

Magnificent Magnesium

**Your Essential Key to a
Healthy Heart and More**

Dennis Goodman, MD, FACC

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Introduction

All too often, the public is besieged by reports that a particular supplement holds the secret to a longer, healthier life. Exciting new information is released, spurring a surge of interest and, of course, a rise in supplement sales. As claims about the nutrient circulate, people are exposed to some truth, some hype, and, often, a good deal of wishful thinking. The pity is that while the media focuses on a short-lived trend, some very important nutrients are often overlooked—to the detriment of everyone’s health.

Consider the following: Heart disease is the number one killer in the United States today. Each year, we spend billions of dollars on medical tests, operations, hospital stays, rehab centers, equipment, and drugs—all to help prevent or remedy heart disease—yet with very little to show for our investments. Heart disease accounts for direct and indirect costs of more than \$190.3 billion each year, and the American Heart Association forecasts that these costs will increase by a minimum of 200 percent over the next twenty years.

Billions more go to the satellite industries that have developed to cater to our health epidemics, producing everything from best-selling diet books to weight loss centers to lines of “heart-healthy” foods and making promises that they can prevent or reverse these conditions. The media is flooded with ads and television shows

that tell us that if we don't do something, we are bound to become statistics—the victims of our own inaction. Yet there *is* something we can do to offset the outrageous expenditures and unnecessary procedures; in fact, there's something we can take even now to help prevent these life-threatening health conditions from developing in the first place. The answer is simple, inexpensive, and effective: magnesium.

As a heart specialist, I feel that the treasures held within magnesium have yet to be embraced by the medical community. The more studies I read confirming the vital roles magnesium plays in the body, the more clearly I realize that too few people know how critical magnesium is to good health.

Magnesium is the eighth most abundant element on Earth and the eleventh most common element in the human body. It has been studied by medical researchers for over a hundred years, and while it has always been considered a reasonably important mineral, it is, in fact, essential to the proper functioning of the body. This master mineral is a necessary ingredient for approximately three hundred and fifty enzyme systems, thus playing a role in the majority of your body's metabolic processes. Surprisingly, however, upwards of 80 percent of Americans are deficient in this nutrient.

Why is magnesium deficiency worth our attention? First and foremost, without the proper levels of magnesium in the body, we are subject to heart attacks—the number one killer of Americans—as well as a variety of other heart-related disorders. Second, many other serious health problems are associated with magnesium deficiency, including type 2 diabetes, metabolic syndrome, osteoporosis, muscle cramps, fatigue, depression, migraines, and insomnia.

At this point, you may be wondering, "If magnesium is this important, why haven't I heard about it before?" While there are many reasons why magnesium has been overlooked for so long, I strongly believe that magnesium's time is now. Once you have read this book, you will understand the difference magnesium can make in your life. The goal of *Magnificent Magnesium* is to contribute to wider public knowledge about the value of this miner-

al—knowledge that you will be able to apply the moment you turn the book's last page.

This book is designed to present an understanding of magnesium with a sharp focus on its role in heart health and several other aspects of physical well-being. Chapter 1 takes an unflinching look at the heart disease epidemic that claimed nearly 800,000 American lives in 2010, with stroke killing over 129,000 people that same year. It examines the most common forms of heart disease and details their causes, risk factors, symptoms, diagnoses, and typical treatment methods, so that you will be able to recognize and potentially prevent these devastating conditions.

In Chapter 2, you will be introduced to magnesium and its many roles in supporting and maintaining your body's vital functions. You will also learn the reason that magnesium deficiency is so common in the United States today: stress. Stress comes in many forms—psychological, physical, and environmental. The important thing to understand is that all of these forms of stress contribute to the extensive depletion of magnesium from our bodies and food sources.

Chapter 3 sets the foundation for understanding heart disease, providing an overview of the cardiovascular system. By learning how your heart and blood vessels work under normal circumstances, you will be able to understand what happens when something goes wrong—as with the heart conditions discussed in Chapter 1. This knowledge base also allows you to see how magnesium can help your body, from the cellular level on up.

In Chapter 4, you will take a closer look at the way the medical community currently views and treats heart disease. The chapter also introduces an emerging model for understanding heart disease—and preventing it. The starved heart model of heart disease asserts that without an optimal supply of magnesium, the heart begins to break down at every level, leading to energy starvation, dysfunction, and eventually cardiovascular disease. Accordingly, to reverse or protect against cardiovascular disease, it is essential to maintain good magnesium levels and excellent magnesium stores.

Chapter 5 demonstrates that the benefits of magnesium

extend far beyond their applications for cardiovascular disease. Many of the United States' other major health conditions are caused or exacerbated by magnesium deficiency. This chapter lays out the research, showing that you can help improve, protect against, and even prevent these diseases by simply increasing your intake of magnesium.

Finally, in Chapter 6, all this information is put to work, providing you with a practical guide to integrating magnesium into your life. You will be shown how to determine the amount of magnesium you need to obtain and maintain optimal wellness, taking into account your current magnesium status and the amount you burn through on a day-to-day basis. You will also be provided with information on the best sources for getting this vital nutrient, so that you will never be without.

By the time you finish reading *Magnificent Magnesium*, you will be equipped with the knowledge you need to understand the origins of heart disease—and, potentially, to prevent it from ever developing. But while reading this book is a significant first step, it is far more important that you actually use the tools contained within to take charge of your health. Be proactive; only you can change your life!

What's Our Problem?

Hear disease is the leading cause of mortality in the United States, accounting for 25 percent of all recorded deaths. It strikes indiscriminately—teenagers and adults, men and women, blacks and whites—all are susceptible. It can kill quickly or it can linger for years, causing pain, depression, and a wide variety of painful and debilitating symptoms. Affecting over 80 million Americans today, heart disease is a modern-day plague with a reach and severity that extend further with every passing week. And yet, for the most part, too many of us simply accept it as the price we pay to live in a country of so-called abundance. But it is a very high price.

So if we know we have a problem, why does heart disease persist? Is it genetics, our diet, or just a lack of exercise? Is it our cholesterol levels or blood pressure? Why is it that there are so many seemingly right answers, and yet, so many of us continue to die prematurely? This book attempts to address all of these issues, and to present an answer of its own. There is a solution to our health woes, a tragically underutilized remedy that has been with us for decades: magnesium.

In order to get a sense of just how fully magnesium can improve our quality of life, we need to examine the epidemic that poses the greatest challenge to our health: heart disease. Moreover, we need to know the ways in which this epidemic has

typically been addressed by the medical community. An understanding of the types and causes of heart disease, and the standard medical responses to them, will enable you to make better decisions regarding your own well-being.

THE STATISTICS TELL A TALE

Since the beginning of the twentieth century, heart disease has been our nation's number one killer. It is unlikely to give up that position any time soon. Consider these grim statistics from the American Heart Association's *Heart Disease and Stroke Statistics—2013 Update*:

- More than 2,150 Americans die of heart disease each and every day. That's an average of one death every 39 seconds.
- An average of 150,000 Americans who die of heart disease each year are younger than 65 years of age, while 33 percent of all deaths caused by heart disease occur before the age of 75 years, which is well below the average life expectancy of 77.9 years.
- Coronary heart disease causes one of every six deaths in the United States each year, while one out of every eighteen deaths is caused by stroke.
- An average of 800,000 Americans die of heart disease each year.
- Each year, an estimated 785,000 Americans have a heart attack, and 470,000 more have a repeat attack.
- Approximately 195,000 Americans experience their first silent (unnoticed or undiagnosed) heart attacks each year.
- Approximately every 25 seconds, an American will have a coronary event, and approximately every minute, someone will die of one.

Once mistakenly thought to primarily affect men, approximately half of all deaths caused by heart disease in the United States each year occur among women, accounting for more than

six times the number of deaths caused by breast cancer. Although mortality rates caused by heart disease have started to decline over the past fifty years, the overall toll continues to rise, both in terms of impaired health and financial cost.

Here is the most important statistic to remember: For half of the people who die of a heart attack, death is the first and last symptom that they ever experience. In other words, prior to their deaths, most victims never experienced any sort of symptom to warn them that they were at risk for heart attack. This is why it is so important to work regularly with your physician to determine your risk and monitor the health of your heart and overall cardiovascular system.

THE MOST COMMON TYPES OF HEART DISEASE

We can certainly see the devastation that cardiovascular disease produces. In order to understand the different ways that cardiovascular disease affects us, let's take a closer look at the fifteen most common types. They include:

- Angina Pectoris
- Arrhythmias/Atrial Fibrillation (Irregular Heartbeat)
- Atherosclerosis
- Cardiac Arrest
- Congestive Heart Failure
- Coronary Heart Disease (CHD)
- Enlarged Heart (Cardiomegaly)
- Heart Attack (Acute Myocardial Infarction)
- Heart Murmur
- Heart Muscle Disease (Cardiomyopathy)
- High Blood Pressure (Hypertension)
- Mitral Valve Prolapse

- Pericarditis/Pericardial Effusion
- Premature Ventricular Contraction (PVC)
- Stroke

This section will define what each condition is, explain why it occurs, describe its symptoms, and explain how it is currently diagnosed and treated.

Angina Pectoris

The term angina pectoris is derived from Latin and means “squeezing of the chest.” Angina is chest pain caused by a decreased supply of blood to the heart muscle, usually due to a lesion on the walls or valves or the heart, or because of a narrowing of the coronary arteries. As a result of this constriction or blockage, the heart receives less oxygen—a condition called *ischemia*. Spasms of the coronary arteries can also be involved.

Risk factors for angina pectoris include smoking, lack of exercise, chronic stress, and high blood pressure. Being overweight or obese also increases risk, as does diabetes. The risk for angina also increases as you age.

Classical or typical symptoms of angina include pain, pressure, or other discomfort in the middle of the chest. This chest pain can radiate to the throat, jaw, upper back, arms, and even teeth. Unfortunately, cases of angina often go misdiagnosed or undiagnosed in women, who are more likely to suffer atypical symptoms, including palpitations, dizziness, heartburn, indigestion, nausea, numbness in the arms, weakness, and shortness of breath. Symptoms typically worsen after a heavy meal or physical exertion, and during times of emotional stress, as all of these situations demand that more oxygen be pumped to the heart.

There are two types of angina: stable and unstable. Stable angina is the most common type, and is characterized by typical symptoms that are predictable. Ordinarily, symptoms last around five minutes or so, and then subside.

Unstable angina is a more serious condition, with symptoms being more severe and less predictable, and usually lasting much

longer. Unstable angina symptoms can occur even at times of rest. Because unstable angina is often a precursor and warning sign of a heart attack, prompt medical attention should be sought at the first sign of unstable angina.

Angina can be diagnosed using a number of tools. An electrocardiogram (EKG), which records the electrical activity of heart, can detect signs of ischemia and is also useful for monitoring changes to the heart muscle caused by a lack of oxygen. Even when EKG readings are normal, however, angina may still be present. Physicians who suspect that this is the case may also use exercise stress testing, in which a patient is asked to perform activities that stress the heart (such as walking on a treadmill or using a stationary bike) while their EKG readings are continuously monitored.

If the exercise stress test remains inconclusive, your physician may order a stress echocardiogram or nuclear heart scan. Stress echocardiography combines ultrasound imaging of the heart muscle with exercise stress testing in order to screen for abnormalities in your heart's contractions. Since there is no radiation exposure, stress echocardiography is preferred to nuclear heart scans. In a nuclear heart scan, a safe, radioactive trace substance such as thallium or Cardiolite is injected into your bloodstream and an external camera is used to monitor the activity of this trace substance as it travels through your veins to your heart. Typically, there are two parts to this test; one set of images will be taken after a mild stress test (similar to the one described above), and another set will be produced later, when your body is at rest. Both these tests allow your physician to see how well blood is flowing through your heart, and can identify any muscle areas that might be damaged or narrowed.

If your stress test yields abnormal results, your doctor may also order a coronary computed tomography angiogram (CTA). This test uses a computed tomography (CT) scan to visually track the progress of an intravenous dye containing iodine through the bloodstream, making it possible to see the coronary arteries and determine if any blockages are present. For most patients, a CTA is an excellent, noninvasive way to diagnose angina.

In some cases, cardiologists may also order or perform a cardiac catheterization with angiography. During this procedure, small, hollow plastic tubes (catheters) are inserted through arteries in the groin or forearm and threaded into the openings of the coronary arteries under the guidance of X-rays. Iodine contrast dye is injected into the arteries while an X-ray video is recorded, providing doctors with images of the location and severity of coronary artery disease. Cardiac catheterization is commonly regarded as the most accurate test to detect coronary artery narrowing. It is particularly useful in cases where there is a high likelihood that therapeutic intervention will be required, because it allows for immediate treatment. If a blocked artery is found, a metal tube called a stent can be placed inside the troubled area, supporting the artery and facilitating blood flow.

If angina symptoms are present but not severe, or if no serious blockages are seen on a CTA or cardiac catheterization, doctors may simply instruct their patients to make healthy lifestyle changes. With better food choices, smaller meals, rest, and stress reduction, many patients will see their symptoms improve. Otherwise, medical treatments may be advised. Treatment options include conventional medications, such as nitroglycerin tablets or sprays to reduce the heart muscle's demand for oxygen; beta blockers, to reduce the effects of adrenaline on the heart; and calcium channel blockers, to lower blood pressure and reduce the pumping force of the heart muscle, and thus its need for oxygen.

If the above measures fail to correct the problem, angina patients may be advised to consider surgery. In addition to the stent placement described above, the two most common surgical procedures for angina pectoris are angioplasty and coronary artery bypass surgery. During an angioplasty, a small balloon is inserted into the narrowed artery and inflated; this dilates the narrowed artery and allows blood to flow more freely. In some cases, a small mesh tube, or stent, may also be placed inside the artery to hold it open. Coronary artery bypass surgery, a form of open heart surgery, is a procedure that redirects blood around a blocked artery (bypassing it), creating a new pathway for blood to flow to and from the heart. This is done by taking an artery or vein from

the patient's leg or chest wall and sewing one end above the blocked coronary artery and the other end below the blockage.

Regardless of the type of surgery performed, angina patients are still vulnerable to future heart attack. It is therefore essential that all angina sufferers make the necessary lifestyle changes to lower their risk, following a heart-friendly diet, maintaining a healthy weight, exercising regularly, reducing stress, and keeping appropriate levels of cholesterol and blood sugar.

Arrhythmia/Atrial Fibrillation

Arrhythmia is a condition characterized by an abnormal or irregular heartbeat caused by faulty electrical impulses to the heart. Unlike other organs and muscles in your body, your heart has its own "electrical generator"—a specialized group of cells located in the heart's upper right chamber (right atrium). As you'll read in Chapter 3, this group of cells, known as the sinoatrial (SA) node, creates a series of electrical impulses that make your heart pump blood in an even, continuous flow. Arrhythmia occurs either when the SA node is damaged or when there is some other disruption to the heart's conduction of electrical signals (see page 78 for more information). There are two basic kinds of irregular heart rhythms. The first is known as *bradycardia*, and is characterized by heartbeats that are too slow—fewer than sixty beats per minute. The second type is known as *tachycardia*, and is characterized by a racing heartbeat of more than 100 beats per minute.

The most common form of arrhythmia is *atrial fibrillation* (AF), in which the heart's two top chambers (the atria) beat quickly and irregularly, causing blood to pool within and preventing the atria from working in harmony with the heart's lower two chambers (the ventricles). According to the Centers for Disease Control and Prevention (CDC), approximately 2.66 million people currently suffer from atrial fibrillation, and as many as 12 million people will have the condition by 2050. Less common, but very serious, are the two forms of arrhythmia that occur in the lower two chambers (ventricles) of the heart: *ventricular tachycardia* and *ventricular fibrillation*. The result of these two conditions is that the ventricles

are unable to pump blood to the rest of your body. Your blood pressure drops, and your vital organs cease to receive the blood they need to operate. Ventricular arrhythmias are the most common cause of death related to heart attack. Immediate attention—cardiopulmonary resuscitation (CPR) and/or defibrillation—is necessary to prevent death.

A number of factors can increase the risk of arrhythmia, including high blood pressure, smoking, excessive alcohol consumption, and the use of pharmaceutical drugs, including over-the-counter cold and flu medications. Other risk factors include sleep apnea (a condition in which breathing is interrupted during sleep), thyroid problems, and other pre-existing heart conditions (including coronary artery disease, heart valve problems, and congestive heart failure).

Symptoms of arrhythmia can often go undetected, manifesting as a brief and barely noticeable skipped heartbeat. In more serious cases, where arrhythmia prevents the heart from pumping enough blood, patients can feel sensations of fluttering in the chest or neck, along with dizziness or lightheadedness, fatigue, and fainting. Other symptoms include chest pain and shortness of breath. If you experience any of these symptoms, contact your physician or seek medical help immediately. In some cases, arrhythmia can trigger a heart attack and even cause death.

Arrhythmia is most often detected with an electrocardiogram (EKG), which also helps physicians determine where in the heart the problem starts. Stress testing and tilt table tests (used to detect the cause of arrhythmia-induced fainting) are also commonly used, as are tests that specifically map the heart's electrical system and any flaws that may have arisen in it, including electrophysiology studies (EP studies). During an EP study, thin, flexible catheters with electrodes on their tips are threaded through the heart's blood vessels in order to provide a precise picture of the pathways that electrical impulses take while traveling through the heart. The electrodes can also be used either to trigger or to stabilize an arrhythmia, enabling the doctor to pinpoint the exact location of the problem.

If an arrhythmia is detected, your doctor may ask you to alter your lifestyle with an improved diet, exercise, and stress

management. Medications may also be prescribed in order to control arrhythmia directly, or to deal with associated risks; anticoagulants (blood thinners, beta blockers, and calcium channel and/or sodium channel blockers) are all commonly used. Should all of these options fail, other treatment options may be required.

The most common nondrug procedures used to treat arrhythmia are cardioversion, defibrillation, cardiac ablation, and the Maze procedure. Cardioversion is used to temporarily normalize arrhythmias that could otherwise cause heart attack or death. Using either fast-acting drugs or an electric shock delivered with defibrillator paddles directly over the heart, the abnormal heartbeat is interrupted, allowing the heart's electrical system to regain control and restore a normal heart rhythm. Defibrillation is a somewhat more intense form of cardioversion that is performed in emergency situations involving severe or highly irregular arrhythmias, as in cardiac arrest; it employs a stronger set of electrical shocks to jolt the heart rhythm back to normal.

In some cases of tachycardia and ventricular fibrillation, an electrical device known as an implantable cardioverter defibrillator (ICD) may be surgically inserted into a patient's chest, as a pacemaker might be. When an arrhythmia occurs, the ICD delivers a shock to reset the heartbeat and get the SA node to send a normal electrical signal. (See the inset on page 79 for more information.)

In severe cases of arrhythmia, physicians may elect to perform more invasive surgical procedures to remove damaged or otherwise abnormal tissue in the heart muscle that is triggering arrhythmia. During cardiac ablation, a thin tube (catheter) is inserted into a vein and then guided into the heart muscle. Once there, the tip of the catheter emits a burst of energy to destroy the areas of heart tissue shown to be causing abnormal electrical signals.

The Maze procedure is an invasive surgical procedure used to treat atrial fibrillation. During the Maze procedure, the surgeon makes a number of incisions, which are then sewn up again, creating scar tissue. These scars serve as barriers, forcing the electrical impulses responsible for your heartbeat to travel along a

single, uniform pathway into the ventricles so that a normal heart rhythm can be restored.

Atherosclerosis

Atherosclerosis refers to a hardening or blockage of the arteries due to the accumulation of a waxy substance called plaque. Plaque builds up as part of your body's inflammatory response to damage in the walls of the arteries. When your arteries are damaged as the result of high blood pressure, cigarette smoke, environmental toxins, or the presence of other irritants, your body sends cholesterol and other substances to the wound in an attempt to repair it. Collectively, these fatty deposits are known as plaque. Over time, they can build up, narrowing and hardening the arteries, and thus reducing the flow of blood and increasing blood pressure levels. (For a more complete explanation of how atherosclerosis develops, see Chapter 4.)

Risk factors for atherosclerosis include age, diabetes and insulin resistance, high blood pressure, high cholesterol, obesity, smoking, and a family history of heart disease. Because inflammation is an integral part of the process by which atherosclerosis develops, doctors have theorized that factors that increase inflammation can often indirectly contribute to atherosclerosis, too. For example, several studies have shown that there was a strong association between atherosclerosis and *Chlamydophila pneumoniae*, one of the bacteria that causes pneumonia. Scientists theorized that because *C. pneumoniae* infections seemed to cause or contribute to the inflammation that in turn causes atherosclerosis, treating the infections with antibiotics would potentially help reduce the atherosclerosis. Unfortunately, subsequent studies showed that patients with atherosclerosis derived no overall benefit from antibiotics, and the theory was deemed less plausible.

Atherosclerosis can go undetected for years before symptoms present themselves. In fact, in recent years, an alarming number of teens and preteens have been found to have some degree of atherosclerotic plaques. Overall, nearly 5 million Americans are diagnosed with atherosclerosis each year, while a significantly

higher number of Americans have already been diagnosed and are living with this condition.

Symptoms of atherosclerosis depend on the extent of the blockage and the specific arteries affected. In arteries of the heart, atherosclerosis can manifest as chest pain or pressure (angina), while in leg or arm arteries atherosclerosis can cause intermittent pain. In the arteries that lead into the brain, atherosclerosis can produce warning signs of stroke, including slurred speech, drooping muscles in the face, and numbness or weakness in the arms or legs. In arteries leading to the genitals, atherosclerosis can cause erectile dysfunction in men, while in women, the same condition can reduce blood flow to the vagina, resulting in less pleasurable sex. Unfortunately, many patients will not show symptoms until the atherosclerosis is severe, blocking over 70 percent of the affected artery. This makes atherosclerosis harder to diagnose and treat.

Blood tests that screen for LDL (“bad”) cholesterol, HDL (“good”) cholesterol, and total cholesterol levels—as well as other markers such as homocysteine, C-reactive protein (CRP), and lipoprotein-associated phospholipase (Lp-PLA-2)—can indicate whether atherosclerosis is likely to be present. Other diagnostic tests include the various forms of stress testing, although these methods have certain drawbacks. Stress tests only detect large blockages that have obstructed at least 70 percent of your arterial passage. Accordingly, you can still be at serious risk for heart attack even if your doctor says you “passed a stress test.” Your arteries may not be severely blocked, but they may not necessarily be clean and healthy, either.

Fortunately, there are more effective and noninvasive tests that can detect plaque in the coronary or carotid (neck) arteries before a significant blockage develops. Two of the most common procedures used for early detection of atherosclerosis—that is, before most symptoms arise—are coronary calcium scoring by CT scan, which measures the amount of plaque in your coronary arteries, and carotid intima-media thickness testing (CIMT), which uses ultrasound technology to screen your carotid arteries for plaque.

Should atherosclerosis be detected, your doctor may prescribe aspirin or cholesterol-lowering drugs—statins or other natural alternatives. You will probably be asked to make certain lifestyle changes, involving a low-cholesterol diet, regular exercise, and the avoidance of unhealthy behaviors such as smoking and alcohol consumption. Because stress is a major risk factor for heart disease, learning to reduce or control it is essential for the proper treatment of atherosclerosis, as you will read later in this chapter. By adopting these lifestyle changes, you can prevent plaque from developing or progressing, significantly reducing the likelihood that atherosclerosis will threaten your life.

Cardiac Arrest

Cardiac arrest, also known as cardiopulmonary or circulatory arrest, sudden cardiac arrest, and sudden cardiac death, is a condition in which the heart abruptly stops beating. Cardiac arrest differs from heart attack in that the disruption of blood flow is caused not by a physical blockage, but rather by an electrical disturbance that impairs the heart's ability to pump blood to the rest of the body. And while the heart may continue to beat during a heart attack, it stops completely in cardiac arrest. As a result, blood ceases to flow, preventing oxygen from being delivered to the body and brain. Cardiac arrest is a very serious medical emergency. Each year, an estimated 295,000 Americans suffer cardiac arrest; only 8 percent will survive when the incident occurs out of hospital. The majority of cases that are not treated within ten minutes end in death; patients who survive are likely to suffer brain damage due to the loss of blood flow and needed oxygen to the brain.

The immediate cause of cardiac arrest is usually a severe arrhythmia such as ventricular fibrillation (see page 11), in which the heartbeat cycle is electrically disrupted to the point of stopping altogether. But this life-threatening arrhythmia is itself the result of an underlying heart condition, usually coronary artery disease, although occasionally an enlarged and weakened heart (cardiomyopathy), heart valve disease, or congenital heart defect is to blame. Cardiac arrest can also be caused by noncardiovascu-

lar sources, including trauma, gastrointestinal bleeding, or hemorrhaging inside the cranium. Other factors that compound the increase the risk of cardiac arrest include age (the risk increases in men over forty-five and women over fifty-five), smoking, high blood pressure, being overweight or obese, lack of exercise, diabetes, excessive alcohol consumption, drug use, and a previous history of heart disease. Men are two to three times more at risk for cardiac arrest than women, and blacks are about one-third as likely as other groups to survive.

Symptoms of cardiac arrest appear suddenly and must be treated immediately. A victim of cardiac arrest will collapse, unconscious, unable to breathe, and with no pulse. Sometimes cardiac arrest will be preceded by a period of faintness or dizziness, chest pains, shortness of breath, nausea, or vomiting. It is essential that these symptoms be taken seriously.

Due to the catastrophic nature of cardiac arrest, immediate treatment is essential for survival. A patient is more likely to die with every moment that passes without medical treatment. If you or someone near you appears to be suffering a cardiac arrest, call 911 immediately. Until emergency medical treatment is available, perform cardiopulmonary resuscitation (CPR). If you have not been trained in basic CPR, now is the time to learn—you never know when you could be called on to save a life. Contact your local American Heart Association office for more information. Even if you don't know CPR, you can still assist the patient until help arrives by pushing firmly and steadily on the patient's chest at a rate of around 100 pushes per minute. Allow the chest to fully rise between each push. Continue until help arrives or until the patient regains consciousness and is able to breathe unaided.

As soon as possible, an automated external defibrillator (AED) should be used to deliver electrical shocks to the patient's heart in an effort to get it beating normally again. Many public spaces—including shopping malls, hotels, convention centers, airports, and sports stadiums—have AEDs for general use. If one is not immediately available, the police or emergency medical staff will provide one when they arrive at the scene. When the patient gets to the emergency room, drugs will be administered in order

to treat a heart attack (if one has occurred), stabilize heart rhythm, and rectify an electrolyte imbalance.

The cause of cardiac arrest is diagnosed after the event. Patients who survive cardiac arrest need to be tested in order to identify the underlying factors that triggered the episode, which, if left unaddressed, could trigger future episodes. Testing methods include electrocardiogram (EKG), echocardiogram, chest X-ray, and angiogram. Blood and hormone testing are also commonly ordered. Other tests include computed tomography (CT) scan, magnetic resonance imaging (MRI), ejection fraction testing, nuclear heart scans, and electrophysiology (EP) studies.

Treatment may include medications, including angiotensin-converting enzyme (ACE) inhibitors, which widen and relax the blood vessels; beta blockers; and calcium channel blockers. Surgery may also be recommended in order to prevent future recurrence of cardiac arrest. Surgical methods can range from the implantation of an implantable cardioverter defibrillator (ICD) device to monitor heart rhythm and reset it, if necessary; coronary angioplasty stenting or bypass surgery; or corrective heart surgery to repair faulty heart valves, diseased heart muscle tissue, or congenital heart deformities. A procedure called radiofrequency catheter ablation can also be used in order to destroy (ablate) the area or areas of the heart that are causing the arrhythmia.

Because cardiac arrest is frequently fatal, prevention is often the best cure. If you are at risk, your doctor may advise you to make lifestyle changes in order to lower your chance of cardiac arrest. Don't smoke, drink moderately or not at all, eat a balanced diet, and get plenty of exercise; these choices will improve your health and help lower your vulnerability to cardiac arrest.

Congestive Heart Failure

Congestive heart failure (CHF) is a condition in which the heart is unable to pump a sufficient supply of blood to the rest of the body. CHF can be either chronic and ongoing or sudden and acute. Most cases of CHF initially develop in the heart's main blood pumping chamber, the left ventricle. CHF gets its name because when it

occurs, blood backs up into, or congests, the liver, abdomen, lungs, and/or legs, ankles, and feet. Left untreated, CHF can cause heart valve problems, heart attack, stroke, and damage to the liver and kidneys.

CHF can be caused by a variety of conditions that weaken or damage the heart, including coronary heart disease, heart attack, high blood pressure, congenital heart defects (heart abnormalities that are present from birth), damaged heart muscle or valves, inflammation of the heart, arrhythmia, and atherosclerosis. Risk for CHF can be increased by various noncardiovascular diseases, including severe anemia, diabetes and certain diabetes medications, hyperthyroidism and hypothyroidism, emphysema, lupus, infections, kidney disease, blood clots in the lungs, smoking, and excessive alcohol consumption.

There are many symptoms of CHF, ranging from chest pain and shortness of breath (after exertion or when lying down), fatigue, weakness, edema (swelling in ankles, feet, or legs), rapid or irregular heartbeat, swelling in the abdomen, sudden weight gain due to fluid retention, and nausea. All of these symptoms are typically more severe in cases of sudden CHF.

Diagnosis of CHF begins with a thorough medical history intake and physical exam. Often, your doctor will order a blood test to screen for a chemical known as brain natriuretic peptide, or BNP, high levels of which can indicate CHF. Other diagnostic methods include chest X-ray, electrocardiogram (EKG), echocardiogram, computed tomography (CT) scan, magnetic resonance imaging (MRI), and stress testing. An ejection fraction test can also be used, usually in conjunction with an echocardiogram. An ejection fraction measures how well your heart pumps blood. In a healthy heart, the ejection fraction is above 55 percent, meaning that more than half of all the blood that fills the ventricle is pumped out with each heartbeat; a reading lower than 50 percent can confirm heart failure. Lung function will likely also be checked through the use of a stethoscope to listen for signs of lung congestion.

Chronic CHF requires lifelong management. With proper treatment, CHF symptoms can improve; in some cases the heart

itself can even become stronger over time. Conventional medications used to treat CHF include angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers, both of which widen blood vessels, reduce blood pressure, and improve blood flow; digoxin (digitalis), which increases heart muscle contractions and slows the heartbeat; beta blockers, which slow heart rate and reduce blood pressure; and diuretics, to decrease fluid buildup.

Surgical procedures to treat CHF include coronary bypass surgery, heart valve repair or replacement, placement of an implantable cardioverter defibrillator, the implantation of a mechanical heart pump, and the insertion of a pacemaker. In severe cases of CHF, a heart transplant may be warranted.

Patients with CHF are often advised to weigh themselves each morning and to notify their doctors if they experience a weight gain of three pounds or more over a 24-hour period. Such weight gain is usually a sign of fluid retention, indicating the need for adjusted treatment. CHF patients are also advised to achieve and maintain a healthy weight; follow a low-fat, low-salt diet; and limit their intake of alcohol and, in more severe cases, other fluids.

Coronary Heart Disease

Coronary heart disease (CHD), also called coronary artery disease, is a type of atherosclerosis that occurs specifically in the arteries of the heart. Once the inner wall of a coronary artery becomes diseased or damaged, fatty deposits composed of cholesterol and other cellular waste products—plaque—accumulate in the coronary artery walls, hardening and narrowing these vessels and restricting blood flow. Because the coronary arteries are already narrower than your other arteries, the effects of this particular type of atherosclerosis can be serious: Deprived of blood, your heart can simply stop working. According to the CDC, an estimated 6 percent of all American adults suffer from CHD, many of them unknowingly.

As with atherosclerosis, CHD can be caused by a variety of factors, including poor diet and lack of exercise, high blood pressure, smoking, chronic stress, high levels of LDL (“bad”) cholesterol and

low levels of HDL (“good”) cholesterol, and other health conditions, including diabetes, sleep apnea, and obesity. Radiation therapy, especially when used to treat certain cancers, can also cause CHD.

Initially, symptoms of CHD may not be apparent, but as the condition worsens, so, too, do the symptoms. As the artery blockages grow, CHD can manifest as angina (chest pain), and shortness of breath. Left untreated, CHD can result in arrhythmia, heart muscle failure, heart attack, or sudden death.

Because CHD is a “silent” killer—meaning you can suffer from the disease without experiencing any of its symptoms—regular medical checkups are important for everyone, but especially for those who are considered to have a higher risk for developing this serious disease. A physical exam and a blood test will provide general screening for CHD. Your doctor may also order additional diagnostic tests, such as an electrocardiogram (EKG), echocardiogram, and a stress test. In cases of CHD where significant blockages are suspected, other tests may be prescribed, such as a computed tomography (CT) scan, angiogram, or magnetic resonance angiogram (MRA), during which magnetic resonance imaging (MRI) is used to track the progress of an injected contrast dye in order to check for areas of the arteries that may be narrowed or blocked.

Treatment for CHD usually involves a combination of drugs and lifestyle changes, including adopting a heart-healthy diet, regular exercise, stress management, the cessation of smoking, and often weight loss. The most commonly used drugs to treat CHD are aspirin, statins, beta blockers, calcium channel blockers, and ACE inhibitors. In some cases, nitroglycerin tablets, patches, or sprays may also be used to control chest pain related to CHD, and to help widen arteries. If a nonpharmacological approach is warranted, the most common procedures are angioplasty and coronary bypass surgery (see pages 10 and 11).

Enlarged Heart

Enlarged heart, or cardiomegaly, is not a disease, but rather a manifestation of another heart condition, such as coronary artery disease, high blood pressure, heart valve disease, arrhythmia, or

a weakened or damaged heart muscle. While an enlarged heart is usually a chronic condition, there are also more temporary situations in which the heart becomes enlarged for a short period of time due to pregnancy, excessive exertion, or stress being placed on the body. The risk of developing an enlarged heart increases for anyone born with a condition that affects the structure of the heart (congenital heart disease), and for people with high blood pressure or a family history of enlarged heart.

An enlarged heart can go unnoticed, with no signs that anything is wrong; alternatively, it can present with symptoms such as arrhythmia, chest pain, coughing, edema, difficulty exercising, and shortness of breath. Left untreated, an enlarged heart can result in blood clots within the heart chambers, heart failure, cardiac arrest, and sudden death.

Physicians use a variety of diagnostic methods to screen for an enlarged heart. These include electrocardiogram (EKG), echocardiogram, chest X-ray, computed tomography (CT) scan, magnetic resonance imaging (MRI), and stress testing. In addition, blood tests will usually be ordered to screen for signs of other possible heart problems.

If detected early, an enlarged heart can be treated and even reversed. Treatment options include medications such as angiotensin-converting enzyme (ACE) inhibitors, anticoagulants (blood thinners), beta blockers, diuretics, and digoxin (digitalis). Surgery may also be necessary. Surgical options include the placement of an implantable cardioverter device (ICD) or ventricular assist device (VAD), heart valve surgery, and coronary bypass.

Heart Attack (Acute Myocardial Infarction)

A heart attack, or acute myocardial infarction (AMI), occurs when blood flow to the heart is interrupted, causing heart muscle cells to die. Lack of blood flow to the heart is most often due to a blockage of a coronary artery caused by a substance called *vulnerable plaque*. Vulnerable plaque is an unstable combination of cholesterol, fatty acids, and white blood cells that can form on the arterial wall in response to inflammation. When vulnerable plaque

ruptures, blood clots can form, blocking the artery and diminishing blood flow, thus reducing oxygen supply to the heart and causing damage or death to heart muscle cells and tissues. The result is often fatal.

A wide range of factors can increase the risk of heart attack, including age, poor diet, lack of exercise, smoking, diabetes, being overweight or obese, chronic stress, high levels of physical exertion, high blood pressure, excessive alcohol consumption, the overuse of pharmaceutical or illegal drugs, kidney disease, and a personal or family history of heart disease. Risk can also be increased by various psychosocial factors, including low income or poverty, social isolation, depression, and stress. All of these factors impair survival outcomes following a heart attack.

In both men and women, symptoms of AMI may be “silent,” meaning they may occur without being noticed; an estimated 25 percent or more of all cases of AMI in the United States fall into this category. When symptoms are apparent, they occur gradually, over the course of several minutes. The most common symptoms of AMI are chest pain (which can spread down the left arm and/or the left side of the neck), shortness of breath, nausea, vomiting, excessive sweating, and chest palpitations. In women, symptoms may not be as intense or as varied, and most commonly manifest as shortness of breath, fatigue, weakness, and sensations similar to indigestion. In the most serious cases, loss of consciousness or sudden death can also occur.

Because they can be fatal, heart attacks require prompt medical attention. Diagnostic tests include the electrocardiogram (EKG), which can detect abnormalities in the electrical activity of the heart that usually occur during an AMI and also identifies the areas of heart muscle that are deprived of oxygen. Various blood tests may also be used after the incident to screen for blood markers that indicate AMI has occurred.

Once a diagnosis of AMI has been confirmed, immediate treatment can include the use of oxygen, aspirin and other blood thinners (to reduce clotting), and sometimes nitroglycerin tablets (to widen narrowed blood vessels). More invasive procedures, including surgery, may also be necessary in order to unclog

blocked arteries and restore the flow of blood and oxygen to the heart as quickly as possible. The more rapidly blood flow can be reestablished, the more heart muscle can be saved.

The restoration of blood flow to the heart is known as *reperfusion*. Methods of reperfusion include angioplasty and/or the placement of one or more stents inside the coronary arteries. These procedures are the preferred methods for preserving heart muscle, particularly if they can be performed within ninety minutes after AMI patients reach the hospital. If there is a delay past this time or if catheterization is not available, thrombolytics, or clot-busting drugs, may also be used. Patients with multiple blockages in their arteries may also have coronary bypass surgery in order to redirect and improve blood flow.

Following immediate care, with or without surgery, AMI patients will usually be prescribed various heart medications, which can include the continued use of aspirin, ACE inhibitors, beta blockers, blood-thinning drugs such as heparin, and/or statin drugs to control cholesterol levels and prevent a recurrence of heart attack. In addition, doctors will typically provide guidance about necessary dietary and lifestyle changes; stress management can be the key to a successful recovery.

Heart Murmur

A heart murmur is characterized by abnormal sounds heard during the heartbeat cycle. Heart murmur is not a disease, but it can be a sign of an underlying heart condition. There are two types of heart murmur: *innocent* and *abnormal*. Innocent murmurs do not require treatment and are common in cases that are present from birth, or congenital. Abnormal murmurs are more serious and can indicate inflammation in the heart, heart valve problems, or a hole in a wall within the heart's chambers. The severity of the abnormal murmur will determine the kind and intensity of its treatment.

Congenital heart murmur is linked to a family history of heart defects, or an illness and/or medication use that occurred during the pregnancy. Abnormal murmurs can appear at any time, but particularly later in life, and usually indicate a developing heart

condition such as a narrow or leaky valve (see page 30). Factors that raise the risk of heart murmurs include high blood pressure, rheumatic fever, a weakened heart muscle, and a past heart attack.

People with innocent murmurs are unlikely to experience symptoms aside from the murmur itself—a disruption, extra beat, or whooshing sound that's heard when listening to the heartbeat. People with abnormal murmurs may also have symptoms that derive from the underlying condition causing the murmur, including chest pain (angina), shortness of breath, excessive sweating, dizziness or fainting, chronic cough, bluish skin (particularly around the lips and fingertips), swelling or sudden weight gain, enlarged liver or neck veins, and poor appetite and failure to grow in infants.

Physicians can detect a heart murmur using a stethoscope. The stethoscope also allows them to evaluate the murmur according to how loud it is, where in the heart it is located, when it occurs and for how long, and whether its sound changes with changes in body position. If further tests are necessary, they may include chest X-rays, an electrocardiogram (EKG), an echocardiogram, transesophageal echocardiogram (TEE), a CT scan, or an MRI.

Treatment is unnecessary for innocent murmurs; even with abnormal murmurs, physicians may elect to monitor the effects over time. Additional medical care, when ordered, usually treats the heart condition that is the source of the murmur, and might involve anticoagulants, diuretics, angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs), statins, beta blockers, or digoxin. If necessary, surgery or catheterization might be performed in order to repair or replace heart valves, or to patch a hole in the heart.

Heart Muscle Disease

Heart muscle disease, or cardiomyopathy, refers to any of a number of diseases that affect the heart muscle. In cardiomyopathy, the heart muscle becomes enlarged, thick, or rigid; sometimes, it is even replaced with scar tissue. As a result, the heart's ability to

pump blood to the rest of the body is impaired. Left untreated, heart muscle disease can lead to heart failure and death.

There are three main types of cardiomyopathy: *dilated*, *hypertrophic*, and *restrictive*. Dilated cardiomyopathy is the most common of the three. In this condition, the heart's main pumping chamber, the left ventricle, becomes enlarged, or dilated, and can no longer effectively pump blood out of the heart. Hypertrophic cardiomyopathy is characterized by abnormal growth or thickening of the heart muscle, once again preventing blood from being pumped out of the heart. Restrictive cardiomyopathy is a condition in which the heart muscle weakens and loses its ability both to pump out and fill with blood between heartbeats.

Cardiomyopathy can be inherited (passed on by one or both of your parents) or acquired (developed as a result of another condition or factor). Around one-third of all cases of dilated cardiomyopathy are inherited; other risk factors include coronary heart disease or heart attack, high blood pressure, diabetes, thyroid disease, viral hepatitis, HIV, and the abuse of alcohol and certain drugs. Most cases of hypertrophic cardiomyopathy are inherited, caused by a mutation that makes the heart muscle grow especially thick; some cases, however, are associated with diabetes or thyroid disease. Restrictive cardiomyopathy is often linked to diseases such as hemochromatosis, in which excess iron builds up in your body; sarcoidosis, an inflammatory disease; amyloidosis, in which excess protein builds up in your body; and some types of cancer and cancer treatments.

In the early stages of cardiomyopathy, symptoms may not be apparent; in many cases, the first symptom will be the last—a sudden collapse due to heart failure. Otherwise, common symptoms include sensations of breathlessness, even when at rest; swelling of the ankles, feet, and legs; bloating and fluid buildup in the abdomen; fatigue; dizziness; fainting; chest pain; cough; and arrhythmia.

A variety of diagnostic tests can be used to detect heart muscle disease. Your doctor will need to take into account your personal and family history, and also screen for symptoms, including heart murmurs and swelling of the ankles, feet, abdomen, or neck

veins. If cardiomyopathy is suspected, you may be asked to undergo additional tests, including chest X-rays, electrocardiogram (EKG), angiogram, MRI, or, in some cases, cardiac catheterization with biopsy, in which a catheter is inserted into the groin and then threaded upward to the heart in order to extract a small sample of heart tissue for analysis. Sometimes, your doctor will order a specific blood test that measures the level of a chemical known as brain natriuretic peptide (BNP), which is often elevated when the heart is under stress.

Treatment for heart muscle disease varies according to the type, but the primary goal is always to manage symptoms and keep them from worsening. Drugs prescribed for dilated cardiomyopathy include angiotension-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs), beta blockers, diuretics, and digoxin. The insertion of an implantable cardioverter device (ICD) may also be necessary to help regulate the contractions between the heart's left and right ventricles.

Beta blockers and calcium channel blockers are the two most common classes of drugs used to manage hypertrophic cardiomyopathy. If necessary, an ICD or a regular pacemaker may be implanted. In some cases, other types of surgery may be performed. The first is known as septal myectomy, a form of open-heart surgery in which parts of the thickened, overgrown heart muscle wall (known as the septum) are removed to improve blood flow. A second type of surgery, known as septal ablation, or septal alcohol ablation, destroys a small portion of the thickened heart muscle. This is accomplished by injecting alcohol through a catheter into the artery that delivers blood to the septum.

In cases of restrictive cardiomyopathy, doctors often recommend a low-salt diet along with careful monitoring of water intake. Diuretic and blood pressure medications will often be prescribed. Beta blockers and calcium channel blockers may also be used along with blood thinners and drugs in order to regulate heart rhythm. In certain cases, a pacemaker may be surgically implanted or a heart transplant may be performed, but surgery is rarely undertaken, due to poor likelihood of success.

High Blood Pressure (Hypertension)

High blood pressure, or hypertension, affects 76.4 million Americans today. Blood pressure is essentially a measure of the force (pressure) exerted by circulating blood on the walls of your arteries. Hypertension occurs when the force becomes so strong that it begins to stretch or cause damage to the arteries. Serious cases of hypertension can eventually create other health problems, including heart attack and stroke.

There are two types of hypertension: *primary (essential) hypertension* and *secondary hypertension*. Primary hypertension usually develops gradually over many years, and can be caused by a number of genetic and environmental factors, including age, gender, race, family history, stress, excessive sodium or alcohol consumption, poor diet, lack of exercise, and being overweight or obese. Secondary hypertension is usually caused by an underlying health condition, such as kidney disease, adrenal gland tumors, congenital heart conditions, or by the use of pharmaceutical drugs, including birth control pills, cold and flu remedies, decongestants, and pain medications, and illegal drugs such as amphetamines and cocaine.

Most of the time, there are no symptoms of hypertension. When symptoms do appear, it is usually a sign that the condition has progressed and may even be life threatening. The most common symptoms are dull headaches, dizzy spells, and sometimes nose bleeds.

High blood pressure is easily diagnosed; a simple blood pressure reading can be taken using an automatic cuff-style monitor at the doctor's or even at some local drugstores. Many communities also offer free blood pressure screenings throughout the year. If you are particularly concerned, you can even buy a monitor for home use.

Usually, physicians will take two or more blood pressure readings during separate appointments before making a diagnosis of hypertension. That's because blood pressure levels vary over the course of the day, and can also spike in the presence of doctors due to nervousness or anxiety—a phenomenon known as “white

coat" hypertension. For this reason, many doctors wait until their patients are relaxed and comfortable before taking blood pressure readings.

In any blood pressure reading, there are two measurements taken. The first (top) number is your systolic blood pressure, or the pressure that is exerted on your blood vessels when your heart contracts, pumping blood through your body. The second (bottom) number is your diastolic blood pressure, or the pressure exerted on your blood vessels when your heart relaxes. For people age fifty or older, a high systolic reading with a normal diastolic reading most frequently indicates hypertension. (For more information on blood pressure levels, consult the inset below.)

BLOOD PRESSURE LEVELS IN ADULTS		
CATEGORY	SYSTOLIC (TOP NUMBER)	DIASTOLIC (BOTTOM NUMBER)
Normal	Less than 120	<i>and</i> Less than 80
Prehypertension	120–139	<i>or</i> 80–90
High blood pressure		
Stage 1	140–159	<i>or</i> 90–99
Stage 2	160 or higher	<i>or</i> 100 or higher

Once a diagnosis of hypertension is made, other screening tests may be ordered to determine whether the hypertension is a symptom of an underlying condition. These include blood tests or an electrocardiogram (EKG) or echocardiogram to screen for other possible signs of heart disease, or perhaps a urine test to screen for kidney problems.

Proper treatment of hypertension begins with a healthy, low-sodium diet, regular moderate exercise, and stress management. Blood pressure medications may also be necessary and can range from diuretics and vasodilators (drugs which cause the arteries to relax and widen) to angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs), beta blockers, and calcium channel blockers. Once you have been diagnosed

with high blood pressure, regular checkups will also be advised in order to monitor your condition.

Mitral Valve Prolapse

While both of the valves that connect your upper and lower heart chambers can develop disorders, mitral valve prolapse, or MVP, is the more common valve condition. In MVP, the mitral valve, which connects your left atrium and left ventricle, doesn't close properly. Instead, this valve bulges, or prolapses, into the left atrium every time that the heart muscle contracts. In some cases, this can cause blood to leak backwards into the left atrium, causing what is known as mitral valve regurgitation.

Although MVP can develop at any age, it's most common in men above the age of fifty, and tends to be inherited from a parent. A number of diseases can also increase the risk of MVP, including adult polycystic kidney disease (a genetic disorder of the kidneys), Ebstein's anomaly (a rare heart defect that causes leakage between heart chambers), or certain conditions that affect the connective tissues, including Ehlers-Danlos and Marfan syndromes. Scoliosis, or abnormal curvature of the spine, can also increase the risk of MVP.

Many people with MVP do not experience any symptoms and are therefore surprised to discover that they have this heart condition. When symptoms are present, they may include arrhythmia, dizziness, shortness of breath, fatigue, and/or chest pain. People who have MVP are at a higher risk for a condition called *endocarditis*, in which the inner tissue of the heart becomes infected with bacteria.

The easiest way to test for MVP is with a stethoscope; if MVP is present, your doctor will hear clicking sounds or a heart murmur, as both are good aural indicators of an abnormal flow of blood in the heart. Other diagnostic tests associated with leaky valve (mitral regurgitation) may include chest X-ray, electrocardiogram (EKG), echocardiogram, stress testing, and cardiac catheterization.

Most cases of MVP are not serious and do not require treatment or even changes in lifestyle. If symptoms are present, usual-

ly due to an arrhythmia or a leaky valve, your doctor may decide to monitor your condition to ensure that it doesn't worsen, or prescribe drugs such as aspirin, anticoagulants, or beta blockers. Surgery is rarely necessary, but occasionally open heart surgery is performed in order to repair or replace the leaky mitral valve.

Pericarditis and Pericardial Effusion

Pericarditis is an inflammation of the pericardium, the thin set of membranes that encases the heart. When the pericardium is inflamed, its two layers rub against each other, causing painful friction. There are two kinds of pericarditis: acute, which lasts for six weeks or less, and chronic, which can last for six months or longer. Although unpleasant, pericarditis is rarely fatal.

By contrast, pericardial effusion is more serious. In this condition, fluid builds up between the two layers of the pericardium, putting pressure on the heart and preventing it from functioning properly. Severe cases of pericardial effusion can force the heart's chambers to compress or even collapse; this condition is life-threatening and is called cardiac tamponade.

While the cause of pericarditis is not always clear, viral or bacterial infections are often to blame. Risk factors for pericarditis also include chest injury, kidney disease, heart attack, lupus, and rheumatic fever. Pericardial effusion is often, but not always, a response to pericardial inflammation. It can also be caused by viral, bacterial, fungal, or parasitic infections; autoimmune diseases (lupus, HIV); certain types of cancer; and trauma to the heart (caused by injury or surgery).

Acute pericarditis produces sharp, stabbing chest pains that come and go quickly; sufferers may believe they're experiencing heart attacks. Other symptoms include fever, weakness, difficulty breathing, and coughing. Chronic pericarditis will cause fatigue, coughing, shortness of breath, and swelling of the stomach and legs; chest pain is often absent.

Symptoms of pericardial effusion include shortness of breath or difficulty breathing, chest pain behind the breastbone or the left side of the chest that is exacerbated by inhalation and wors-

ens when lying down, coughing, dizziness, low-grade fever, and rapid heart beat. Symptoms may not be initially apparent, manifesting only when the fluid buildup increases.

Your doctor may be able to diagnose pericarditis or pericardial effusion using a simple chest exam with a stethoscope; other tests include electrocardiogram (EKG), echocardiogram, chest X-rays, MRI, and CT scan. Blood tests may also be ordered to help determine underlying causes.

Treatment for pericarditis and pericardial effusion might include anti-inflammatory drugs such as aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs), colchicine, and corticosteroids such as prednisone. If bacterial infection is suspected as the cause of the inflammation, antibiotics will be prescribed. In cases of cardiac tamponade, a procedure called pericardiocentesis or even open-heart surgery may be required in order to drain the pericardium. Often, a catheter will be left in the pericardium in order to encourage further drainage; it is then removed after a few days. Rarely, the pericardium itself will be removed, in a procedure called pericardiectomy.

Premature Ventricular Contractions

Premature ventricular contraction, or PVC, is a common condition that occurs when one of the ventricles produces an extra, abnormal heartbeat, disrupting the regular heart rhythm and thus, potentially, the flow of blood. Most people will experience a PVC at one time or another—it's often described as the sensation of the heart "skipping a beat," although in fact the heart is actually adding one.

The causes of PVC aren't always clear, but are generally thought to be rooted in faulty electrical impulses. Other factors that increase the likelihood of a PVC include biochemical changes or imbalances in the body (e.g. low potassium or magnesium), alcohol or drug abuse, overexertion, excess caffeine consumption, smoking, hypertension, anxiety, and other underlying heart conditions. Certain medications, particularly those used to treat asthma, can also trigger PVCs. While most cases of PVC are harmless,

in others they can lead to arrhythmias which, if they become chaotic enough, can result in sudden cardiac death.

Many people who have a PVC will never even notice it. If you do notice, you might feel as if your heart is racing, flip-flopping, or fluttering, or as if it has either skipped a beat or stopped.

The standard method for detecting PVC is an electrocardiogram (EKG), with or without a stress test. In some cases, devices such as the Holter monitor or an event recorder can also be used. A Holter monitor is a small, portable device that can be carried in your pocket or attached to your belt. It automatically records your heart rhythms for a twenty-four hour period, so that your doctor can better detect any anomalies. An event recorder is a small portable EKG device that can also be carried on your person the way a Holter monitor can. When PVC symptoms are experienced, the recorder is activated with the push of a button so that a brief EKG recording is made. This enables doctors to see the heart rhythm as the PVCs occur.

Because PVCs are usually innocuous, treatment is rarely required for people who have no underlying heart conditions. If the symptoms are particularly frequent or troubling, however, your doctor may encourage you to make lifestyle changes that can minimize PVC triggers, such as avoiding alcohol, limiting caffeine intake, quitting smoking, and stress management. In the event that medication is required to treat a PVC, beta blockers are the drugs most commonly used.

Stroke

A stroke is caused when the blood supply to the brain is interrupted or severely reduced, either because an artery has ruptured (burst) or because it has been blocked by a clot. Deprived of oxygen and other nutrients that the blood transports, brain cells begin to die within minutes after a stroke occurs. Prompt medical attention is thus essential to limiting brain damage and other potential complications. Nearly 800,000 Americans will experience a stroke each year; it is the fourth most common cause of death in the United States and a leading cause of disability.

There are two main types of stroke. The most common is called an *ischemic stroke*, which accounts for 87 percent of all strokes each year. An ischemic stroke occurs when an artery to the brain becomes blocked by a blood clot, causing severely reduced blood flow (ischemia). There are two subcategories of ischemic strokes: *thrombotic strokes*, in which the blood clot forms in an artery that has already been narrowed (usually by atherosclerosis), and *embolic strokes*, in which the clot breaks off from another location (usually the heart) and travels to one of the brain's blood vessels, which are too narrow to allow the clot through.

Hemorrhagic stroke accounts for the other 13 percent of all strokes, and refers to a stroke that is caused by a blood vessel that ruptures and then leaks blood (hemorrhages) into the brain. There are two subcategories of hemorrhagic stroke. The first type is *intracerebral hemorrhage*, in which a blood vessel in the brain bursts, spilling its contents into surrounding brain tissue, damaging brain cells and depriving them of oxygen. The second type is *subarachnoid hemorrhage*, which is caused by the bursting of an artery or aneurysm (abnormal bulge or "balloon" in a blood vessel) on or near the surface of the brain.

A particularly acute form of subarachnoid hemorrhage is due to the rupture of an *arteriovenous malformation* (AVM). An arteriovenous malformation is an abnormal tangle of blood vessels in or on the surface of the brain; they are usually present from birth and affect less than one percent of the population. While many AVMs are harmless, they are known to hemorrhage in over half of all patients who have them, and thus must be monitored regularly.

In addition to the two main categories of stroke, you can also suffer a *transient ischemic attack* (TIA), or what is sometimes called a mini-stroke. A TIA is similar in nature to an ischemic stroke, in that it, too, is caused by a blood clot; the only difference is that in a TIA, the blood clot eventually passes through, ending the blockage. Although the symptoms are nearly identical, a TIA is not formally classified as a stroke, because the blockage is temporary, lasting five minutes or less. People who experience TIAs may suffer some brain damage, and are still at

risk for a full-blown stroke later on. Because of this, prompt medical attention is recommended even when symptoms seem to be fleeting.

A variety of factors increase the risk of stroke, including poor nutrition and diet, hypertension, lack of regular physical activity, being overweight or obese, smoking or regular exposure to secondhand smoke, diabetes, a previous history of heart disease, excessive alcohol consumption, the use of illegal drugs such as cocaine and amphetamines, and sleep apnea, a condition in which oxygen levels fluctuate and drop during the night due to intermittent interrupted breathing. Use of birth control pills can also increase the risk of developing blood clots, and thus stroke. In addition, race can be a factor; statistically, African Americans have a higher risk for stroke than whites and other groups.

Symptoms vary according to the type and severity of the stroke. They include sudden dizzy spells, loss of coordination or difficulty walking, slurred speech, difficulty understanding speech, paralysis or numbness of the face, arm or leg, and blurred or blackened vision in one or both eyes. A person who suffers a hemorrhagic stroke may also experience a sudden, sharp headache, which may or may not be accompanied by vomiting. At the first sign of symptoms, dial 911 for immediate medical attention, for the sooner you receive treatment, the higher your chances will be for a successful recovery.

Ischemic stroke is more likely than hemorrhagic stroke to be fatal. In both types, the risk for a second stroke is greatest in the weeks or months following the first; thus it is vital that proper treatment and preventive measures be taken.

In order to ensure appropriate treatment, the doctor will need to identify the type of stroke suffered. A thorough physical exam will be conducted, with questions about the symptoms experienced and their duration. Blood tests will be ordered to determine more information about the levels of blood sugar and other chemicals, and to determine how quickly the body forms blood clots. The patient might also undergo a CT scan and/or MRI to detect brain damage, an ultrasound of the carotid arteries in the neck to determine blood flow and plaque build up, an angiogram of neck

and brain arteries, or an echocardiogram to determine the source of blood clots in the heart.

Treatment varies according to the type of stroke suffered. For ischemic strokes, doctors focus on quickly restoring proper blood flow to the brain. This can be accomplished by giving the patient aspirin immediately following the stroke to prevent further clots from forming. Simultaneously, blood clot-dissolving drugs called thrombolytics will be administered, ideally within 4 to 5 hours after the stroke occurs; the most common thrombolytic used is called tissue plasminogen activator (TPA). In severe cases of ischemic stroke, physicians may surgically thread a thin tube (catheter) through an artery and up to the brain, in order to deliver TPA directly to the area where the stroke occurred and bust the clot. A catheter might also be used to insert a small device to mechanically capture and remove the blood clot.

In some cases, surgical measures might be taken in order to prevent the risk of a future stroke. This can be accomplished by angioplasty with stents or by a procedure called carotid endarterectomy, in which the carotid artery is opened to remove the plaque that is blocking it. The artery is then either stitched up or patched using material from another vein or an artificial graft.

In cases of hemorrhagic stroke, the focus is on controlling bleeding in the brain, and to reduce pressure caused by the bleeding. In such cases, aspirin, thrombolytic drugs and TPA cannot be given, as these drugs can cause the bleeding to worsen. Instead, drugs to lower blood pressure levels, prevent seizures, and reduce brain pressure will likely be used. It may also be necessary to repair blood vessels surgically. Procedures include surgical clipping, in which a tiny clamp is attached to the base of the damaged blood vessel or aneurysm in order to prevent it from bursting, and coiling, in which small coils are threaded into an aneurysm to block blood flow. When hemorrhagic stroke is threatened or caused or by the rupture of an arteriovenous malformation (AVM), surgery can also be performed to remove the problematic veins if they are small and easily accessible.

Treatment will also be necessary to manage the lingering after-effects of a stroke, which include loss of muscle control or paralysis

on one side of the body, continued problems speaking and being understood, difficulty reading or writing, difficulty swallowing, mental confusion and memory problems, pains or numbness in the parts of the body affected by the stroke, and depression or other emotional problems. Most people require some degree of caretaking after suffering strokes, and many will need to undergo a rehabilitation program in order to regain speech and muscle capacity. A psychologist or psychiatrist may also be necessary in order to deal with any depression or other lingering emotional problems that result from the stroke. With proper treatment and rehabilitation, symptoms can improve over time, and even resolve fully.

THE RISK FACTORS

Having read about the most common types of cardiovascular disease, you now understand how serious our national epidemic is, and why it is truly “at the heart” of America’s health care crisis. Although treatment options are expanding, the best way to manage heart disease is to prevent it from happening in the first place. In addition to regular screenings from your doctor, true prevention of heart disease involves addressing all of the known risk factors that increase its likelihood of occurrence. The most common risk factors for each condition were mentioned in the earlier descriptions. Now let’s examine these risk factors separately in order to get a better sense of the roles they play in heart disease.

There are two categories of risk factors: uncontrollable (non-modifiable) and controllable (modifiable). As the name implies, uncontrollable risk factors are facets of your life that you have no control over, such as age, hereditary factors (your genes), a family history of heart disease, and race. African Americans, Native Americans, and Mexican Americans all have a higher risk for developing heart disease compared to whites and Asian Americans.

By contrast, controllable risk factors are those you *can* manage in order to minimize your risk of cardiovascular disease. Although doing so does not guarantee that you will never develop heart disease, at the minimum, proactive behavior allows you

to improve your mindset and your health in other areas. The most common controllable risk factors are discussed here.

Being Overweight or Obese

Because of poor eating habits and a sedentary lifestyle, Americans are getting fatter. According to the CDC, nearly 34 percent of all men and women in the United States are obese (at least 20 percent over their ideal body weight), and an additional 30 percent more are unhealthily overweight, though not yet obese. Being overweight strains your heart and can contribute to other risk factors for heart disease, including high blood pressure, diabetes, and high cholesterol. If you are overweight, seek help to lose weight by eating right and exercising.

High Blood Pressure (Hypertension)

High blood pressure is the most common risk factor for heart disease, affecting nearly one in three adults in the United States. Have your blood pressure levels regularly screened by your doctor, and learn how to control it with diet, exercise, stress and/or weight management, and, if necessary, blood pressure medications. For more information, see the section on hypertension (page 28).

High LDL and Total Cholesterol Levels, Low HDL Cholesterol Levels

High levels of low-density lipoprotein (LDL or “bad”) cholesterol and total cholesterol, along with low levels of healthy HDL cholesterol, have long been linked to an increased risk for heart disease. Because cholesterol is a major risk factor, your intake of this fatty substance must be controlled. Cholesterol management should be individually tailored to take into account your other specific risk factors, but will almost always involve eliminating unhealthy trans fats, junk food, and soft drinks from your diet.

Lack of Exercise

Americans live increasingly sedentary lifestyles; most of us fail to get the exercise we need. Regular physical activity will significantly reduce your risk of coronary heart disease, and provides a wealth of other benefits as well—it helps people lose weight, reduce stress, strengthen bones and muscle, and raise their HDL (“good”) cholesterol levels. You don’t need to be a gym rat to achieve these benefits, either. In fact, a growing body of research indicates that moderate exercise is sufficient for most people’s requirements. A daily walk, gardening, bicycling, and swimming are all excellent ways to get the exercise you need. The key is to pick an activity that you enjoy doing and stick to it—getting twenty to thirty minutes of exercise each day will put you on the right path to optimal health and make you feel much better. If you are not used to physical activity, be sure to consult with your physician first before beginning an exercise program.

Poor Dental Hygiene

Historically, some studies have indicated that gum disease seemed to be associated with a higher risk for heart disease. It seemed to make good sense that bacteria from the mouth could enter the bloodstream and travel to other areas of the body—including the heart—where they would cause inflammation and contribute to atherosclerosis. More recently, however, the American Heart Association issued a statement casting doubt upon this theory. Gum disease and heart disease share certain common risk factors—including smoking, age, and diabetes—which probably account for the correlation previously observed between the two conditions. But correlation does not give us proof of causation. In other words, it is now considered highly unlikely that gum disease causes heart attack or stroke.

Even so, it is in your best interest to maintain good dental hygiene by brushing your teeth, flossing, and using a germ-killing mouthwash daily. These are all essential self-care measures you can and should take to maintain your overall health.

Poor Diet

The standard American diet is responsible for much of our nation's health care crisis, and plays a major role in many cases of heart disease. Your diet is another area over which you have a great deal of control. Emphasize foods that are healthy for you and free of chemical additives; eat an abundant supply of fresh vegetables each day, along with lean meats, poultry, and heart-healthy fish such as salmon (avoid fish that is farm-raised due to the food dyes, antibiotics, and other additives they contain), and moderate amounts of whole grains and legumes. For snacks, consider nuts or fruit in place of sweets, and avoid junk and fast food.

Smoking

Smoking is a deadly habit that affects almost every organ in your body. Tobacco is linked to one out of every five deaths in America, and is responsible for at least 30 percent of all cancer deaths. In addition, smoking is a major risk factor for cardiovascular disease. Smoking decreases the supply of oxygen to the heart, increases blood pressure and heart rate, and also causes the formation of unhealthy blood clots. Even light smoking causes damage to the heart and blood vessels, and can change the structure of blood vessels. Smoking is a major risk factor for atherosclerosis and significantly increases your risk of developing heart disease. In fact, the risk of heart attack is over 50 percent higher for smokers compared to nonsmokers, and even higher than that for heavy smokers (ten or more cigarettes a day). If you smoke, quit; seek help to do so, if necessary. If you don't smoke, but are frequently around people who do, try to limit your exposure, as people who inhale secondhand smoke also run a higher risk for developing heart disease.

Stress and Uncontrolled Emotions

Both stress and uncontrolled emotions, especially anger, significantly raise the risk for heart disease, and have been linked to high-

er risk for heart attack and stroke. Research has shown that chronic stress can increase the risk of heart attack by nearly 30 percent. In addition, uncontrolled stress has also been shown to elevate blood pressure and increase levels of LDL (“bad”) cholesterol.

If you suffer from chronic stress or have trouble controlling your emotions, consider exploring stress and anger management techniques, either on your own or with the help of a health professional. Also consider making time for hobbies or other activities you enjoy, and for spending time with friends and family members who are supportive of your needs. By becoming more conscious of how you respond to stressful or upsetting conditions, you will start to gain better control over your reactions.

Type 2 (Adult-Onset) Diabetes and Prediabetes

Type 2 diabetes is a condition in which the blood contains high levels of unregulated glucose (sugar) due to the body’s inability to produce or use a substance called insulin. If not properly treated and controlled, type 2 diabetes and its precursor, prediabetes, can cause serious damage to the heart and lead to heart attack, stroke, and other forms of heart disease. Both type 2 diabetes and prediabetes are virtually nonexistent in cultures that adhere to a healthy diet and get regular exercise, yet their incidence in the United States continues to skyrocket. Fortunately, both conditions are easily managed; with proper diet, exercise, and weight loss, prediabetes can even be reversed if caught promptly. If you suffer from either type 2 diabetes or prediabetes, be proactive and take control before your condition takes control of you.

THE MISSING LINK

As you can see, there are many aspects of your life that you can control and change in order to lower your risk for cardiovascular disease. Unfortunately, because there are many other aspects of your life that you can’t control, sometimes even the best intentions go unrewarded. The fact is that many people who are overweight or have high blood pressure and high cholesterol live long

lives without suffering from heart disease, while many others who have addressed these same risk factors and eliminated them are still prone to heart attacks and other heart conditions. Research shows that many patients with normal LDL (“bad”) cholesterol levels still go on to develop heart disease. Although scientists today are at a loss to understand why, you needn’t be.

Over the last sixty years, a tremendous body of research has accumulated on the considerable benefits of a single mineral supplement. The research increasingly indicates that this element is the missing link between all these heart conditions, a simple substance without which our bodies suffer, and which, when used as a dietary supplement, can dramatically improve your cardiovascular health, and your quality of life more generally. This substance is magnesium—and the more you know about it, the more control you’ll have over your health.

The goal of this book, therefore, is to show you how vital magnesium is, especially with regard to maintaining a healthy heart and circulatory system. When taken regularly, magnesium may prove beneficial in preventing and treating the heart diseases that have so plagued our country. In the next chapters, you will see why magnesium is indeed “magnificent” and why you are almost certainly deficient in it. Then, in subsequent chapters, you will learn how the cardiovascular and circulatory systems work, the essential roles that magnesium plays in keeping them both functioning properly, what heart disease really is, what other health conditions magnesium helps to prevent and reverse, and, finally, how you can ensure that you are getting all of the magnesium you need safely and effectively.

To find out how a single nutrient can make a huge difference in your health, read on.