitement of seeing our little boy taking his first steps toward recovery.”*

*- Marcy Walsh*



**Amy Yasko Ph.D., CTN, NHD, AMD, HHP, FAAIM** received her undergraduate degree in chemistry and fine arts from Colgate University and her PhD in the department of Microbiology, Immunology, Virology from Albany Medical College. Her postdoctoral work included fellowships in the Department of Pediatric Immunology and the Cancer Center at Strong Memorial Hospital, as well as the Department of Hematology at Yale Medical Center. Dr. Yasko was Director of Research at Kodak IBI as well as a principle/owner of several biotechnology companies including Biotix DNA and Oligos Etc. After receiving additional degrees as a traditional Naturopath and becoming a Fellow in Integrative Medicine, Dr. Yasko shifted her focus from biotechnology to natural medicine. Her approach to addressing complex conditions such as autism is to use her knowledge of molecular pathways and biochemistry and apply it through the use of herbs and supplements. Dr. Yasko has spoken at conferences hosted by the NY Academy of Science, is listed in Who's Who in Women, has received the CASD Award for RNA research in autism and has published numerous articles as well as chapters in books related to her more conventional work in biotechnology. At this time, she has chosen to share her approach to reversing autism by donating her time on an autism discussion group and through the use of books, DVDs and conferences to help those with autism on the path to recovery. Dr. Yasko lives in rural Maine with her husband Ed, her three daughters and her Newfoundland dogs.

[www.HolisticHealth.com](http://www.HolisticHealth.com) [www.DrAmyYasko.com](http://www.DrAmyYasko.com)

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