

Do you suffer from fatigue, anemia,
depression or frequent falls?

Is your child diagnosed with a
developmental delay or autism?

Has your loved one been diagnosed with
dementia, Alzheimer's or MS?

Could It Be B12?

*An Epidemic of
Misdiagnoses*

**The underground classic
that has saved lives**

**2nd
Edition**

SALLY M. PACHOLOK, R.N., B.S.N.
JEFFREY J. STUART, D.O.

WHAT DO THESE PEOPLE HAVE IN COMMON?

- A 40-year old reporter loses his ability to write, falls when he attempts to walk, and becomes so confused that his wife suspects early-onset Alzheimer's ...
- A beautiful, normal eight-month-old baby gradually loses her speech, stops responding to her parents and eventually can't even sit up by herself ...
- A 20-year-old woman becomes severely depressed and attempts to kill herself ...
- A ballet dancer undergoes cosmetic surgery and ends up nearly unable to walk ...
- A 69-year-old woman develops balance problems, falls and fractures her hip ...
- A 38-year-old woman condemned to life in a wheelchair after gastric bypass surgery ...
- An 86-year-old man becomes delusional and kills his wife ...
- A 54-year-old woman experiences paranoid delusions and violent outbursts, coupled with symptoms her doctor diagnoses as multiple sclerosis ...
- A 4-year-old boy is diagnosed with autism ...
- A 73-year-old whose doctors attribute his repeated falls to old age or possible "mini-strokes" ...
- A young woman unable to conceive ...
- A grandfather transforms, in less than a year, from a healthy jogger to a depressed, confused man diagnosed with senile dementia.

Here's what these patients don't have in common: a correct diagnosis. Instead they have a plethora of incorrect, often hopeless diagnoses: developmental disability, autism, multiple sclerosis, psychosis, senile dementia, transient ischemic attacks, depression or diabetic neuropathy. But, in reality, they all suffer from the same medical condition ...

VITAMIN B₁₂ DEFICIENCY

PRAISE FOR
COULD IT BE B₁₂?

“This is the definitive book on B₁₂ deficiency, diagnosis and treatment for the lay reader and for the interested physician.”

—**Jeffrey Dach, M.D.**, author of *Natural Medicine 101*

“I defy you to read this book, then not get yourself or a loved one tested for B₁₂ deficiency.”

—**Dr. Eric Norman**, developer of the uMMA test for B₁₂ deficiency and founder of the first commercial laboratory to provide uMMA testing

“Its been said that nothing is so blind as the eye that wills not to see. As a practicing physician I can only hope that malpractice attorneys don't read this book.”

—**Richard Nimbach, D.O.**

“*Could It Be B₁₂?* is a great resource! It offers answers to some of the perplexing health concerns that providers cannot concretely explain, and therefore only treat symptomatically and, not surprisingly, with suboptimal results. I cannot understand how it is that there are still healthcare professionals that refuse to embrace the concept that it could be B₁₂!”

—**Wasył Schumylowych, M.S., R.D.**

“In this long-needed book, Pacholok and Stuart expose a major health-care scandal: the failure to identify and treat hundreds of thousands of patients who suffer from vitamin B₁₂ deficiency. The cost: an epidemic of dementia, heart disease, depression, developmental disability, infertility, and neurological disorders that doctors write off as “diabetic neuropathy,” “multiple sclerosis-like symptoms,” or “just old age.” In exposing this scandal and explaining how simply we can stop it, the authors provide an invaluable service for medical consumers who want to protect their families and for all medical care providers who truly care about their patients. An important, highly recommended contribution.”

—the late **Bernard Rimland, Ph.D.**, Director, Autism Research Institute

“Sally Pacholok, R.N., B.S.N., and Jeffrey Stuart, D.O., authors of the *Could It Be B₁₂?*, are to be congratulated for calling attention to this common disorder that affects a significant proportion of the population, particularly among the elderly. I enjoyed reading this book and was impressed by the thoroughness of their documentation. The citations to the medical literature and the detailed information in the appendices support the main conclusions of the book. The authors are correct that deficiency of vitamin B₁₂ is often under diagnosed and under treated by the medical profession.

America must understand that finding the underlying cause of disease, like B₁₂ deficiency, threatens the power structure of the medical establishment. Diagnosing B₁₂ deficiency and treating patients with B₁₂ calls into question the practice of giving drugs that suppress symptoms of disease without addressing the underlying cause. Part of the motivation is competition for subjects with vitamin B₁₂ deficiency, who would be lost as prospective patients if they were treated with inexpensive and effective vitamin therapy. The news media are not interested in effective vitamin therapy, partly because of the financial support of the pharmaceutical industry to the media through lucrative advertisements.

I recommend this book to professionals and patients alike who are interested in finding the underlying cause and cure of many common diseases and conditions related to deficiency of vitamin B₁₂.”

—**Kilmer S. McCully, M.D.**, author of *The Homocysteine Revolution* and *The Heart Revolution* and winner of the 1998 Functional Medicine Linus Pauling Award

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Foreword

Recently, at a European conference where both Sally Pacholok and I were speakers, I conveyed to the delegates how much I value this book by stating that wherever I travel, two books always accompany me.

One is the Holy Bible. The other is Sally's book, *Could It Be B₁₂?*

Could It Be B₁₂? speaks only the truth, and in doing so it "gives life back" to those with B₁₂ deficiency who were well on their way to losing their lives altogether.

The authors, Sally M Pacholok, R.N., and Jeffrey J Stuart, D.O., have committed themselves to this noble cause. They have made this book an invaluable resource for medical students, practicing physicians, and other healthcare professionals. And while it is written in a scientific and highly professional manner, Sally and Jeffrey have succeeded in making the book clear and simple enough to be useful to B₁₂ deficiency patients, their families, and friends.

It is unfortunate that despite all the up-to-date evidence that is now available, the medical profession as a whole are taught to believe that B₁₂ deficiency only affects the hemopoietic system—in other words, that it is simply a blood disorder causing anemia and producing megaloblastic (pernicious) red blood cells in the marrow.

What Sally and Jeffrey have accomplished in this remarkable book is to establish the opposite. B₁₂ deficiency is a multi-system, polyglandular, multi-point metabolic poisonous (homocysteine) disease/syndrome.

Sally's interest in this problem began in 1985, when she herself was misdiagnosed time after time, in spite of typical megaloblastosis and a strong family history clearly indicative of B₁₂ deficiency. This prompted Sally, an emergency room nurse, and her husband, Jeffrey, an emergency medicine physician, to conduct their own research, as well as to gather, analyze, and collate numerous supporting papers published by reputable universities and well-known researchers.

Since I read *Could It Be B₁₂?* in 2005, five quotations from the book keep coming back to me. I wondered why. Then I realized that I am also enduring the same burden as Sally and Jeffrey, since I stumbled on my first case of B₁₂ deficiency in 1981. Since that time, I have been diagnosing, treating, and continually monitoring over 1,000 B₁₂-deficient patients—in other words, 18% of my practice population, as opposed to the 0.01% nationally diagnosed.

The five striking quotes from the book:

“Noted physicians had fought the battle to bring the B₁₂ deficiency epidemic to light and had lost. What chance did I have of making a difference?”

“An epidemic is raging, invisible to the public and virtually undetected by medical professionals.”

“But I could not come to terms with the continuing parade of lives ruined by failure to detect and treat a simple-to-identify, simple-to-treat, simple-to-cure disorder.”

“This is one of the most preventable and most curable of all medical scourges, but only if we choose to act.”

“Together, we can stop this epidemic in its tracks.”

I ask myself why the crucial evidence-based knowledge outlined in this book is not accepted, and why the diagnosis and treatment of B₁₂ deficiency is not part of mainstream practice throughout all the continents.

Is there a deliberate conspiracy to suppress and discredit this knowledge and the people who have been battling to bring this to the world's attention? Who is currently profiting from blocking this simple, innocuous treatment of a vitamin deficiency? This treatment can save patients from a miserable existence which eventually leads to a slow, painful, and premature death. Caring for these patients during their often prolonged course of illness costs governments billions of dollars, and relatives and friends time, money, and pain.

And yet, these are the alarming facts:

- The attention paid to B₁₂ deficiency by medical and government bodies is steadily decreasing, not increasing.
- Awareness of this condition is almost non-existent among the current generation of physicians and neurologists.

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- The attention paid to B₁₂ deficiency by medical and government bodies is steadily decreasing, not increasing.
- Awareness of this condition is almost non-existent among the current generation of physicians and neurologists.

- Information about this deficiency disease is downplayed and even presented in a confusing manner in the most recent editions of reputable medical textbooks.

Even when clinicians know that they should be treating in accordance with good medical practice (investigate, diagnose, treat, and save lives), they are afraid to commence treatment because they lack up-to-date national guidelines. This results in worldwide misdiagnosis, mistreatment, untold misery, and tragic deaths.

It is a huge challenge to change entrenched medical ideas, even when these ideas lead to the death or disability of patients. It is an even bigger challenge when pharmaceutical companies make billions of dollars annually by promoting symptom-modifying drugs that merely mask symptoms of B₁₂ deficiency and fight against those who seek a cure*.

But Sally and Jeffrey, please do not get disheartened. We in the UK, and many others across the world, admire and love you and are most grateful to you both for your valuable contribution.

“Who so ever shall endure till the end shall reap the reward in due season.”

Joseph Chandy (Kayalackakom), M.D.

UK National Health Service Medical Practitioner

2010 Glory of India Award winner for medical services to the community

* Alliance for Natural Health v. Sibelius court case, F.Supp.2d, 2010 WL 2110071 (D.D.C. May 27, 2010)

Preface to the Second Edition

More than half a decade has passed since we published the original version of our book. The response from the public has been overwhelming. We've touched more lives than we ever expected, and in this new edition, we relate the stories of people—young and old—whose B₁₂ deficiency diagnoses saved their health and even their lives. We will also update you on the latest research, new case studies in the medical literature, and the best tests and treatments.

Sadly, the response from many in the medical community has been apathy or even outright hostility.

We have been actively educating the public and health care professionals about vitamin B₁₂ deficiency and its frequent misdiagnosis for more than ten years. In 2005, we wrote the first edition of *Could It Be B₁₂?* Four years later, we declared 2009 as the Year of B₁₂ Awareness, trying to get health care professionals and governmental agencies to support our efforts and recognize the fourth week in September as B₁₂ Awareness Week annually. Our efforts are making slow progress, but we are not yet winning the war on misdiagnosed vitamin B₁₂ deficiency.

Not only is most of the health care community still apathetic about this disorder, but so are the government, the media, and the insurance industry—despite the fact that untreated B₁₂ deficiency can cause serious health problems, injury, disability, and even premature death.

There is a pattern of ignorance and accepted neglect regarding vitamin B₁₂ deficiency that must change. Unfortunately, the only avenue may be the courtroom. Million-dollar malpractice settlements are now being awarded to injured B₁₂-deficient victims. But prevention is a far better solution for everyone.

Much is said about preventative medicine, but is it all so much hot air? Diagnosing B₁₂ deficiency is simple and inexpensive, and treating it costs only a few dollars per month. Failure to treat this disorder at an early

stage allows conditions to develop that often cause lifelong disability, resulting in enormous treatment costs or even death. After the release of the first edition of the book, we have reached out to the medical community, health care community, hospitals, and the government (including three Surgeons General, Congressional representatives from both parties, directors of insurance companies, and Medicare officials). Yet overwhelmingly we encounter apathy. Hardly anyone cares and very few want to get involved, or are proactive in changing this system failure.

Yet there are small signs of change. In June 2009, for example, the Centers for Disease Control and Prevention—one of the most prestigious bodies in the field of medicine—issued a report stating that one out of every 31 people over age 50 is B₁₂ deficient. The number is much smaller than our findings, but the CDC's report is a step in the right direction.

There have been highs and lows since the first edition of *Could it Be B₁₂?* came out. The public response, in the form of letters and testimonials, has been astonishing. *We are* making a difference. A 10-month old baby was diagnosed in March 2006 with severe B₁₂ deficiency because the baby's grandmother read our book and gave it to her daughter-in-law to read. The family had the baby tested, and the results revealed he was severely B₁₂ deficient—a problem undetected by his pediatrician. You'll read this mother's triumphant story in Chapter 12.

Another bittersweet victory is that of the Groover family, whose nightmare we also detail in Chapter 12. Their child was severely injured by B₁₂ deficiency in 2001, and as a result, the Groovers have joined us in our B₁₂ Awareness campaign and are vocal B₁₂ advocates.

The Groovers wrote to their Governor, Bob Riley of Alabama, describing their son's needless misdiagnosis and life-long brain injury. In response, Governor Riley assigned State Health Officer Donald E. Williamson, M.D., to investigate what is being done in Alabama regarding vitamin B₁₂ deficiency and what the state might do in the future to alert their citizens and health care practitioners to this epidemic.

In August of 2009, Dr. Williamson directed his staff to develop and disseminate a B₁₂ Deficiency/B₁₂ Awareness press release to newspapers, public health clinics, the Women, Infants and Children (WIC) program, and the Health Provider Standards section of the Alabama Department of Public Health, which regulates standards for nursing homes. He also sent the release to the Alabama chapter of the American Academy of

Pediatrics, the Alabama Academy of Family Physicians, and the Alabama Hospital Association.

Governor Riley and Dr. Williamson are the first governmental leaders in the United States to address the problem of misdiagnosed B₁₂ deficiency. This is exactly what politicians and people in power should be doing, but few are. We hope that Governor Riley and Dr. Williamson will be role models for other leaders to follow.

In 2009, Martyn Hooper, Executive Chairman of the Pernicious Anaemia Society (PAS) of the United Kingdom, joined forces with us and created U.K. B₁₂ Awareness Week in the last week of October. Together with the PAS, we gathered in the House of Commons in London on October 28, 2009, to discuss this issue with Members of Parliament. On May 28, 2010, as a result of the ongoing work of the PAS, the Medical Director of the National Health Service (NHS) in Wales, Dr. Stephen Hunter, became involved and requested a review of vitamin B₁₂ deficiency and its diagnosis and treatment by the National Institute for Health and Clinical Excellence (NICE) in the U.K. Dr. Hunter studied the PAS website forum group, which contains hundreds of testimonials from patients who were misdiagnosed and are receiving improper treatment. We were pleased to learn that the first edition of our book helped to galvanize Dr. Hunter's resolve to get B₁₂ deficiency reviewed by NICE. This is a major victory for those who suffer from B₁₂ deficiency. We hope that NICE will approve the review and create new protocols that will impact patients worldwide.

On another positive note, in 2009 we became acquainted with Dr. Joseph Chandy, a general practitioner working with four doctors in the U.K. with a registered list of 5,700 patients. Little did we know that a seasoned clinician some 3,500 miles away and an ocean apart had been silently fighting the same battle as Sally had for so many years—and had shared the same motivation, passion, dedication, and persecution. Patients and fate would bring us together. Dr. Chandy has been treating patients with neuropsychiatric symptoms with or without macrocytosis, using B₁₂ replacement, since 1981. In contrast to the national estimate that pernicious anemia only affects 0.01% of the population, Dr. Chandy finds that 18% of his patient population exhibit symptoms consistent with B₁₂ deficiency and, perhaps more importantly, benefit from B₁₂ therapy. On two occasions, each for more than 18 months at a time (in 2002 and 2007), B₁₂ treatment was withdrawn from his patients at government insistence, causing untold and sometimes irreversible damage and suffering.

Dr. Chandy and his assistant, Hugo Minney, Ph.D. (himself a B₁₂ deficiency sufferer), are making tremendous changes in the U.K., fighting for their patients by writing letters to Parliament, assisting the PAS, writing academic papers for publication, and assembling evidence for submission to regulatory bodies in the U.K. Hugo authors the B₁₂ Deficiency Patient Support Group web site (www.B12d.org), which gives valuable first line advice to thousands of people worldwide.

On a low note, we ended 2009 with two tragic e-mails. The first was from a mother from the Midwest, telling us how her six-month-old baby began showing signs of developmental delay. Her daughter's pediatrician was aware of this but just continued to watch her closely. At 13½ months of age, the child was finally diagnosed with severe B₁₂ deficiency and began treatment in November 2008. Two years later, the child has improved somewhat, but it appears that she was diagnosed and treated too late and will suffer a permanent brain injury. The second e-mail was from a cardiothoracic surgeon who went to Harvard Medical School. He wrote in December telling us of his misdiagnosed and mistreated B₁₂ deficiency, which occurred in 2009 and has caused him neurologic injury.

Clearly, we are still not winning the war on B₁₂ deficiency—and we need your help. Who will be next in this insidious chain of ignorance, secrecy, and misdiagnosis? Who needs to be injured for this disorder to finally be recognized and diagnosed early? Will it take a president, a pope, a politician, a movie star, a TV personality, a newscaster, or a sports hero? What and who will it take for the world to take notice?

We need to address not just the medical community, but also insurance providers, legislators, and trial lawyers. As medical professionals, it goes against our grain to say this—but often only after prodding by the legal profession does any meaningful change occur in medicine. It takes a landmark case, and often several landmark cases, to get the attention of most physicians. Based on our decades of experience, as well as the experience of others, we are convinced this may be the only avenue for meaningful change. And change must happen, because millions of lives and billions of dollars are at stake.

At this moment, the Centers for Medicare and Medicaid Services (CMS) is taking action to improve the quality of care in hospitals and reduce the number of “never events”—preventable medical errors that result in serious consequences for the patient. The evidence you will read in this book clearly shows that undiagnosed and untreated B₁₂ deficiency,

similar to “never events,” is a condition that should never happen. Every day patients are walking in and out of health care institutions with undiagnosed B₁₂ deficiency. Yet the ignorance, apathy, and severe knowledge deficit of the medical community allow this poor practice to occur hundreds of thousands of times each year.

Health care professionals and the public must band together to end this global epidemic once and for all. Along with Dr. Chandy, we envision the year 2012 as the year B₁₂ Awareness becomes public policy and updated protocols for early diagnosis and treatment are created. We invite all health care professionals, along with the public, to join us in this mission.

In the United Kingdom, we are beginning to see the fruits of our labor. On September 25, 2010, Dr. Chandy received the highly prestigious Glory of India Award, honoring his lifetime of service in primary care and his work on vitamin B₁₂ deficiency. Prime Minister David Cameron invited Dr. Chandy to a reception in Downing Street. Members of Parliament Priti Patel and Grahame Morris have written to Secretary of State Andrew Lansley requesting that the UK government investigate how B₁₂ deficiency impacts patients, the National Health System, and employers. This is a major victory, and we are hopeful that their investigation will lead to the introduction of a screening program, updated protocols, and on-going research into the diagnosis and treatment of B₁₂ deficiency.

In this second edition of *Could it Be B₁₂?*, we include more tragic stories and heartening successes from our own patient population, from readers who have contacted us, and from published case studies in medical journals. We also include a chapter with updated cost-effectiveness statistics that spell out even more clearly the billions of dollars that can be saved by addressing this invisible health crisis. It is our sincere hope that our second edition awakens many more health care professionals and consumers to this overlooked and devastating problem. To keep track of our progress and upcoming B12 Awareness events, please visit our website at www.B12Awareness.org.

Sally M. Pacholok, R.N., B.S.N.

Jeffrey J. Stuart, D.O.

Introduction

In 1983, I was the picture of health. I looked fit, I felt great, and I had no idea that a silent crippler lurked inside me, stealthily damaging my brain, nerves, blood vessels, and nearly every organ in my body.

Because of my medical training, however, I noticed small signs that something wasn't right, and I knew enough to be worried even when my doctors dismissed those signs as "nothing to worry about." I pursued the few clues that my potentially deadly disease left, eventually obtaining a diagnosis of pernicious anemia (an autoimmune form of vitamin B₁₂ deficiency), and as a result I'll never suffer the terrible symptoms that this disorder can cause.

Millions of other victims of B₁₂ deficiency—many of them also victims of doctors who mistakenly ruled out B₁₂ deficiency with complete blood counts (CBC), or never considered the diagnosis at all—aren't as lucky. Some are infants and toddlers, left developmentally disabled for life. Some are young adults, mistakenly diagnosed as having multiple sclerosis or told, erroneously, that they are "incurably" infertile. Others are middle-aged men and women, tormented by balance problems, numb hands or feet, or mysterious shooting leg pains so agonizing that they can barely walk. Some are diagnosed with early-onset dementia or pre-Parkinson's disease in their thirties, forties, or fifties. Some are people so depressed that they try to kill themselves. Some appear to be full-blown schizophrenics. And still others are seniors living out their days in nursing homes because their doctors think they have Alzheimer's disease.

It's too late to completely reverse the symptoms of many of these people—but it's not too late to protect yourself, or the people you love, against a similarly tragic fate. In fact, it's extraordinarily simple to prevent or completely reverse the symptoms of B₁₂ deficiency if the deficiency is discovered in time. But this condition isn't like other vitamin deficiencies, and simply taking a standard multivitamin pill won't protect you; instead,

you need an accurate diagnosis and medical treatment. And getting a diagnosis isn't always easy, as I know from experience.

I had no idea that an invisible disease was attacking my body when I went for a pre-employment physical examination back in 1983, when I was just nineteen. The first clue came when the examining physician reviewed my blood tests and commented on my abnormally large red blood cells. (In retrospect, I may owe my life to the fact that this test came back positive. Many people suffer neurological damage decades before their blood tests become abnormal, and by then it's too late.)

"What kind of diet do you eat?" the doctor asked when he saw my results. When I said that I didn't like vegetables, he told me to eat more of them, dismissing my blood abnormality as merely a sign of a diet low in folic acid.

One month later, another doctor commented again on my large red blood cells, but concluded that my lab results were "insignificant." Like the first doctor, this physician sent me on my way, unaware that he'd just missed diagnosing a disease that could destroy my brain, cripple my body, or even kill me.

Two years later, in nursing school, I bought a manual describing laboratory tests and their meanings. In the section on "macrocytosis"—the medical term for unusually large red blood cells—the manual outlined two different problems, folic acid deficiency and B₁₂ deficiency, which could cause this abnormality. Since I loved B₁₂-rich meat and didn't like folate-rich vegetables, I could see why my first doctor picked low folic acid as a likely culprit in my case. But I wondered why he'd never considered B₁₂ deficiency as well, since most cases of B₁₂ deficiency stem from malabsorption problems rather than diet.

Thinking to myself, "It can't hurt to be sure," I persuaded a doctor I worked with to order a serum folate and serum B₁₂ level for me. That night, when I mentioned the tests to my parents, my father surprised me by saying that back in the 1960s my grandfather had been diagnosed with pernicious anemia—the most well-known, although not the most common, cause of B₁₂ deficiency. My grandfather's first set of doctors thought he had leukemia and told my dad there was nothing more they could do. It wasn't until my father insisted he be transferred to Henry Ford Hospital in Detroit for a second opinion that he was correctly diagnosed and treated (although it took this second group of doctors nearly four weeks

to do so!). So I wasn't completely caught off-guard a few days later when my own B₁₂ test came back low. I started receiving B₁₂ shots, grateful that I'd obtained a diagnosis before I suffered any symptoms.

But that wasn't the end of my story. Two years later, when I needed surgery, I mentioned my B₁₂ deficiency and ongoing treatment to my surgeon. Skeptical because she thought I was "awfully young" to have this problem, she sent me to a hematologist, who dismissed the idea that I had a B₁₂ problem, in spite of my earlier diagnosis and abnormal test results showing macrocytosis, low B₁₂, and abnormal Schilling's test. (In fact, the hematologist's chart notes, which I read surreptitiously at a later visit—a nurse's instinct!—suggested that I was merely a hysterical female, imagining problems that didn't exist.) I insisted he run tests anyway.

The hematologist had changed his mind by the time his office called me a week later, asking me to come in "right away." By then, the tests he'd ordered had revealed that I indeed had juvenile pernicious anemia. In fact, he exclaimed exuberantly, I was the youngest patient he'd ever seen with pernicious anemia in his twenty years of practice. I felt like a rare freak of nature. This time around, the doctor was friendly and informative and, I sensed, secretly relieved that I'd insisted he verify my earlier diagnosis. He certainly wouldn't have detected my problem on his own, even with all of the information I'd given him on my first visit, because that surreptitious glance at my chart showed that his suspected diagnoses *didn't even include* B₁₂ deficiency.

In short, although I'd virtually handed this doctor my diagnosis, he nearly missed it. If I'd come to him without the benefit of my nursing training and my assertive and inquisitive personality, or without already knowing that I had a history of B₁₂ deficiency, his failure could have injured or killed me—because, if I had passively accepted his initial opinion, I would have stopped receiving the B₁₂ shots that saved my body from the ravages of pernicious anemia. And yet, in a way, I'm thankful to him.

Why? Because his disbelief led me to ponder an important question: How many other people suffer or die because their doctors don't consider the simple diagnosis of B₁₂ deficiency? I was lucky because I had enlarged red blood cells—the easiest-to-spot sign of the problem—and a family history of pernicious anemia. Yet despite these red flags, this doctor, as well as others, missed the correct diagnosis. Studies from the 1980s reveal that, unlike me, more than a third of people with B₁₂ deficiency never

develop either enlarged red blood cells *or* anemia, meaning that their disease is invisible to routine blood tests. In addition, most have no known family history of B₁₂ deficiency. I wondered: Were doctors misdiagnosing such patients on a regular basis?

My curiosity developed, over time, into more than two decades of research on the scope of B₁₂ deficiency. I became an expert, reading every textbook and journal article I could get my hands on, and making connections with both clinical doctors specializing in B₁₂ deficiency and scientists involved in B₁₂ research. My husband Jeffrey, an emergency medicine physician, also conducted research to determine the percentage of B₁₂-deficient patients seen in his emergency department. What we learned about the prevalence of B₁₂ deficiency, the havoc it wreaks on the entire body, and the number of undiagnosed cases is alarming.

B₁₂ deficiency is very common—not just in seniors and middle-aged people, but even in teens, children, and infants. As many as 20 percent of people over sixty (and, according to one new study, 40 percent of seniors with severe mental or physical problems) are suffering, most of them unknowingly, from its ravages. Thousands of young children, teens, and young adults have borderline B₁₂ levels, below what's considered necessary to keep their brains functioning optimally. And millions of people labeled as having Alzheimer's, multiple sclerosis, early-stage Parkinson's disease, autism, learning disability, depression, bipolar disorder, vision loss, schizophrenia, diabetic neuropathy, and other severe and often incurable disorders could actually be victims of the easily diagnosable, treatable, and (in its early stages) completely curable problem of B₁₂ deficiency.

Initially I was tremendously excited by the extensive research proving that B₁₂ deficiency plays a role in so many seemingly hopeless problems. That's because this is a problem that's simple to fix. It's an inexpensive problem as well, with treatment costing only a few dollars a month or ten cents a day—pocket change, compared to the expense of other medical conditions. Thus, diagnosing and treating patients with B₁₂ deficiency could both reduce the pain and suffering of these patients and cut medical care costs—a win-win situation, in my opinion.

My excitement was short-lived, however, because most of the doctors I worked with didn't care about an epidemic of undiagnosed B₁₂ deficiency. They didn't care that the serum-B₁₂ test and other B₁₂ markers available to diagnose the problem weren't being used, or that the current

lower-end range of “normal” for this test was inaccurate and misleading. They didn’t care about the growing number of journal articles warning about the high costs, both to patients and to society, of doctors’ rampant failure to identify this problem. Indeed, they accused me of “playing doctor,” and they balked at ordering B₁₂ tests for patients with clear signs and symptoms of the disorder. In September of 2000, I was forced by my employer to sign a document stating that I would not talk to patients or their families about B₁₂ deficiency and I would “stop soliciting physicians to test patients.” I was told, in no uncertain terms, to drop the subject, sign the document, or lose my job.

Their attitude didn’t stem simply from the fact that I am a nurse, rather than a physician (although that didn’t help). My husband encountered a similar level of apathy, even when he showed his colleagues study data revealing that large numbers of his own facility’s patients suffered from undetected B₁₂ deficiency. Later I learned that other physicians aware of the problem had encountered the same negative response from their own colleagues.

Faced with an impenetrable wall of apathy and, eventually, outright hostility, I slowly and quietly gave up. What else could I do? Those with the ability to diagnose and fight this disease chose instead to ignore it. Noted physicians had fought the battle to bring the B₁₂-deficiency epidemic to light and had lost. What chance did I have of making a difference?

My silent surrender lasted until the day I was asked to discharge a patient who’d been labeled by the preceding shift as a “frequent flyer,” a “drug-seeker,” and a patient who “doesn’t want to go home.” When I examined this woman and reviewed her laboratory results and medical history, I saw painfully obvious indications of B₁₂ deficiency, evidence that even a first-year medical student should be able to recognize. I also noted the complete absence of any effort by her doctors to test her accurately for this problem during her numerous previous hospital admissions, or even to recommend such testing to her family physician. This sad and frightened woman had suffered for years from crippling and seemingly mysterious symptoms, *every one of which* could be explained by B₁₂ deficiency, and yet no one had correctly evaluated her for the disorder. Instead, they’d simply labeled her as nuts.

She wasn’t the first patient I’d seen dismissed by doctors who overlooked the signs and symptoms of B₁₂ deficiency. In fact, she was only the latest in a long line of patients written off as hopeless by medical professionals

who'd failed to diagnose a life-threatening and very common medical problem. Indeed, I'd seen far worse cases, including patients who were on the verge of death or in a permanent state of dementia as a result of undiagnosed B₁₂ deficiency. Each case broke my heart. But this time, as I wrote up the discharge papers for this woman who'd received no real help and no real treatment—only a condescending response from her doctors and nurses, a large hospital bill, and a possible death sentence—my anger hit critical mass.

I knew that my own health and life had hung in the balance years earlier, when doctors told me that my troubling lab test findings were “insignificant.” Now, on a regular basis, I was watching other patients being sentenced to death or disability by the doctors they trusted. I knew that many of these patients would wind up back in our hospital some day with strokes, dementia, depression, fall-related trauma (fractures and brain injuries), the need for blood transfusions, and other problems stemming from undiagnosed B₁₂ deficiency.

I could no longer stand by and be a silent accomplice to an epidemic of apathy and non-diagnosis that is leaving millions of young and old patients crippled or dead. As a medical professional, I'd long since come to terms with the daily tragedy of lives ruined by diseases that can't be prevented or cured. But I could not come to terms with the continuing parade of lives ruined by the failure to detect and treat a simple-to-identify, simple-to-treat, and simple-to-cure disorder. Neither could my husband, a physician who finds it reprehensible to refuse a patient the couple of tests that could prevent nearly *every case* of disability or death due to B₁₂ deficiency.

This book was born out of our frustration and anger over these needless injuries and lost lives. But it was also born out of hope—the hope that we can help many current and potential victims of B₁₂ deficiency by putting this information in the hands of sufferers and their families, as well as in the hands of concerned medical professionals, the government, media, and the insurance industry.

If you are a medical consumer, this book will empower you to protect yourself and your family members, by helping you to identify loved ones at risk for B₁₂ deficiency, and to obtain a real diagnosis and real treatment before it's too late. And if you are a medical professional, we hope you will examine the compelling body of research reviewed in this book and make B₁₂ screening (*not* just inaccurate blood counts) part of your standard

practice. The hundreds of studies we cite, published in major and respected medical journals, prove that few diseases are more prevalent, simple to diagnose, and easy to treat than B₁₂ deficiency—and few carry such a high, yet entirely preventable, risk of deadly disease or infirmity.

Above all, the message of this book is that the suffering caused by B₁₂ deficiency, an “invisible” problem so pervasive that it touches the lives of nearly every family in America, is *unnecessary*. We can stop this cruel disorder in its tracks before it destroys more lives. I dodged the bullet of B₁₂ deficiency, and so can its other potential victims—but only if patients and doctors alike open their eyes to the scope of this hidden epidemic.

1

An Invisible Epidemic

A silent crippler stalks millions of Americans—and you may be one of them.

This crippler is a master of masquerade, striking different people in different ways. It afflicts one person with tremors, makes another depressed or psychotic, and causes agonizing leg and arm pains or paralysis in still another. It can mimic Alzheimer's disease, multiple sclerosis, early Parkinson's disease, diabetic neuropathy, or chronic fatigue syndrome. It can make both men and women infertile, or cause developmental disabilities in their children. Other times, it lurks silently, stealthily increasing its victims' risk of deadly diseases, ranging from strokes and heart attacks to cancer.

This medical disorder stems from a vitamin deficiency, but your standard multivitamin pill won't prevent it in many cases, and even some higher-dose oral formulas of this vitamin may not help. It's considered an "old people's disease" by doctors, but it can strike any person at any age, and it sometimes hits children the hardest.

The disorder I've described is vitamin B₁₂ deficiency. If you develop this deficiency, it's easy to spot, easy to treat, and easy to cure—but only if your doctor diagnoses you before it's too late. Unfortunately, that frequently doesn't happen.

WHO ARE THE VICTIMS OF B₁₂ DEFICIENCY?

The cases we'll describe in the pages of this book involve people of every age and from every walk of life: babies, children, young men and women, middle-aged people, and senior citizens.

Among them are the following:

- A thirty-five-year-old man who starts wetting himself, and who can no longer walk steadily or grip with his hands.

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- An eight-month-old baby who loses her speech, stops responding to her parents, and eventually can't even sit up by herself.
- A twenty-year-old woman who becomes severely depressed and who attempts to kill herself.
- A grandfather transformed, in three months, from a healthy jogger into a depressed, confused man, diagnosed with senile dementia.
- A two-year-old child who exhibits severe developmental delay and is diagnosed with autism.
- A young woman unable to conceive a baby.
- A fifty-four-year-old woman experiencing paranoid delusions and violent outbursts, coupled with symptoms that her doctor diagnoses as multiple sclerosis.
- An eighty-year-old man who develops balance problems, falls, and fractures his hip.
- A ballet dancer who undergoes cosmetic surgery and ends up nearly unable to walk.
- A middle-aged woman accused by her doctors of being an alcoholic and a “drug seeker” when she complains of intense, chronic back and leg pain.
- A seventy-eight-year-old with foot and leg numbness diagnosed as incurable diabetic neuropathy.
- A senior citizen whose doctors attribute his repeated falls to “mini-strokes.”

All of these very different patients have one thing in common: Their doctors have failed to properly diagnose them.

All of these very different patients have one thing in common: Their doctors have failed to properly diagnose them. They've been labeled with a dozen different disorders, ranging from incurable diseases to hypochondria, but in reality, they all suffer from the same medical condition: vitamin B₁₂ deficiency.

This isn't a new or fad disease. In fact, you'll find it listed in the textbooks of any first-year medical student. It's not a rare disease, either: If you're over forty, you're at an elevated risk for dangerous B₁₂ deficiency,

HOW COMMON IS B₁₂ DEFICIENCY?

It's important to note that most of the studies mentioned below *underestimate* the prevalence of deficiency, because, as we'll explain later, many deficient people have “normal” serum B₁₂ levels.

Tufts University researchers, analyzing data from the large-scale Framingham Offspring Study, found that *nearly 40 percent of participants between the ages of twenty-six and eighty-three* had plasma B₁₂ levels in the “low normal” range—a level at which many people begin experiencing neurological symptoms. Nearly 9 percent had outright deficiency, and 16 percent exhibited near-deficiency. Remarkably, low serum B₁₂ was as common in younger participants as in the elderly.¹

Smaller studies report that 15 to 20 percent of seniors have a vitamin B₁₂ deficiency.

A recent study found that 40 percent of hospitalized elderly patients had low or borderline serum B₁₂ levels.²

Over 80 percent of long-term vegans who do not adequately supplement their diets with B₁₂, and over 50 percent of long-term vegetarians, show evidence suggestive of B₁₂ deficiency (see Chapter 6).^{3, 4}

In June 2009, the CDC reported that B₁₂ deficiency is present in one out of every 31 people over the age 50.⁵ What's more, this alarming statistic underreports the true incidence of B₁₂ deficiency. That's because the researchers defined B₁₂ deficiency as a serum B₁₂ level under 200 pg/ml. It's well documented that many people whose serum B₁₂ is between 200pg/ml and 350pg/ml have a vitamin B₁₂ deficiency.^{6, 7, 8}

and if you're over sixty, you have up to a 40 percent chance of having potentially dangerous low B₁₂ levels. The lower your serum B₁₂ gets, and the longer you have signs and symptoms, the greater your potential for injury and poor outcomes.

WHAT IS B₁₂ AND WHY IS IT SO IMPORTANT?

To understand why B₁₂ deficiency can hurt or even kill you, and why this deficiency is so common even in seemingly healthy people, it's important to know a little about what vitamins are—and why B₁₂ is unique.

Your body needs thirteen different vitamins in order to stay alive and remain healthy. These tiny molecules participate in thousands of

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chemical reactions that build your tissues and organs, provide you with energy from the food you eat, clean the toxins from your body, protect you against infections, repair damage, and allow your cells to communicate with each other.

Your body can't make vitamins by itself, so it depends on you to provide them by eating the right foods. Some (the fat-soluble vitamins) can be stored; others, including the B vitamins, are water-soluble and need to be "restocked" every day. If you don't take in enough of a particular vitamin, your supplies dwindle, causing a marginal deficiency and, eventually, a deficiency disease such as scurvy (vitamin C deficiency) or beriberi (vitamin B₁ deficiency). The bigger the drain on your stores, the more serious the consequences will be—up to and including death.

Of the thirteen vitamins your body needs, one is vitamin B₁₂. It acts, in many ways, much like the other dozen vitamins. But in other important ways, vitamin B₁₂ is an oddity, and some of the quirks that make it different also make it harder for millions of people to get enough of it.

Among its distinctions, B₁₂ is the only vitamin that contains a trace element—cobalt—which explains its scientific name, *cobalamin*. Because B₁₂ is produced in the gut of animals, it's also the only vitamin that you can't obtain from plants or sunlight. Plants don't need B₁₂, so they don't produce or store it.*

To obtain B₁₂ from your diet, you need to eat meat, poultry, fish, eggs, dairy products, or foods fortified with B₁₂—or, if you don't eat these foods, you need to take supplements. However, even a diet high in B₁₂, augmented with a supplement, isn't sufficient for many people.

In fact, while the Institute of Medicine (IOM) reports that you need only a tiny amount of B₁₂ each day (two to four micrograms or about a millionth of an ounce), it's remarkably easy to become deficient in this nutrient. While deficiency often occurs in vegans or vegetarians who fail to take the right supplements, *the majority of B₁₂-deficient people eat plentiful amounts of the vitamin*—it's just that their bodies can't absorb or use it.

Why? Because to get from your mouth into your bloodstream, vitamin B₁₂ must follow a complex pathway, and a roadblock in any part of that

* In fact, as we'll explain later, several plants that some supplement manufacturers claim are high in B₁₂, such as spirulina and tempeh, actually contain "pseudo-B₁₂" analogues that block the uptake of the real vitamin, making it inactive.

pathway can cause your B₁₂ levels to plummet. Here's a highly simplified explanation of this pathway:

1. The vitamin B₁₂ in your food is bound to animal proteins, and first must be freed. To split the B₁₂ and the protein apart, your body uses an enzyme called *pepsin*, which can be produced in sufficient amounts only if there is enough *hydrochloric acid* available in your stomach.
2. Your stomach also produces *intrinsic factor (IF)*, a protein that makes its way into your intestine to be available for a later step in the B₁₂ pathway.
3. Next, other proteins called *R-binders* ferry the B₁₂ into your small intestine.
4. In the intestine, *intrinsic factor* latches onto the B₁₂ (with the help of enzymes called *pancreatic proteases*) and carries it to the last section of the small intestine, the ileum. The cells that line the ileum contain *receptors* that grab onto the B₁₂-IF complex, pulling it into the bloodstream.
5. In the bloodstream, another protein, *transcobalamin II*, carries vitamin B₁₂ to the various cells of the body, and then transports the excess to the liver for storage.

The majority of B₁₂-deficient people eat plentiful amounts of the vitamin—it's just that their bodies can't absorb or use it.

This complicated B₁₂ metabolism process, far more complex than that for any other vitamin, can break down at any point. The most famous (but not the most common) breakdown in this process is pernicious anemia (an autoimmune disease), a hereditary disorder that once subjected its sufferers to physical and mental deterioration and eventually a terrible death. The disease occurs when the body fails to produce intrinsic factor, making the B₁₂ consumed in the diet useless. In 1926, two doctors, George Richards Minot and William Parry Murphy, discovered that feeding half a pound of liver per day to their patients with pernicious anemia dramatically reversed their symptoms.* The physicians, along with Dr. George Hoyt Whipple (who had earlier found that

* Most of the people categorized as having pernicious anemia during this era may have actually suffered from other, more common, forms of B₁₂ deficiency.

liver reversed pernicious anemia symptoms in dogs), won the 1934 Nobel Prize in medicine for their life-saving discovery.*

It is unknown whether people in the early twentieth century died from “pernicious anemia,” which is an autoimmune phenomenon, or whether other causes of B₁₂ deficiency played a role. The bottom line is that even today, untreated B₁₂ deficiency, whatever its cause, can be “pernicious” or deadly.

A far more common cause of B₁₂ deficiency, especially in people over fifty, is a condition called *atrophic gastritis*, an inflammation and deterioration of the stomach lining. Atrophic gastritis reduces the secretion of the stomach acid that is needed to separate vitamin B₁₂ from protein—a problem often made worse by proton-pump inhibitors and antacids or other medications (see Chapter 2). In addition, older people have smaller numbers of the cells that produce intrinsic factor.

It’s not just the elderly, however, who are at risk. People of any age who undergo gastric surgery for weight loss (gastric bypass), or have partial or complete stomach resections for other reasons, are also candidates for B₁₂ deficiency. This is because they lose the cells that produce hydrochloric acid and intrinsic factor. Intestinal surgery involving partial or complete removal of the ileum will also cause B₁₂ deficiency, because receptors needed for the absorption of B₁₂ are located in this area.

In addition, gastrointestinal disorders such as Crohn’s disease (an inflammatory intestinal disease), enteritis, “blind loop” syndrome, or celiac disease can interfere with the absorption of B₁₂, even if it’s broken down correctly by the body. So can alcohol and many medications, ranging from gastroesophageal reflux (GERD) drugs to ulcer drugs to diabetes medications. Exposure to nitrous oxide, either during surgery (including dental surgery) or through recreational drug abuse, can inactivate B₁₂. Toxins such as mercury interfere with B₁₂’s ability to cross the blood–brain barrier and reach the neurons where it’s needed. And, a variety of inborn errors of B₁₂ metabolism, which we’ll discuss in later chapters, can interfere with B₁₂ metabolism at any step from beginning to end. This is why people who say, “I can’t be deficient—I take a vitamin pill every day” are wrong.

* Frieda Robshneit-Robbings, together with Whipple, discovered that a diet containing large amounts of liver cured anemia in dogs. Although she coauthored many papers with Whipple, he alone received the Nobel Prize for their joint work.

People who can't metabolize B₁₂ from food often can't make use of it efficiently in pill form either, so many of the supplements on the market won't guarantee that you're safe. The National Institute of Health acknowledges that only about 10 mcg of a 500 mcg oral supplement (which is listed as 8,333% of daily value [DV]) is actually absorbed by healthy people.⁹ And, if you're already B₁₂-deficient, the few micrograms of B₁₂ you'll get from a standard supplement (6 mcg) will do as little good as trying to fill an empty swimming pool with a teaspoon of water each day. A person with B₁₂ deficiency needs thousands, not just tens or hundreds, of micrograms of B₁₂ every day—and in some cases, even people taking thousands of micrograms of oral B₁₂ may benefit more by being treated with injections.

Some high-dose over-the-counter lozenges (containing more than 1,000 mcg of B₁₂) can be effective over time, but people who are severely deficient and have neurologic symptoms initially need to be treated aggressively with B₁₂ injections (see Chapter 11). Since B₁₂ symptoms eventually become irreversible, it's important to treat the problem

quickly and aggressively. Patients can be switched to high-dose B₁₂ lozenges afterward, but must be monitored by their physicians to assure that this route is effective.

Most doctors frequently fail to diagnose people with B₁₂ deficiency, mistakenly ascribing their symptoms to pre-existing conditions.

WHY IS B₁₂ DEFICIENCY EPIDEMIC?

Given the dangers of B₁₂ deficiency, it would be natural to assume that doctors put the disorder high on their list of suspects when they see patients with weakness, dizziness, nerve pain or numbness, mental illness, falls, dementia, multiple sclerosis-like symptoms, chronic fatigue, infertility, or other medical problems that can stem from B₁₂ deficiency. You'd probably guess, too, that they automatically screen children with developmental delays or failure to thrive to determine if B₁₂ deficiency is to blame. And you'd assume that they routinely screen patients in the highest-risk age group of sixty and over, and especially patients with unexplained Alzheimer's-like symptoms.

These assumptions, however, are wrong. In reality, most doctors frequently fail to diagnose people with B₁₂ deficiency, mistakenly ascribing

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their symptoms to pre-existing conditions, other diseases, aging, heavy drinking (even when patients deny this), or mental illness—and the results can be catastrophic.

A few years ago, a fifty-four-year-old woman named Rebecca arrived at the hospital in a near-coma after suffering a fall. The description on her chart was “unresponsive,” but an equally accurate description would be “victim of an unresponsive medical system.”

Why? Because throughout Rebecca’s life, her body offered up clue after clue of her B₁₂ deficiency, but no one noticed. Her mother died at an early age of stomach cancer, a rare cancer in the Western world, but one that often targets people with pernicious anemia. Three of Rebecca’s children died shortly after birth—also a red flag for B₁₂ deficiency. Rebecca received numerous blood transfusions over the years for anemia, but her doctors never discovered the cause of that anemia. She’d undergone a complete hysterectomy at a relatively early age, possibly as a result of abnormal cells in the cervix and uterus—also a phenomenon that can occur in B₁₂-deficient women. In middle age, she’d begun experiencing excruciating headaches, and she complained of left-side weakness and pains in her arms and legs. She also found it increasingly hard to walk because of her worsening dizziness, and she frequently fell. (The subdural hematoma—bleeding between the brain and the brain’s lining—that doctors detected in the emergency room resulted from a fall and from repeated blows to her head over the previous few months, which occurred when she lost her balance trying to get into their truck.) In recent months, according to her daughter, Rebecca’s memory and personality had changed. All of these problems—weakness, leg and arm pains, dizziness, loss of balance, mental changes—are classic symptoms that can occur when B₁₂ deficiency progressively damages the brain and nervous system.

The proximate cause of Rebecca’s near-coma when she arrived in the emergency department was a subdural hematoma resulting from hitting her head in repeated falls. The real cause, however, was the dizziness, weakness, and imbalance that made her fall—problems that stemmed directly from her B₁₂ deficiency.

Rebecca was severely anemic and required multiple blood transfusions. Her serum B₁₂ level was very low and her red blood cells were very enlarged. (You’ll remember that enlarged red blood cells are a classic sign of B₁₂

deficiency.) In addition, her platelets were dangerously low, which made it difficult for her blood to clot.

Doctors diagnosed Rebecca with pernicious anemia and a subdural hematoma. Before giving her blood transfusions, they ordered additional tests for B₁₂ deficiency. (These tests measure levels of methylmalonic acid and homocysteine, explained later in this book). The test results came back several days later and were also grossly abnormal. Rebecca survived emergency brain surgery, but her hematoma enlarged dangerously afterward, and, as a result of the ensuing damage to her brain, she is now in a vegetative state and will never recover.

Rebecca's descent into a permanent coma at the age of only fifty-four, as a result of chronically misdiagnosed vitamin B₁₂ deficiency, is a tragedy and unacceptable. But it's only one in a string of tragedies resulting from her misdiagnosis. Rebecca lost years of her life to debilitating vitamin B₁₂ deficiency, and it's a virtual certainty that all three of her babies who died at birth or in infancy were victims of her disorder, because Rebecca's depleted stores couldn't nourish them during pregnancy or breast-feeding. (The babies, too, may have suffered from an inherited—and easily detectable and treatable—form of B₁₂ deficiency [see Chapter 6].) Simply by testing for B₁₂ deficiency, Rebecca's doctors would have uncovered her problem, and early treatment would have prevented the damage her body suffered for years. Almost undoubtedly, a correct diagnosis also would have saved the lives of Rebecca's babies. But nobody ordered the tests because none of the physicians Rebecca encountered were knowledgeable about vitamin B₁₂ deficiency.

As medical professionals, we see cases like Rebecca's on a regular basis. Most of the patients with undiagnosed B₁₂ deficiency that we encounter aren't at death's door, but a few are—and the majority have suffered terribly, both physically and emotionally, from symptoms that are destroying their health and quality of life.

How can something as simple as a vitamin deficiency cause so much suffering? One explanation is that doctors receive surprisingly little training (much of which is outdated) in the diagnosis and prevention of B₁₂ deficiency.

In general, doctors are trained to recognize only the *blood* abnormalities associated with B₁₂ deficiency. In particular, they're trained to look for evidence of *macrocytosis*, or the presence of large, immature red blood cells, a classic sign of B₁₂ deficiency anemia. (Anemia, which causes

extreme fatigue and weakness, occurs when your red blood cells don't have enough hemoglobin—the substance that ferries oxygen throughout your body. “Macrocytic” or “megaloblastic” anemia, in which the red blood cells are enlarged, stems from too little B₁₂ or folic acid.) In addition, many doctors who treat severely anemic patients give these patients blood transfusions *before* ordering sensitive tests to rule out underlying B₁₂ deficiency. When doctors order these tests later, the healthy donor blood may mask the abnormalities in the patient's blood or make serum

B₁₂ deficiency mimics many other diseases, so your doctor can't know if you're low in B₁₂ simply by analyzing your symptoms.

B₁₂ levels appear normal. Doctors who look only for classic blood abnormalities (macrocytic anemia) can misdiagnose the *neurological* abnormalities that stem from B₁₂ deficiency, including tingling or “pins and needles” sensations in the hands and feet,

memory loss, depression, personality changes, dizziness and loss of balance, or even outright dementia. These nervous system symptoms often precede classic blood abnormalities by many years—and the neurologic damage that underlies them can be permanent by the time tests for the blood abnormalities traditionally associated with B₁₂ deficiency begin to come back abnormal.

Many doctors also fail to recognize that high levels of another B vitamin, folic acid (folate), can make the complete blood count (CBC) test results appear normal even when a B₁₂ deficiency exists. In 1998, new U.S. government rules mandated the fortification of grains with folic acid, increasing the likelihood of missing B₁₂ deficiency due to high folate levels, which normalize the size of blood cells that otherwise would appear enlarged. Enriching foods with folic acid is a good idea because it helps prevent spina bifida and related birth defects linked to low folic acid levels; but ironically, the same enrichment that protects many babies from harm also endangers other babies and adults whose doctors rely solely on a complete blood count to detect B₁₂ deficiency. New studies reveal B₁₂ is also essential to prevent spina bifida (see Chapter 6).

B₁₂ deficiency mimics many other diseases, so your doctor can't know if you're low in B₁₂ simply by analyzing your symptoms. Also, your doctor can't determine if you're deficient or not simply by ordering a blood count or smear (a test for anemia, enlarged red blood cells and abnormal white

TYPES OF TESTS FOR B₁₂ DEFICIENCY

SERUM VITAMIN B₁₂ TEST

Measures the level of vitamin B₁₂ in your blood serum. There is much controversy as to what constitutes a normal result for this test (see discussion later in this box). Because of this controversy, this test is often used in conjunction with other markers of B₁₂ deficiency (MMA, Hcy, and more recently the holoTC).

However, it appears that these markers demonstrate B₁₂ deficiency primarily in patients whose serum B₁₂ is in the “gray zone” (a serum B₁₂ result between 200 pg/ml and 450 pg/ml). We believe that the “normal” serum B₁₂ threshold needs to be raised from 200 pg/ml to at least 450 pg/ml because deficiencies begin to appear in the cerebral spinal fluid (CSF) below 550 pg/ml.^{10, 11, 12}

At this time, we believe normal serum B₁₂ levels should be greater than 550pg/ml. For brain and nervous system health and prevention of disease in older adults, serum B₁₂ levels should be maintained near or above 1,000 pg/ml.

We commonly see patients with clinical signs of B₁₂ deficiency who are not being tested. Others who are being tested are not being treated because their serum B₁₂ falls in the gray zone. This error results in delayed diagnosis and an increased incidence of injury.

Moreover, of the total serum B₁₂, only about 20% is transcobalamin II—the biologically active form. The other two proteins (I and III) are thought to be inactive, but will be included in the total serum B₁₂ result, yielding higher results and giving false assurance that a patient’s B₁₂ status is fine. This is yet another reason why the serum B₁₂ lower end range must be raised. (See more below in the HoloTC test section.)

METHYLMALONIC ACID (MMA) TEST

Measures the amount of MMA in the urine or blood. Elevated levels of MMA indicate B₁₂ deficiency (see Chapter 11). According to Dr. Eric Norman of Norman Clinical Lab, Inc., MMA is 40 times more concentrated in the urine than in the blood, and the urinary MMA (uMMA) is the preferred test over the serum MMA. **The urinary MMA can be helpful in ruling out B₁₂ deficiency, especially since our current lower limit range for B₁₂ deficiency is much too low (typically less than 200pg/ml).** (See above.)

However, after reviewing past and present literature as well as thousands of patients' results over a ten year period, we believe it does not make sense to use the MMA test to identify B₁₂ deficiency when the serum B₁₂ can do the job in the majority of cases if doctors use an updated threshold (greater than 450pg/ml), along with a clinical exam. We often see symptomatic patients whose serum B₁₂ is low or in the "gray zone" and whose MMA is normal—and these patient often respond well to B₁₂ treatment. It would be dangerous not to treat these patients because their MMA is normal, or to wait for the MMA to become abnormal and the serum B₁₂ to fall further—resulting in poor health or worse yet, permanent neurologic injury.

Moreover, the serum MMA also has limitations and can cause false positives and false negatives. The specificity of these tests is debated.^{13, 14, 15} We have seen symptomatic patients denied treatment because their serum B₁₂ was in the "gray zone" and their urinary MMA, serum MMA, and/or homocysteine (see next section) was normal, only for these patients to return many months later in worse shape and with tests showing deficiency.

In addition, MMA values can be normal in B₁₂-deficient patients receiving antibiotics, which can eradicate the intestinal flora needed to synthesize propionic acid.¹⁶

HOMOCYSTEINE (HCY) TEST

Measures the level of homocysteine in the plasma. Elevated levels of Hcy can indicate vitamin B₁₂, vitamin B₆, or folate deficiency. Hcy may also be elevated in a few other medical conditions (see Chapter 11). The Hcy test is not necessary to diagnose B₁₂ deficiency, but is a valuable adjunct to the serum B₁₂ test, because the higher your Hcy level, the higher your risk of cardiovascular disease (see Chapter 5). Patients with vascular disease should always have their Hcy, serum B₁₂, and RBC-folate levels measured to determine if B vitamin deficiencies are causing or contributing to their health problems. As with the MMA tests, we have seen many B₁₂-deficient patients with normal Hcy levels who were symptomatic and either had a serum B₁₂ level less than 200 pg/ml or were in the gray zone.

HOLOTRANSCOBALAMIN (HOLOTC) TEST

Vitamin B₁₂ in serum is bound to two proteins, transcobalamin and haptocorrin. The transcobalamin-cobalamin complex is named

holotranscobalamin (HoloTC) or “active-B₁₂.” Only around 20% of total serum B₁₂ is in the active form our bodies use, and the HoloTC test measures this fraction. The test detects active-B₁₂ or holotranscobalamin (HoloTC), which may be a helpful way of determining vitamin B₁₂ deficiency. The test has been available for decades, but has been termed investigational until recently. Coverage for this test will depend on individual insurance policies. As with the MMA test, this test would most likely not be necessary if we raised the lower limit for the serum B₁₂ test and used updated clinical exams. A group of researchers concluded that the HoloTC and the serum B₁₂ test had equal diagnostic accuracy in screening for metabolic B₁₂ deficiency. They found that both tests used in combination provided a better screen than either assay alone.¹⁷ (See “Reference Ranges for Diagnostic Tests” on page 14 for ranges considered acceptable for these tests.)

As you read through all of these tests, remember this bottom line: If we simply raised the lower limit of serum B₁₂, the expensive and “presumably more sensitive” tests (MMA, Hcy, and holo-TC) would not be needed to diagnose B₁₂ deficiency in the majority of people with this problem.

What we see is that when a patient is *severely* B₁₂ deficient, typically all lab results agree with one another. The serum B₁₂ is low, the MMA is elevated, and the Hcy is elevated. When these three laboratory tests all agree with one another, the patient has been B₁₂ deficient for a long time and is being diagnosed in the later stages of B₁₂ deficiency (in which damage often is permanent). This is why the current lower-end normal range for the serum B₁₂ test must be raised, and why we need to educate clinicians that symptomatic patients with a serum B₁₂ between 200pg/ml and 450pg/ml almost certainly have a B₁₂ deficiency that must be addressed. We have seen cases of severe clinical B₁₂ deficiency where the serum MMA was normal, the B₁₂ was very low, and the Hcy was very high (renal function and RBC-folate levels normal). **For our part, we advocate treating all patients who are symptomatic and have serum B₁₂ levels under 450pg/ml, regardless of what the MMA, Hcy, and HoloTC results are. In addition, we advocate treating symptomatic patients with normal serum B₁₂ but elevated urinary/serum MMA or Hcy, and/or low HoloTC.**

Also, be aware that when it comes to B₁₂ deficiency, many physicians tend to treat the paper laboratory report rather than the patient. Numerous times in our experience, a symptomatic patient's serum B₁₂ was between 200 pg/ml and 300 pg/ml and the doctor told the patient, "You do not have a B₁₂ deficiency." Given the remarkable safety of B₁₂ treatment and the horrific consequences of ignoring a deficiency, it is always best to err on the side of treatment.

While raising the lower limit for B₁₂ is the most crucial step in accurate diagnosis, we also want to be clear that there are times when the additional markers for B₁₂ deficiency (urinary MMA, Hcy, HoloTC) are needed and may be useful. (You'll find more on this in chapters 3, 11, and 12).

blood cells [neutrophils] seen in some clear-cut cases of B₁₂ deficiency).

The major problem—indeed, the most important factor—is that most physicians fail to contemplate B₁₂ deficiency, are poorly educated about it, and therefore fail to test for it.

Also, the serum B₁₂ test will uncover many cases of B₁₂ deficiency, but it's possible to have a B₁₂ deficiency and still have "normal" lab results because of the accepted normal range used in the U.S. and world-wide. Most doctors don't understand that a serum B₁₂ result in the gray zone (200 pg/ml-450pg/ml) can most certainly be a B₁₂ deficiency, and choose not to treat patients in this range or order additional B₁₂ tests (see box page 14). The accepted normal range, created many decades ago, is based on hematologic (blood) changes and not neurologic changes, and thus contributes significantly to late diagnosis.

The urinary MMA test described above costs insurance companies or patients around \$150 to \$256, which isn't much money, especially when you compare it to thousands of dollars for CT scans, MRIs, and other tests that doctors routinely order. Moreover, the MMA and Hcy tests are covered by insurance, but not all doctors know this. The unfortunate result of this lack of awareness is that many physicians forgo these tests in situations where they are indicated, and also forgo treating patients in the "gray zone" who are symptomatic, thus condemning these patients to ill health and unknowingly setting them up for neurologic injury and poor outcomes in the near future.

REFERENCE RANGES FOR DIAGNOSTIC TESTS**COMMON REFERENCE RANGES FOR THE SERUM B₁₂ TEST**

Serum B₁₂: 211–911 pg/ml
 180–914 pg/ml
 200–1,100 pg/ml

EXAMPLE SERUM B₁₂ REFERENCE RANGES FROM A HOSPITAL WITH GUIDELINES STRONGER THAN THE RANGES ABOVE:

Deficient: < 200 pg/ml
 Borderline: 200–270 pg/ml
 Normal: 271–870 pg/ml

As you can see, a few institutions are making physicians aware that a serum B₁₂ between 200 and 270 pg/ml is problematic, using the term “borderline.” This gives a hint to the doctor that the patient’s B₁₂ needs to be higher.

Serum B₁₂ Gray Zone: 200–450 pg/ml (We advocate B₁₂ treatment in all symptomatic patients with serum B₁₂ below 450 pg/ml).

Urinary MMA: < 3.8 µg MMA/mg creatinine
 (3.6 µmole/mmol creatinine)

Serum MMA: 0.04–0.27 µmol/L or 70–270 nmol/L
 0.07–0.40 µmol/L or 70–400 nmol/L

Homocysteine (plasma): 4.0–12.0 µmol/L

HoloTC (Active-B₁₂): 35–101 pmol/L (Specialty Laboratories in Santa Monica, California, currently performs this test)

Ironically, this misplaced concern over the expense of B₁₂ testing costs the medical system far more than it saves, because B₁₂ deficiency is remarkably simple to detect and even easier to treat. Patients treated in the early stages of the disease usually experience complete recovery, with even severe symptoms such as vision loss, agonizing leg pains, paralysis, multiple sclerosis-like symptoms, psychosis, and dementia often receding in months or even weeks. Moreover, unlike many medical problems, B₁₂ deficiency is very inexpensive to treat. Treatment for one year involving bi-monthly injections and a series of six initial daily injections costs \$36 per year when patients or family members administer the injections (which are similar to the insulin shots diabetics give themselves).

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An alternate option, high-dose methyl-B₁₂ lozenges (2,000 mcg), costs around \$48 to \$72 per year depending on the brand used. Compare this to the cost of giving a depressed or demented patient with undiagnosed B₁₂ deficiency unnecessary antidepressants or dementia drugs, which can run over \$1,000 a year—or to the cost of caring for a B₁₂ deficient patient misdiagnosed as having Alzheimer's, multiple sclerosis, or developmental disability, an expense that can run \$60,000 a year or more for decades. The cost in human terms, of course, is far greater. There is no price one can place on the pain of individuals whose undiagnosed B₁₂ deficiency leads to severe, irreversible physical and mental disability. Here are a few examples:

In 2000, a fifty-year-old Illinois woman, Vicki Lambert, received a \$3 million out-of-court settlement from two hospitals and two physician groups. Lambert charged doctors at each of these institutions failed to diagnose her B₁₂ deficiency, leaving her permanently crippled. She suffers from chronic painful neuropathy, uses specialized crutches to walk, and has irreversible cognitive deficits. She is unable to work as a nurse because of her disability and has moved to a one-story home because she could no longer go up and down stairs.

“Unless someone were in my shoes, you can't imagine,” Lambert told a newspaper reporter. “I remember lying in bed and feeling death would be better because I was so sick.”¹⁸

In a similar 1999 case, a sixty-four-year-old Georgia woman was awarded \$3.1 million after a missed diagnosis of B₁₂ deficiency. The woman now requires a wheelchair as a result of permanent nerve damage due to her doctors' failure to identify her condition.¹⁹

In December 2007, the Toronto Sun reported the case of a 12-year-old boy named J.J. who suffered great neurologic injury due to misdiagnosed vitamin B₁₂ deficiency. J.J. was in and out of the Hospital for Sick Children for more than eight months, slowly losing his ability to walk, write, and draw. J.J.'s neurologic status continued to deteriorate to the point where he needed a wheelchair, and none of his doctors could figure out why. He then became jaundiced, and his pediatrician worried that J.J.'s organs were shutting down.

“I was watching my son dying in front of my eyes and no one would do anything,” his mother said. “Later I overheard the doctors saying that when

we brought him in, he was close to death. He stumped everyone, he hit the medical history books because no one has been as bad as him.”

J.J. didn't have a bizarre or rare disorder; he simply had vitamin B₁₂ deficiency. Yet none of his doctors knew the signs or symptoms, despite J.J.'s classic presentation.²⁰ (More on J.J. in Chapter 6.)

Two cases of severe B₁₂ deficiency were reported in Madison, Wisconsin, in the American Journal of Emergency Medicine (2007). Both patients were diagnosed in the emergency department (ED) rather than by their primary care doctors or neurologists. Both had prolonged and progressive symptoms and “had had rather extensive outpatient workups without diagnosis.” Their previous doctors and specialists never contemplated vitamin B₁₂ deficiency as the cause of their progressive neurologic decline. The diagnosis was only suggested when blood abnormalities were found in the ED. These blood changes (severe anemia and macrocytosis) are very late signs of B₁₂ deficiency.

The first woman was fifty years old and presented to the ED complaining of progressive weakness and increasing numbness of her arms, feet and legs. Her serum B₁₂ was critically low at 72 pg/ml, despite the fact that she was on a multi-vitamin. Her neurologic signs and symptoms were slightly improved at a one-week follow-up.

The second woman was twenty-five years of age and came to the ED complaining of increasing weakness. She had a six-month history of decline which led to her using a walker for three months. Later, she began to use a wheelchair because she was too unstable to use the walker. Her serum B₁₂ was undetectable in lab tests, and she was severely anemic and required four blood transfusions. However, she was not macrocytic. Two months after starting B₁₂ treatment, her sensory abnormalities improved, but her motor deficits were unchanged and she continues to use a wheelchair.

Prior to this woman's arrival in the ED, it was reported, her own doctors ordered tests including an MRI of her brain and spine and even an electromyogram (EMG). But they didn't contemplate or investigate vitamin B₁₂ deficiency, even though her signs and symptoms were obvious as well as numerous. As a result, this young woman will have a life-long disability and her physicians may have a costly malpractice suit.²¹

HOW B₁₂ DEFICIENCY ATTACKS THE BODY

As you can guess from the cases we described at the start of this chapter, it's impossible to paint a simple picture of what B₁₂ deficiency looks like. When B₁₂ deficiency attacks the body, it takes many guises, depending in part on the age and genetic vulnerabilities of its victims, and the length and severity of the deficiency. Also, because B₁₂ deficiency is progressive, signs and symptoms may take years to develop. The following list outlines signs and symptoms that can stem from B₁₂ deficiency.

Note: If you have any of the following signs or symptoms, it does not necessarily mean that you have a B₁₂ deficiency. These symptoms can stem from many causes. However, it does mean that your doctor needs to rule out B₁₂ deficiency as a possible culprit.

MENTAL CHANGES

- irritability
- apathy
- sleepiness
- suspiciousness (paranoia)
- personality changes
- depression (including postpartum depression)
- memory loss
- dementia, intellectual deterioration
- hallucinations
- violent behavior
- in children, developmental delay and/or autistic behavior

NEUROLOGICAL SIGNS AND SYMPTOMS

- abnormal sensations (pain, tingling and/or numbness of legs, arms, trunk, or other area)
- diminished sense of touch, pain, and/or temperature
- loss of position sense (awareness of body position)
- weakness (legs, arms, trunk, or other area)

- clumsiness (stiff or awkward movements)
- tremor
- symptoms mimicking Parkinson's disease or multiple sclerosis
- spasticity of muscles
- incontinence (urine and/or stool)
- paralysis
- vision changes (decreased vision or loss of vision)
- damage to the optic nerve (optic neuritis, inflammation, or atrophy of the optic nerve)

VASCULAR PROBLEMS

- transient ischemic attacks (TIAs, or “mini-strokes”)
- cerebral vascular accident (CVA or “stroke”)
- coronary artery disease
- myocardial infarction (“heart attack”)
- congestive heart failure
- palpitations
- orthostatic hypotension (low blood pressure when standing, which can cause fainting and falls)
- deep vein thrombosis (blood clot to the leg or arm)
- pulmonary embolism (blood clot to the lung)

ADDITIONAL SIGNS AND SYMPTOMS

- shortness of breath
- generalized weakness
- chronic fatigue or tiredness
- loss of appetite/weight loss or anorexia
- epigastric pain (poor digestion, full or bloated feeling after eating small or normal sized meals)
- gastrointestinal problems (diarrhea, constipation)

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- osteoporosis
- increased susceptibility to infection
- in newborns and infants, failure to thrive
- tinnitus (ringing or roaring in the ears)
- vitiligo (white patches of skin) or, conversely, hyperpigmentation of skin
- prematurely gray hair

SYSTEMS AFFECTED BY VITAMIN B₁₂ DEFICIENCY

NEUROLOGIC

Numbness, tingling, and/or burning sensation in arms, legs, or body, balance problems, difficulty ambulating, falling, weakness, tremor, paralysis, confusion, forgetfulness, dementia, depression, mental illness, psychosis, incontinence, impotence, headaches, vision loss.

HEMATOLOGIC (BLOOD)

Fatigue, weakness, anemia, shortness of breath, enlarged spleen or liver, enlarged red blood cells (macrocytes), hypersegmented neutrophils, ovalocytes.

IMMUNOLOGIC

Poor wound healing, increased susceptibility to infections, increased risk of cancer, poor antibody production after vaccines.

VASCULAR

Coronary artery disease, myocardial infarction (heart attack), pulmonary embolism (blood clot(s) in lungs), deep-vein thrombosis (DVT) of extremities, mini-stroke, stroke.

GASTROINTESTINAL

Indigestion, abdominal pain, constipation, diarrhea, gastroesophageal reflux disease (GERD), gastric stasis, weight loss (in some people).

MUSCULOSKELETAL

Fractures, osteoporosis, suppressed activity of osteoblasts (cells that build new bone).

GENITOURINARY

Abnormal PAP smears, urinary incontinence, impotence, infertility.

It amazes many people that a single medical problem—B₁₂ deficiency—can cause so many medical symptoms. But the reason is simple: B₁₂ wears many hats, playing key roles in the health of your nerves, your brain, your blood, and your immune system, as well as in the formation of DNA (the molecular blueprint for making the substances that create and maintain your body). Thus, B₁₂ deficiency can impair the functioning of almost any part of your body.

In particular, B₁₂ deficiency often strikes the nervous system, causing damage to the soft fatty material called *myelin* that surrounds and protects nerve fibers. This damage (*demyelination*), which can be compared to the fraying of an electrical wire, can cause you to develop mysterious and frightening neurological problems, ranging from numb, tingling, or painful legs and arms, to loss of balance, vision loss, impotence, or incontinence. Because your brain and nervous system control your mental state, the demyelination caused by B₁₂ deficiency can also lead to memory loss, “fuzzy” thinking, personality changes, depression, or even psychosis or dementia. In a child, the damage can be even worse, because the young brain is still forming and requires adequate B₁₂ to grow normally.

B₁₂ deficiency can impair the functioning of almost any part of your body.

As B₁₂ deficiency continues, your immune system also falls prey, because it can no longer produce enough disease-fighting white blood cells. Thus, you become an easier target for viral or bacterial infections. Your gastrointestinal system suffers as well, because your body can't make enough cells to replace your intestinal lining efficiently, so you may experience diarrhea, nausea, or severe appetite loss. And eventually, as your B₁₂ deficit grows, you're likely to feel exhausted and weak due to the anemia that occurs when your body can't make enough healthy blood cells to carry oxygen to the cells of your body.

At the same time, B₁₂ deficiency causes a breakdown in a crucial metabolic pathway that detoxifies the potentially dangerous amino acid homocysteine. As homocysteine accumulates in your blood, it dramatically increases your risk of coronary artery disease, stroke, and blood clots. If you become pregnant, high homocysteine levels will also make you more vulnerable to preeclampsia, a potentially fatal pregnancy complication.

If you're a woman, the blood abnormalities resulting from B₁₂ deficiency may affect the lining of your uterus and cervix, causing cervical

dysplasia (abnormal cervical cell appearance) that can be mistaken for a pre-cancerous condition. But B₁₂ deficiency doesn't just mimic cancer warning signs; it also puts you at higher risk for certain cancers, whether you're male or female. Pernicious anemia, the classic form of vitamin B₁₂ deficiency, is a strong risk factor for stomach cancer, and there is mounting evidence linking deficient levels of B₁₂ to breast cancer, as well.

THE BAD NEWS...AND THE GOOD NEWS

So far, what we've told you is frightening. Millions of Americans and millions of other people world-wide suffer from undiagnosed B₁₂ deficiency—and you may be one of them. If you are, this disease could be attacking your brain, your nervous systems, your cardiovascular system, and your immune system, putting you at risk for everything from Alzheimer's-like dementia to heart disease and cancer. You're not safe even if you get regular checkups, because your doctor may miss the correct diagnosis until it's too late to reverse your symptoms. And if you're a woman who is B₁₂ deficient and you don't find out about your condition in time, even your children may suffer permanent damage to their bodies and brains.

That's the bad news. The good news is that if it's caught early, B₁₂ deficiency is one of the simplest disorders in the world to treat. In fact, many formerly B₁₂-deficient people say that getting a diagnosis was the best thing that ever happened to them, because it meant that the "incurable" neuropathy, weakness, infertility, MS-like symptoms, depression, or other problems that afflicted them weren't untreatable after all. In this

The good news is that if it's caught early, B₁₂ deficiency is one of the simplest disorders in the world to treat.

book, we'll share the stories of once-bedridden people who can walk again... people freed from excruciating leg and back pain... individuals cured of memory loss, depression, schizophrenic symptoms, and even dementia... people freed from the need for repeated blood transfusions for mysterious anemia... people able to conceive healthy babies after B₁₂ treatment... and even developmentally disabled or autistic

children who made almost miraculous gains after their deficient B₁₂ levels were detected and treated. All of these individuals experienced dramatic improvement after undergoing the simplest and safest of treatments: a few shots (or, in some cases, pills) containing megadoses of vitamin B₁₂.

WHO'S AT GREATEST RISK FOR B₁₂ DEFICIENCY?

Anyone, at any age, can become B₁₂-deficient. Thus, you need to be tested immediately if you develop any of the symptoms we've described in this chapter. However, certain people are at an elevated risk. They include the following:

- Vegetarians, vegans, and people eating macrobiotic diets
- People aged sixty and over
- People who've undergone any gastric and/or intestinal surgery, including bariatric surgery for weight loss purposes (gastric bypass)
- People who regularly use proton-pump inhibitors, H₂ blockers, antacids, metformin and related diabetes drugs, or other medications that can interfere with B₁₂ absorption
- People who undergo surgeries or dental procedures involving nitrous oxide, or who abuse this drug recreationally
- People with a history of eating disorders (anorexia or bulimia)
- People with a history of alcoholism
- People with a family history of pernicious anemia
- People diagnosed with anemia (including iron deficiency anemia, sickle cell anemia, and thalassemia)
- People with Crohn's disease, irritable bowel syndrome, gluten enteropathy (celiac disease), or any other disease that causes malabsorption of nutrients
- People with autoimmune disorders (especially thyroid disorders such as Hashimoto's thyroiditis and Graves' disease), type 1 diabetes, vitiligo, lupus, Addison's disease, ulcerative colitis, infertility, acquired agammaglobulinemia, or a family history of these disorders.
- Women with a history of infertility or multiple miscarriages
- Infants born to and/or breast-fed by women who are symptomatic or are at risk for B₁₂ deficiency

Their stories are a powerful counterpoint to the horrific stories of patients who have suffered devastating injuries, years of poor health or terrible illnesses, and who have incurred huge medical expenses as well, due to the non-diagnosis or late diagnosis of their B₁₂ deficiency.

We want it to be perfectly clear at the outset of this book that B₁₂ isn't a "magic bullet." The symptoms we've outlined have many causes, and B₁₂ deficiency is only one of them. But patients and doctors need to be aware that B₁₂ deficiency often *does* cause these symptoms, and that doctors who fail to rule it out or treat it may be condemning their patients to unnecessary debility or even death. Conversely, the brief amount of time and money required to identify B₁₂ deficiency is a small investment to make—and whether you're a doctor or a medical consumer, it may be the most important investment you'll ever make.

Vitamin B₁₂ treatment is quite possibly the safest medical treatment on earth.

Note: Vitamin B₁₂ treatment is quite possibly the safest medical treatment on earth. However, one small group of people—those with a rare disorder called Leber's hereditary optic neuropathy—should never take cyanocobalamin, one specific form of B₁₂. Information about safe forms of B₁₂ treatment for these individuals is contained in Chapter 11.

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