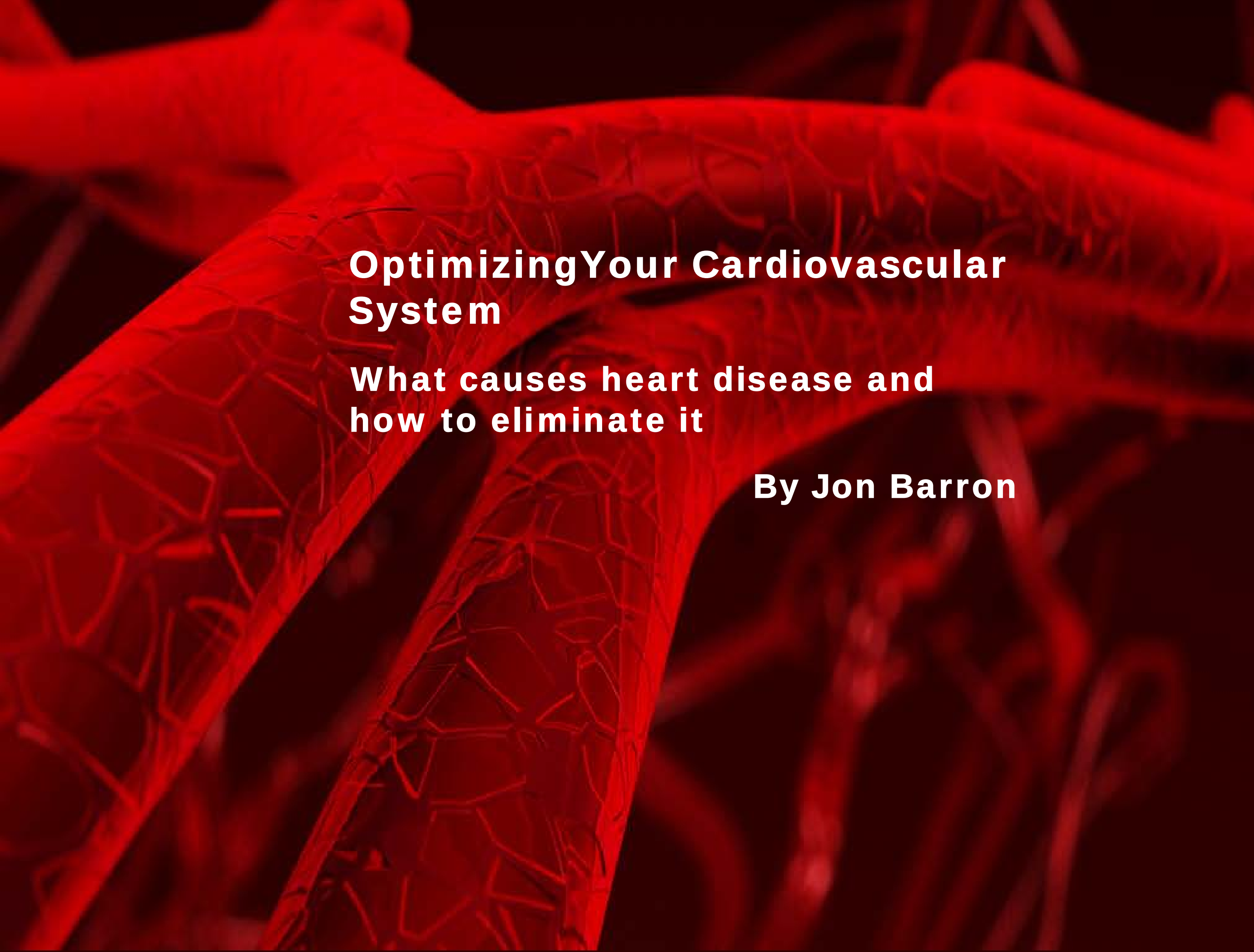


OptimizingYour Cardiovascular System

What causes heart disease and how to eliminate it

By Jon Barron

Heart disease is the leading cause of death in the world. In the United States, it is not only the leading cause of death but is a major cause of disability. The most common heart disease in the United States is coronary heart disease, which often appears as a heart attack. According to the Centers for Disease control, in 2009, an estimated 785,000 Americans will have a new coronary attack, and about 470,000 will have a recurrent attack. About every 25 seconds, an American will have a coronary event, and about one every minute will die from one.

To solve this problem, every year doctors announce some new magic pill or surgical technique to cure heart problems. And each year, heart disease continues to be the leading cause of death in the developed world. Doctors just don’t get heart health. Over the years, they have attributed the cause of cardiovascular disease to smoking, eating habits, weight problems, high-cholesterol, high blood pressure, and just plain genetic bad luck. But even now, scientists are discovering that free radicals, Omega-6 fatty acids, high homocysteine levels, circulating immune complexes in the blood, overall systemic inflammation, and more also play fundamental roles in the onset of heart disease.

Introduction

In the following extensive report on cardiovascular system, you will find that cardiovascular health is possible and heart disease is even reversible! Information on naturally reversing heart disease may be shocking to some, but the health secrets revealed in this report could also open your eyes to a whole new world of how alternative medicine can help heal even the most dire health conditions, once you get to the root of the problem.

To help you understand these heart health secrets, this report will discuss all aspects of the cardiovascular system: from the anatomy of the heart and its valves to the functioning of the arteries, veins, and blood. Take a medical journey and discover exactly what your doctor is looking at when you visit him/her for a check-up. Learn how to evaluate your doctor's perspective, and empower yourself with the right information to make informed decisions.

The following report is broken down into seven chapters:

Chapter One: Anatomy of the Heart

By looking at the basic anatomy and physiology of the heart from a doctor's perspective, we can better understand symptoms of heart disease and how to evaluate common medical treatments. More importantly, you can make informed decisions on what alternatives might actually work to improve your cardiovascular health.

Chapter Two: Heart Problems and Alternative Health Solutions

Although many problems with the heart may seem to be biomechanical in nature and beyond the purview of nutrition and supplements, that's not necessarily true. Learn some of the natural remedies that can actually heal heart disease.

Chapter Three: Understanding Your Doctor's Diagnosis

Learn to take the mystery out of a doctor's diagnosis so that you know what your doctor is looking at, listening to, and analyzing when he/she is looking at your heart. Arm yourself with some basic diagnostic knowledge so you are not totally at the mercy of the medical mystique when the results of your next physical are pronounced.

Chapter Four: Vascular Problems: Clogged Arteries to DVT

Explore the vascular system — your arteries and veins. Gain a deeper understanding of your body's systems so that you can communicate with your doctor and actively participate in your treatment. If you have high blood pressure, blood clots, or atherosclerosis, it's imperative that you fully understand how that happened, the physiological consequences of any medical treatments, and any viable alternative solutions that might be available to you.

Chapter Five: The Functions of Blood and How It Maintains Health

The cardiovascular system has only one purpose—to move blood through the body. Learn the role of blood, from transporting oxygen and nutrients to removing waste, and how proper diet and hydration can assist your blood in protecting your overall health.

Chapter Six: Blood Composition and how that Affects Your Health

It's important to examine the composition of blood and how that determines its functionality. This insight will give you access to a world of alternatives that your doctor is unlikely to inform you about—or to be informed about themselves, for that matter.

Chapter Seven: Understanding Blood Types & Blood Tests

We conclude our report by exploring blood types and blood tests. Specifically, you're going to learn about the importance of blood type, how it affects diet, what doctors test for when they check your blood, and what the results mean to you.

Appendix: Protocol Summary

A summary of all the recommendations and protocols detailed in the preceding seven chapters.

Once we understand the underlying basis of medical treatments used to correct heart problems, we can make informed decisions as to which of those treatments and medications actually make sense for us...and, more importantly, what alternatives might actually work better. So with that in mind, let's begin our journey and start with the anatomy of the heart.

Chapter 1: Anatomy of the Heart

Why talk about the heart from a medical point of view? How boring, unless you're a doctor that is. Right?

Not necessarily.

By looking at the basic anatomy and physiology of the heart from a doctor's perspective, we gain a unique privilege. We get to evaluate that perspective. Once we understand the underlying basis of medical treatments used to correct heart problems, we can make informed decisions as to which of those treatments and medications actually make sense for us...and, more importantly, what alternatives might actually work better. So with that in mind, let's take a look at the human heart.

Quick facts

Your heart is located between your lungs in the middle of your chest, immediately behind and slightly to the left of your breastbone (sternum). In this location, it is protected by the breastbone in front, the spinal column in back, and the ribs on the sides. It weighs 7-15 ounces and is about the size of a human fist.

With each beat, the heart muscle expands and contracts, sending 2 to 3 ounces of blood on its way through the vascular system. The full circuit around the lungs and body (covering a mind boggling 50-60 thousand miles of branching blood vessels) takes only about one minute to complete when the body is at rest. In that same minute, your heart can pump some 1.3 gallons of blood to every cell in your body. Over the course of a day, we're talking about 100,000 heartbeats shuttling some 2,000 gallons of oxygen rich blood throughout your body. That works out to some 35 million beats a year and an unbelievable 2.5 - 3.5 billion beats in a lifetime. Another way of looking at it is that the heart pumps approximately 700,000 gallons a year and almost 50 million gallons in an average lifetime.

Two circulatory systems

I will cover the circulatory system in detail in its own chapter a little later, but for now it's important to understand in our discussion of the heart that the heart actually pumps blood through two very distinct circulatory systems.

- Systemic
- Pulmonary

The systemic system is what most people think of when they think of the circulatory system. That's the system that feeds the organs, tissues, and cells of your body. That's the system in which fresh oxygenated blood pumps out through the arteries and in which deoxygenated blood returns to the heart through the veins. The pulmonary system is actually quite different – just the opposite in fact. Deoxygenated blood is pumped out of the heart through the pulmonary arteries into the lungs, and recharged oxygenated blood returns to the heart through the veins. It is this recharged oxygenated blood that gets pumped out through the systemic circulatory system. Understanding these differences will be important later. For now, just consider the simple fact that these two separate systems must be perfectly balanced in terms of input and output. If for example, the pulmonary system is just one drop a minute behind the systemic system, in short order, the left ventricle of the heart (the chamber that pumps blood out to your body) will become under-filled with blood and cease to function efficiently.

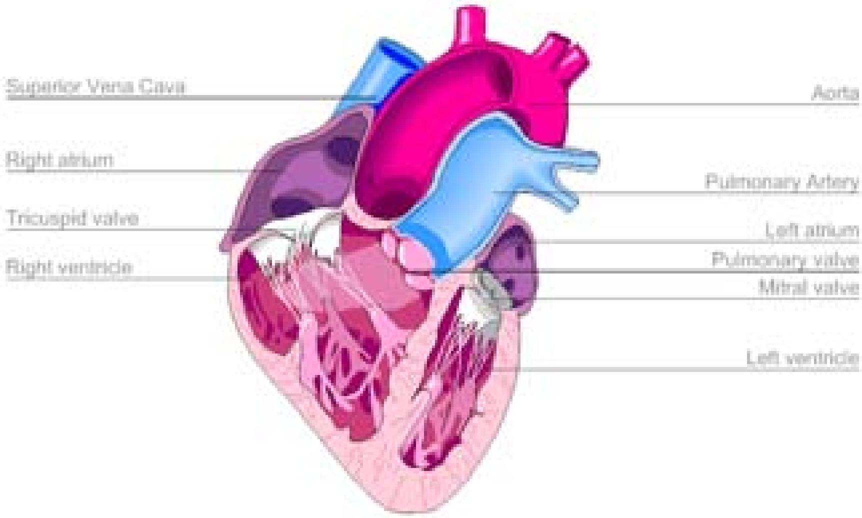
Construction of the heart

The tissue of the heart is comprised of three layers. The primary layer, the middle layer, is called the myocardium. This is the actual muscle tissue of the heart and the part of the heart that will feature most prominently when we talk later about what can go wrong with the heart. The myocardium is a thick strong muscle and comprises the bulk of the heart. It is formed of smooth involuntary muscle like your intestines and your bladder – but with a several key differences.

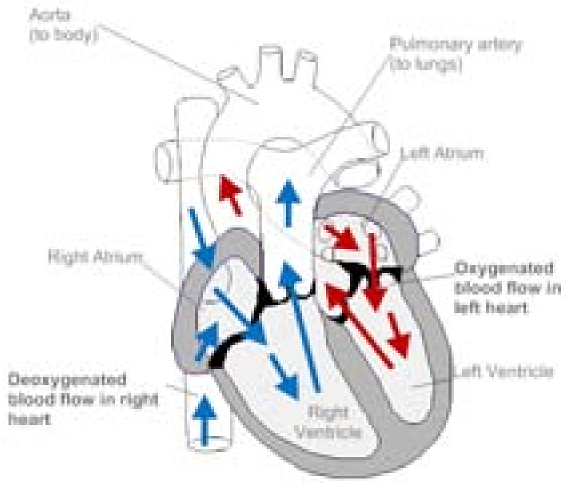
- It has built in rhythmicity. That is to say, unlike other muscle tissue, it is self-stimulating and doesn't require a signal from the nervous system to contract.
- The muscle tissue itself has a spiral structure that allows for the twisting action of the heart as it contracts with each beat. (We'll talk more about this later.)

The myocardium is lined on the inside (where all the blood is pumping) with a thin membrane called the endocardium. On the outside, the myocardium is enclosed by a membranous sac filled with fluid called the pericardium. The outside of the pericardium sac is pressed against the lungs and the chest wall. The inside of the sac (called the visceral pericardium) is actually attached to the heart muscle. The purpose of the sac is to hold the heart in place, protect it, and eliminate inflammation by protecting the heart from friction as it beats. If you think about it, every time the heart beats it expands and contracts rubbing and sliding against the lungs and the chest wall. It is the fluid filling the pericardial sac that allows the inner and outer parts of the sac to slide against each other with no friction thus allowing the heart to beat some 2.5 - 3.5 billion times in a lifetime without rubbing itself raw.

The heart itself is divided into four chambers: the right and left atria and the right and left ventricles. As you can see below, it is separated vertically by part of the myocardium heart muscle. Horizontally, the two halves are further divided by two valves – the mitral or bicuspid valve on the left side of the heart (right side of the illustration) and the tricuspid valve on the left.



The flow of blood through those chambers is actually quite simple.



All of the deoxygenated blood in need of "recharging" returns to the heart through the large veins called the vena cava (anterior and posterior). The two vena cavae empty into the right atrium, the first chamber in the heart. (Incidentally, one of the definitions of atrium is a forecourt of a building – which is essentially what the atria are: forecourts to the two ventricles.) From there, the blood passes through the one-way tricuspid valve into the right ventricle, which pumps it out through the pulmonary valve into the pulmonary aorta and into the lungs.

Note in the illustration above how much smaller the left ventricle is than the right and how much thicker the muscles are surrounding it (about 4 times thicker). The reason is simple. Smaller chamber and greater force of contraction means greater pressure. When you consider that the right ventricle only needs to push the blood a few inches into the lungs and back, whereas the left ventricle needs to push the blood throughout the entire body, this makes sense. In fact, the left ventricle produces about 4 times the pressure of the right ventricle. It is through this difference in pressure that the body keeps the blood supply perfectly balanced between the two chambers even though they are powering two entirely different circulatory systems.

Once oxygenated, the blood makes the short trip back through the pulmonary veins and back into the heart, entering through the left atrium. This is the pulmonary circulatory system we referred to above.

From the left atrium, the oxygenated blood passes down through the one-way mitral valve and into the left ventricle. From there, the large muscles surrounding the left ventricle squeeze the blood out through the aorta as it starts its circuit out to every single cell in the body.

The valves

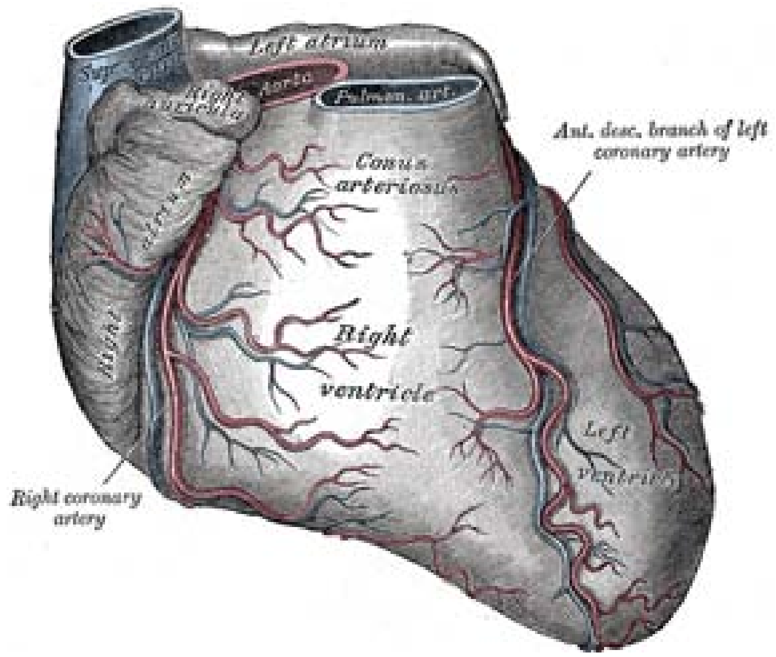
At this point, a quick discussion of the two main valves in the heart (the mitral or bicuspid valve, and the tricuspid valve) makes sense.

In construction and function, the two valves are quite simple, but extremely important. Fundamentally they look like parachutes with tendons or cords running down into the ventricles to keep them from opening too far. (See below.) When there is no blood in the ventricle below them, there is no pressure on the valves, and they are in the open position. In the open position, blood can passively move from the atrium above down through the openings in the valve into the ventricle below. Once the ventricle fills with blood and the heart contracts creating pressure in the ventricle, that pressure pushes up on the bottom of the valve forcing it closed so the blood cannot flow back into the atrium above. At that point, the blood has only one way out of each ventricle – through the main pulmonary artery in the right ventricle and the aorta in the left ventricle. The system is brilliant, totally passive, and amazingly durable. For most people it functions flawlessly for 70-100 years, through 2.5 billion plus heartbeats.

For a great review of everything we've talked about so far, check out the medical animation from the University of Pennsylvania Health System.

The coronary arteries

Once the oxygenated blood leaves the heart and heads into the aorta, it almost immediately encounters the first two blood vessels off the aorta: the left and right coronary arteries. These are the main arteries that feed the heart muscle, the myocardium. One of the first things you'll notice in the illustration below is how much branching and redundancy there is in the arteries and veins that feed the heart.



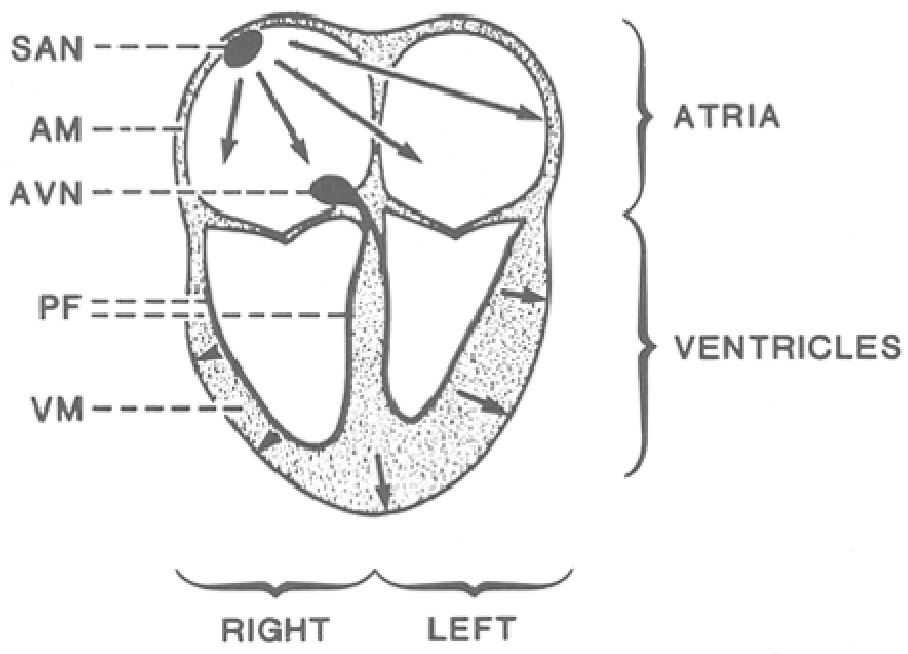
The medical term used to describe this branching is anastomosis. You don't have to remember it. Just remember that the blood vessels of the heart have many branches that reconnect in multiple places to provide alternate pathways for the blood in case one branch is blocked. In fact, there is so much redundancy, that your heart can function with no visible symptoms with up to 70% blockage. It's almost as though nature anticipated the western fast food diet and built in a huge reserve capacity knowing how aggressively we would seek to clog the system up.

The electrical system

We've established the basic bio-mechanics of the heart, but there's one key question we haven't addressed yet:

What makes the heart muscle contract?

Fundamentally, the contraction of the heart is an electrical phenomenon – or more precisely, a bio-electrical phenomenon based on the movement of sodium, calcium, and potassium ions across membranes. (We'll cover this in more detail in a moment.)



A simplified picture of the electrical system of the human heart.
The direction of the activation is indicated by the arrows and is:
SAN (= sinoatrial node), AM (= atrial myocardium), AVN (= atrioventricular node),
PF (= Purkinje fibers), VM (= ventricular myocardium).

For now, just understand that when a muscle cell is excited, an electrical signal is produced and spreads to the rest of the muscle cell, causing an increase in the level of calcium ions inside the cell. The calcium ions bind and interact with molecules associated with the cell's contractile machinery, the end result being a mechanical contraction. To simplify this, a sodium ion starts the stimulation of the cell, a calcium ion extends that stimulation to allow the entire muscle to contract before potassium comes along and tells the muscle cell to relax for a moment and get ready for the next wave. Even though the heart is a specialized muscle, this fundamental principle still applies. (Makes you think about the importance of minerals in the diet, doesn't it?) One thing, however, that distinguishes the heart from other muscles is that the heart muscle, as we've already discussed, has built in rhythmicity. Thus, an electrical excitation that occurs in one cell easily spreads to neighboring cells.

Under normal circumstances, the initial electrical excitation that starts the beat of the entire heart originates in the pacemaker cells of the sinoatrial node, located on top of the right atrium. This small group of cells pretty much serves as the impulse-generating pacemaker for the heart and normally discharges about one hundred times per minute. These impulses move down through fibers in the myocardial wall and come together in the atrial ventricular node where they are slowed down before entering and stimulating the controlled contraction of the muscles surrounding the two ventricles.

As mentioned in the paragraph above, there is a moment of rest in the contraction of the muscle cells as the heart prepares for its next beat. This moment of rest is actually critical as we will discuss in the next chapter as a spurious impulse during this rest period can cause premature contractions leading to compromised filling and poor ejection of blood from the heart. This can lead to life threatening arrhythmias that so severally compromise the heart's ability to pump that death can occur quickly.

As an interesting side note, when doctors or EMTs use a defibrillator to get a "fluttering" heart going again, the primary effect is to depolarize the heart muscle and actually stop the heart. The electric shock from the defibrillator doesn't switch the heart back on. Instead, defibrillation actually stops the heart briefly! It's this stoppage of the heart that allows the sinoatrial node to reestablish control of the heartbeat.

Next Chapter

That concludes our discussion of the anatomy of the heart. In the next chapter, we will actually explore the physiology of the heart in some detail, specifically talking about:

- What can go wrong with the heart.
- What things must be handled by a medical doctor.
- The side effects associated with many medical options. (In most cases, it’s not a free ride.)
- What things can be handled by diet, lifestyle, and supplement choices. (Surprisingly, much more than you might think.)

Chapter 2: Heart Problems – the Physiology of the Heart

In the last chapter, we worked through the anatomy of the heart -- primarily to lay the groundwork for a discussion of the physiology of the heart. By using what we learned in the last chapter, we can now explore:

- Things that can go wrong with the heart.
- Medical treatments.
- Limitations that may be inherent in some of those treatments.
- What you can do to change the equation.

Problems of the epicardium

As you may remember, the epicardium is the lining that surrounds the heart muscle -- inside and out. On the inside, it's called the endocardium, and on the outside it's called the pericardium. Let's start our discussion of heart problems by looking at the epicardium -- not because it's the most important part of the heart, but because it's a simple place to start and lets us dip our toes into the subject before plunging into deeper waters.

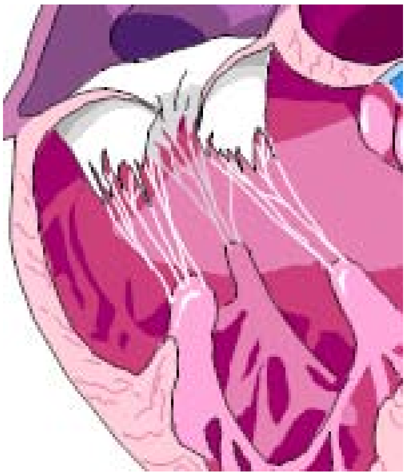
Problems that can occur with the heart lining pretty much fall into two categories

- Physical damage.
- Inflammation caused by infection.

Physical damage is easy to understand, and usually easy to repair. You're driving in your car, you get into an accident. You're slammed against the steering wheel or an airbag. Your body stops suddenly but your heart, powered by inertia (an object in motion tends to stay in motion) keeps moving forward and tears the pericardium that holds it in place before bouncing back and coming to rest. This causes bleeding in the pericardial sac, which serves as the buffer between the heart and the chest wall and lungs. The extra fluid (blood) pumps into the sac under pressure which expands the sac, thereby squeezing and constricting the heart. If the pressure isn't relieved, it can build to the point where it constricts the heart so much that it prevents it from beating. Herbs and neutraceuticals are not much use here. Fortunately, medical intervention tends to be easy and effective in these situations. A catheter inserted into the sac to drain the excess blood and relieve the pressure will usually do the trick -- along with stopping the bleeding.

Inflammation (known as "itis" in medical terminology) is a little more complex. The primary cause of inflammation of the heart lining is infection, both viral and bacterial. Depending on which part of the lining is affected, it will be called pericarditis, endocarditis, or epicarditis. The inflammation can cause chest pain, difficulty pumping, or fever. These symptoms can be mild, acute, or even chronic. Standard treatment includes the use of antibiotics and antivirals. These are "usually" effective unless the underlying infection is resistant to the arsenal of drugs at your doctor's disposal, which is a growing problem. Fortunately, there are natural alternatives including garlic, olive leaf extract, oil of oregano, grapefruit seed extract, etc. that can work even in the case of drug resistant infections.

Problems with heart valves



Also, as we discussed in the last chapter, your heart valves are constructed like parachutes with tendons or cords anchoring them to the heart muscle to keep them from opening too far. Their role is to allow blood to flow down from the atria into the ventricles, and then to seal shut when the ventricles pump so that blood doesn't back up into the atria, but is instead forced out into the main pulmonary artery from the right ventricle or into the aorta from the left ventricle. Problems with the valves are easy to understand and fall generally into two categories.

- Backflow, or regurgitation, is caused by misshapen or damaged valves or ruptures to the tendons that hold the valves in place. These things cause the valves to imperfectly seal with each heartbeat, thus allowing backflow into the atria.
- Stenosis, or hardening of the valves, caused by disease or aging prevents the valves from fully opening. This limits the flow of blood into the ventricles so that they cannot fill completely in the fraction of a second the valves are open. Since the ventricle chamber is now partially empty when it pumps, it generates less pressure with each beat, which ultimately reduces the amount of blood that flows through the body.

There can be multiple causes for both problems.

- Either you were born with a problem. This can be genetic or it can be the result of nutritional problems in your parents' diet (either before you were conceived or while you were gestating).
- Over time, as a result of aging and poor nutrition, the valves shrink and change shape.
- Infection has caused the valves to inflame so that they no longer seal perfectly.
- Diseases such as rheumatic fever and syphilis have scarred and hardened the valves.
- Valvular tissue can be damaged in the same way as heart muscle tissue as the result of a heart attack.
- Valve tendons may rupture, which means the valve no longer stays in place when backpressure is created by the squeezing of the ventricles.

The bottom line is that the pumping process becomes less efficient, and your heart has to pump harder and faster to compensate. Treatments can range from doing nothing, to using drugs to reduce infection and inflammation, to surgically replacing the damaged valves with artificial valves.

Doing nothing you might ask? Absolutely! In most cases, that's what doctors do. Why? The heart has tremendous reserve capacity. Last chapter we mentioned that you can have 70% blockage of your coronary arteries and never experience any outward symptoms. It doesn't stop there. Your heart also has a tremendous reserve pumping capacity and when called upon can increase output 5-8 times if needed. For example, in mitral valve prolapse (a condition in which the mitral valve "falls down", or prolapses too far into the left ventricle allowing for backflow into the right atrium), there are usually few symptoms or any problems. In most cases doctors will just make note of it and watch for any changes.

On the other hand, sometimes, there are symptoms. These can include:

- That old standby, chest pain.
- Fatigue and/or dizziness.
- Shortness of breath.
- Low or high blood pressure, depending on which valve is affected.
- Palpitations caused by irregular heartbeats.
- Even migraine headaches.

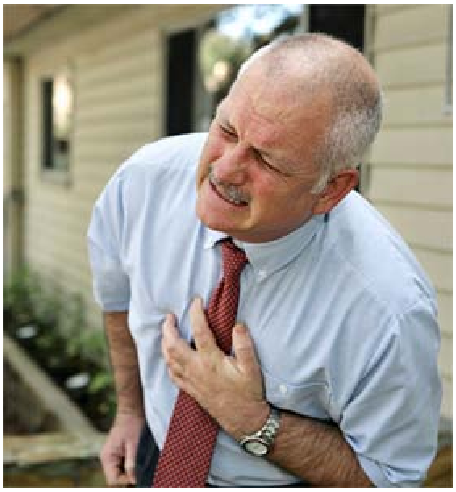
In those cases the valves are often replaced with mechanical valves. At one time, you could actually hear the mechanical valves make a slight clicking sound as they opened and closed 70-80 times a minute. This drove some people crazy when they tried to sleep at night. Newer models have overcome that problem and are silent.

Now you might think since problems with valves are mechanical in nature that nutrition and supplements would not play much of a role in resolving them. If so, you would be wrong. Most medical doctors are not aware of this fact, but there are numerous studies showing nutrients matter -- and supplementation can actually change the mechanical aspects of valve function. For example, it has been shown that magnesium plays a role in mitral valve prolapse.

- Therapeutic effect of a magnesium salt in patients suffering from mitral valvular prolapse and latent tetany.
- Magnesium Deficiency in the Pathogenesis of Mitral Valve Prolapse.

This is just the tip of the iceberg. In fact, nutrition and supplementation can play a primary role in maintaining optimum heart health -- and even reversing many chronic heart problems. We will talk more about this later; but for now let's explore problems that happen within the coronary arteries.

Circulatory problems



The first blood vessels off the aorta are the two coronary arteries, which subsequently split off into numerous branches that feed the heart. Blockage of these arteries through the build-up of arterial plaque is one of the most common causes of death. The net result is ischemia, which means a "reduced blood supply." As I mentioned last chapter, because there is so much redundancy in the branching of the coronary arteries, you can have up to 70% blockage and yet have no obvious symptoms. At some point, though, you will have a heart attack, also known as myocardial infarction. The myocardium is the name of the heart muscle, and infarction means the "death of tissue." In other words, a heart attack is the result of loss of blood flow to the heart muscle, which causes death of heart muscle tissue. The severity of the attack is determined by:

- Which part of the muscle is damaged. (Some parts are more critical than others.)
- How extensive the damage is.

In some cases, people do indeed die from their first heart attack. In most cases, though, the attacks are progressive -- with each attack killing more and more tissue until the remaining heart muscle can no longer carry the load. Depending on the extent of the damage, standard medical treatments include:

- Drugs, such as:
  - Beta-blockers to slow heart rates and decrease blood pressure -- thus lowering the heart's demand for oxygen.
  - Nitroglycerin to open coronary arteries and reduce the heart's demand for oxygen.
  - Calcium channel blockers to open coronary arteries to increase blood flow to the heart muscle.
  - Angiotensin-converting enzyme to allow blood to flow from the heart more easily, decreasing the workload on the heart.
- Angioplasty uses a balloon inflated inside the blocked artery to press the plaque against the arterial wall, thus clearing the blockage -- at least temporarily.
- Stents are like angioplasty on steroids. Instead of just pressing the plaque against the wall of the artery, the balloon is also used to also press a wire mesh against the arterial wall to hold the artery open.
- Bypass surgery involves using a vein (usually taken from the leg) to literally create a bypass around the clogged area of the coronary artery.
- Heart transplants.

None of these options are perfect. Angioplasty and bypass surgery (even though they have been in use for years) are actually unproven (for those of you who think everything in medicine is backed by peer reviewed studies). In fact, recent studies indicate that they may actually give only slight temporary relief with no extension of life -- not to mention an increased risk of stroke. Both stents and angioplasties (and bypasses too, for that matter) quickly re-plug, a problem called restenosis, and need to be periodically redone or replaced. New forms of stents are coated with drugs to slow down restenosis but come with their own set of problems. Bypass surgery produces a dramatically increased risk of stroke, infection and profound depression. And heart transplants force you to stay on immunosuppressant drugs for the rest of your life.

Far and away the biggest problem with all of these treatments, though, is that they only treat one manifestation of the problem, not the underlying cause -- the fact that the arteries are blocking in the first place. It is here that alternative therapies excel -- both short term, and long term. For example:

- Dietary changes can have a profound impact in reversing coronary heart disease as can a number of supplements.
- Shifting the balance of Omega-6 to Omega-3 fatty acids can eliminate a major source of heart attacks.
- Hawthorne berries are tonic for the heart, working to support the relaxation and dilation of coronary arteries and increasing the flow of blood and oxygen to and from the heart. In effect, Hawthorne berries work much like prescription drugs, but without the side effects.

Blood Clots

Another aspect of coronary heart disease is the blood clot or thrombus. (If it becomes dislodged and floats free, it's called an embolus.) In larger arteries, a clot will only impede the flow of blood. In smaller arteries, it can completely block it. Thrombi form most often in the veins of the leg, where they then float off (now called emboli) and end up lodging in and blocking the smaller arteries of the heart, lungs, and brain. There

can be many triggers for the formation of clots and emboli, but one of the more interesting is deep vein thrombosis -- the formation of blood clots as the result of prolonged sitting in airplanes and cars.

Preventing blood clots reduces the risk of stroke, heart attack and pulmonary embolism. The standard treatment for those at risk of embolisms involves the use of drugs such as Heparin or warfarin (a form of rat poison), which are anticoagulants used to inhibit the formation and growth of existing blood clots.

But these drugs are dangerous and require constant watching and regulating since they can cause internal bleeding. Far safer (and better since they also dissolve arterial plaque and help promote the repair of arterial tissue) are proteolytic enzyme formulations that incorporate specialized enzymes such as nattokinase.

Problems with the heart muscle -- the myocardium

In the end, when you're talking about the heart, it mostly comes down to the myocardium -- the heart muscle. The danger of coronary heart disease, for example, is that it starves the myocardium of oxygen and kills it. The danger of a valve problem is that it forces the myocardium to work too hard. The danger of a bio-electrical/conductivity problem is that it throws the heart muscle out of rhythm and causes it to lose its beat, or to fibrillate. (Fibrillation occurs when a heart chamber "quivers" due to an abnormally fast rhythm and can no longer pump blood well. Fibrillation of the atrium is called atrial fibrillation; in the ventricle it's called ventricular fibrillation. Ventricular fibrillation usually leads to death.) To paraphrase the Clinton campaign in the ‘90's, "It's all about the myocardium."

Problems in the atria

For the most part, problems in the atria are not life threatening. Even if both atria totally lose their ability to pump or weaken and balloon out, you lose maybe 30% of your total heart function. Without pumping, gravity and suction will still bring most of the blood down into the ventricles. There are, of course, times your doctor will want to address problems, but for the most part, you can live for years with barely functioning atria.

Problems with the ventricles

Ah, but the ventricles are a different story. When the left ventricle goes into fibrillation, we're talking cardiac arrest. It's time to pull out the electric paddles. So what kinds of problems are we talking about?

- Myocarditis, or inflammation of the heart, is a form of cardiomyopathy (which literally translates as "heart muscle disease"). The problem here is that blood flows more slowly through an enlarged heart, which increases the likelihood of blood clots. In addition, people with cardiomyopathy are often at risk of arrhythmia and/or sudden cardiac death. When cardiomyopathy results in a significantly enlarged heart, the mitral and tricuspid valves may not be able to close properly, resulting in murmurs. There may be multiple causes of myocarditis, including viral infection. Common culprits include: influenza, herpes, Epstein-Barr, hepatitis, and salmonella.
- Ischemic cardiomyopathy is a weakness in the muscle of the heart due to inadequate oxygen delivery to the myocardium, with coronary artery disease being the most common cause. (Ischemia simply means "reduced blood flow.") Anemia, sleep apnea, and hyperthyroidism can also contribute to ischemic myocardium.
- Myocardial infarction literally means the "death of heart muscle tissue." Since heart muscle does not grow back, this has a snowball effect. If you have a heart attack that starves part of the heart muscle of oxygen so that it dies, that scar tissue does not recover. You now have a weakened heart that is more likely to suffer a subsequent attack -- leading to more heart muscle damage and increased chances for a third attack. And so on. It's not too hard to see where this leads -- to **long-term loss of heart muscle activity and chronic heart failure**.
- Congestive heart failure (CHF) is a condition in which your weakened heart can no longer pump out all the blood that flows into it. CHF is the most common cause of hospitalization for people over age 65. It kills more than 50,000 people a year in the US and costs the health care system more than $50 billion per year. The heart is just like other muscles. When it is weakened, it becomes enlarged and inefficient. This leads to congestion and flaccid muscle tone. In fact, it can even lead to prolapse of the heart in which the heart literally "drops" from its original position in the chest. It is not unusual to require a stethoscope placement three to five inches below the normal area when listening to a weakened heart.

Unfortunately, modern medicine comes up short when it comes to problems of the myocardium. Mostly it just deals with the aftermath.

- If the heart stops beating, use the electric paddles to get it going again

- If no paddles are near, pop a nitroglycerine tablet.
- Perform a coronary bypass to try and prevent any further damage.
- Use nitroglycerine tablets to open up the arteries in an emergency and prevent a heart attack.

When it comes to the muscle itself, nothing! But as luck would have it, here's where alternative therapies shine.

- All of the B vitamins, but especially vitamin B4 are essential for heart health.
- Congestive heart failure has been strongly tied to significantly low blood and tissue levels of CoQ10. Supplementation with CoQ10 can literally change the size and shape of the heart.
- Studies have shown that high concentrations of heavy metals such as mercury directly correlate to higher incidences of acute coronary events. Regular heavy metal detoxing directly reduces and eventually eliminates that risk.
- Studies have also shown a direct connection between periodontal disease and acute coronary events. Regular use of avocado soy unsaponifiables, proteolytic enzymes, immune boosters, and pathogen destroyers can reduce the risk.
- Incidentally, electric paddles are not the only thing that can get a heart muscle going again. In an emergency cayenne pepper can do the trick too. A teaspoon of cayenne pepper in a glass of warm water taken every fifteen minutes can raise the dead.
- And in the end, the heart is a muscle, and like all muscles responds to exercise. Cardiovascular exercise, particularly interval training, can improve the efficiency and strength of your heart.

Heart rhythm disorders

The heart is an unusual organ. It has millions and millions of cells, and each cell has the potential for electrical activity. In the normal heart these electrical impulses occur in regular intervals. When something goes wrong with the heart's electrical system, the heart does not beat regularly. Unlike most organs in the body, all the cells in the heart are wired together so that if a single cell fires prematurely or late, the neighboring cells will be activated and a mistimed wave will travel over the heart. The irregular beating results in a rhythm disorder, or arrhythmia.

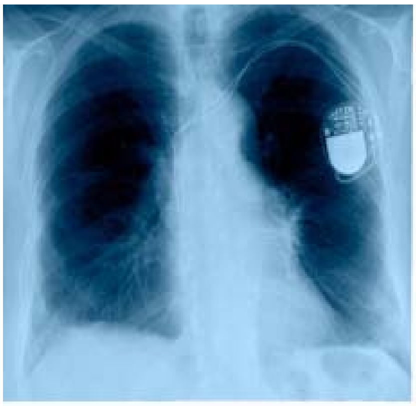
To quickly review from the last chapter.

- Every heart beat begins in the sinoatrial node (SA node) located in the right atrium. The SA node is "smart" and adapts to the body's overall need for blood and increases the heart rate when necessary, such as during exercise.
- Electrical impulses leave the SA node and travel through special conducting pathways in the heart to the atrioventricular node (AV, node). The purpose of the AV node is to provide a pathway for impulses from the atria to the ventricles. It also creates a delay in conduction from the atria to the ventricle. This delay allows the atria to contract first, allowing the ventricles to fill with blood before they contract themselves.
- The delay ensures proper timing so that the lower chambers have time to fill completely before they contract.
- From the AV node, the signal travels down through a group of fibers in the center of the heart called the bundle branch -- and then to the ventricles.

So what can go wrong?

- Due to natural aging or disease, the SA node starts losing function and no longer produces the right number of signals at the proper rate.
- The AV node normally has one group of cells through which the electrical impulse can travel. However, due to aging or heart disease, it is possible for the AV node to develop two or more groups of conductive cells. Because of the extra conduction pathways, your heart can at times beat more quickly than normal.
- The bundle branch (see above) becomes "blocked" as a result of a heart attack which damages the inner heart muscle and nerves. This stops the signal from traveling from the AV node to the ventricles. Left to their own devices, the ventricles establish their own rhythm of about 20-40 beats per minute. This is much too slow for health and results in weakness, fainting, and shortness of breath.
- Valve stenosis (stiffness) causes increased pressure in the atria (since blood never fully clears) which causes ballooning of the walls of one or both of the atria (aka atrial dilation). Because the atrium is now bigger, it increases the distance signal has to travel. The increased distance means it takes longer for the signal to reach its final destination which throws off the pacing of the heartbeat.

Medical Treatments



Typical medical treatment involves drugs such as adenosine, calcium channel blockers (e.g., diltiazem, verapamil), short-acting beta-blockers (e.g., esmolol), and digitalis.

The other option, of course, is the pacemaker. The pacemaker uses electrodes attached to the heart that take over from the SA node to control the beating of the heart. The pacemaker is run by a small computer installed in the body. Modern pacemakers are externally programmable and allow for the selection of optimum pacing modes for individual patients. Some can even self-regulate and adapt to changing requirements such as stress or exertion. And some combine a pacemaker and defibrillator in a single device.

Drugs and pacemakers work reasonably well at keeping the heart going, but still address the problem after the fact. Keep in mind that in most cases the rhythm of the heart was lost through degradation based on nutrition or disease. Installing a pacemaker does not address that problem; it merely bypasses it. On the other hand, it is possible to reverse many of those conditions nutritionally and thus reverse many of the associated problems.

Alternatives

- Mineral deficiencies particularly in calcium, sodium, magnesium, potassium, and many of the trace minerals can have a profound effect on the electrical efficiency of the heart since they are responsible for running it. Supplementing with minerals and liquid trace minerals can make a profound difference.

- Supplementing with CoQ10 can significantly improve the energy level of each cell in the heart, thus improving its ability to respond to an electrical stimulus and pass the signal on to its neighbor in a timely manner.
- Shifting the balance of Omega-6 to Omega-3 fatty acids can eliminate a major source of potassium imbalance which can trigger heart attacks.

Conclusion

That concludes our discussion of the physiology of the heart. In the next chapter, we will conclude our discussion of the heart by exploring what happens in your doctor's office:

- What tests does your doctor run?
- What do they mean?
- What can ***you*** tell from them?
- What questions should you ask your doctor when viewing the results?

For now, though, it's worth reviewing a key concept:

Although many problems with the heart may seem to be biomechanical in nature and beyond the purview of nutrition and supplements, that's not necessarily true. As we've seen:

- Magnesium supplementation can change the shape and condition of heart valves.
- The B vitamins can help rebuild the heart.
- CoQ10 can reenergize every single cell in the heart and can literally remold the size and shape of the heart after the onset of congestive heart failure.
- The use of Omega-3 fatty acids can reverse damage caused by NEFAs.
- Proteolytic enzymes can provide nutritional support for your body as it works to clean out the coronary arteries and repair damage to epicardial tissue surrounding the heart.
- The use of heavy metal chelators such as cilantro and chlorella can reduce the risk of an acute coronary event.
- Regular supplementation of a tonic made with cayenne and Hawthorne berry can rebuild the strength of the heart.
- Proper dental care and the use of avocado soy unsaponifiables and proteolytic enzymes can reduce the incidence of periodontal disease, which reduces the chances of an acute coronary event.
- Regular use of immune enhancers and pathogen destroyers decreases the risk of most inflammatory heart disease and the incidence of viral and bacterial infections that can adversely affect the heart.
- And regular exercise can strengthen the heart and improve its efficiency even in your eighth and ninth decade of life.

As usual, it's not just about pharmaceutical drugs and surgical procedures. Following the principles of the Baseline of Health Program can change your heart…and your prospects for long-term survival.

Chapter 3: Secrets of the Heart

In the last two chapters, we discussed the anatomy of the heart and the things that can go wrong with the heart. In this chapter, we're going to examine how your doctor unravels the secrets of your heart when you visit his/her office. My goal is not to turn you into a doctor, but to take some of the mystery out of diagnosis so that you know what your doctor is looking at, listening to, and analyzing when he/she is looking at your heart -- to arm you with some basic diagnostic knowledge so you are not totally at the mercy of the medical mystique when the results of your next physical are pronounced.

A definition

Before we launch into our subject, though, we have to define two terms that will be referenced throughout this chapter: ***systole*** and ***diastole***:

- Systole refers to the contraction of the chambers of your heart.
- Diastole refers to the relaxation of those chambers.

In fact, you can have systole and diastole in all four heart chambers, but in most cases, doctors focus on the left ventricle -- the chamber that pumps blood throughout your entire body -- when using the terms. Also, there are two kinds of systole and diastole: electrical and mechanical. Electrical systole is the electrical activity that precedes actual contraction. It's what stimulates the heart muscle of the different chambers to actually contract. The delay between electrical stimulation and actual contraction is about a tenth of a second.

The same is true of diastole, the relaxation of the heart mucles. Electrical diastole is the recovery and repolarization of the heart in preparation for the next beat. Mechanical diastole is the actual relaxation of the muscle that follows electrical diastole. This distinction becomes important when you look at your ECG.

Incidentally, the increased pressure produced in your circulatory system by the mechanical systole (contraction) of the left ventricle is referred to as systolic pressure. The reduced pressure during relaxation is called diastolic pressure. These are the two numbers your doctor gives you when reading your blood pressure (e.g., 120 over 70). We'll explore that in detail in the next chapter when we explore the circulatory system.

The Sounds of Your Heart

The most basic tool your doctor has for evaluating the health of your heart is the stethoscope. It is so fundamental to medicine that it has been around in various forms for almost 200 years and is probably the most recognizable symbol of doctors in the world today. Before the stethoscope, physicians would just listen to the heart by pressing their ears against the patient's chest -- not very efficient, and often very unclean.

Early 19th century stethoscope

And what do doctors hear through a stethoscope?

Surprise! It's actually not the beating of your heart. The heartbeat itself is virtually soundless. That thump…thump your doctor listens to is the sound of blood dashing against the inner walls of the heart chambers. This is a very useful distinction. Hearing the movement of blood reveals far more than would be the case if all we heard was a mechanical contraction.

More precisely, the thump…thump of your heartbeat is **the sound of the turbulence of blood against the walls of the heart and the valves during systole (contraction)**. In fact, thump…thump is not an entirely accurate description of the sound. As it turns out, each thump is, in reality, comprised of separate sounds in both the atria and the ventricles. But because the sound in the ventricles is so loud, it drowns out the other sounds…unless there is a problem.

For example, if there's stenosis (hardening) of the mitral valve, part of the heartbeat is slowed down because it takes longer for the stiff valve to close so that the multiple sounds start to separate. Instead of the normal thump…thump, you hear something that sounds more like thump…pa pa. On the other hand, if you have an incomplete closer of a valve, as in aortic regurgitation, you lose the clean thump and get sort of a chortling "woosh" sound as in whoosh...thump. (If you're interested, here's a link to more heart sounds.)

Invariably, then, listening to your heart through a stethoscope is one of the fundamental parts of any checkup. It provides the first clues as to the health of your heart.

Note: for those of you interested in coaching your doctor through anything they may have forgotten in medical school, here's a more detailed tutorial.

The ECG/EKG

When most people think of heart tests, they think of the ECG. ECG stands for electrocardiogram. It's also called an EKG, from the German elektrokardiogram. Although it may look like an ECG is recording heartbeats, it's not. In fact, it records the electrical activity (the electrical triggers, if you will) that presage the actual heartbeat. The mechanical beats follow the electrical triggers by about a tenth of a second -- unless, of course, there's a problem. Or to state it in "medicalese," electrical systole and diastole precede mechanical systole and diastole (contraction and relaxation) of the heart by about a tenth of a second.

The ECG is an important tool for your doctor, but is hardly complete and comes with several limitations.

- It's a static test, which means it doesn't necessarily identify problems that appear only when the patient's heart is under stress. An example would be a patient complaining of intermittent chest pain. This might actually be an indicator of a **severe** underlying problem, and yet a standard ECG could easily read as perfectly normal.
- ECG readings indicate only general problems. In most cases, abnormalities in the reading are non-specific as to cause, and in fact, many times, **may mean nothing at all**.
- Bottom line:
  - A normal ECG reading doesn't necessarily mean that there is no problem.
  - An abnormal reading doesn't necessarily mean that there is.
  - It's merely a piece of the puzzle that can help point the doctor in a direction.

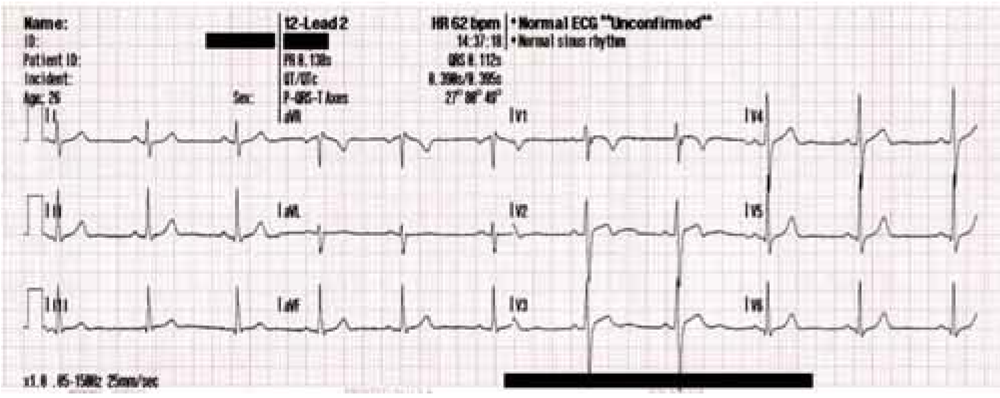
That said, an ECG provides four primary pieces of information for your doctor.

1. First, an ECG can show how fast your heart is beating -- or more accurately, how fast the electrical activity is moving through your heart. By measuring the intervals between beats, your doctor can determine if the electrical signal is moving through your heart too slow or too fast.
2. It also shows the strength and timing of the beat. By measuring the amount of electrical activity passing through your heart muscle, your doctor can get an indication as to which parts of your heart are too large or are overworked or if it's not pumping forcefully enough.
3. It can provide evidence of damage to various parts of the heart muscle caused by:
    1. Previous heart attacks.
    2. Congenital heart abnormalities.
    3. Diseases such as thyroid problems, rheumatic fever, diabetes, and high blood pressure.
    4. Inflammation to either the heart muscle or its lining (inside and out).
    5. Very low or very high levels of electrolytes including calcium, magnesium, and potassium.
4. And it can indicate problems with impaired blood flow in the coronary arteries supplying oxygen to your heart muscle.

Reading the ECG

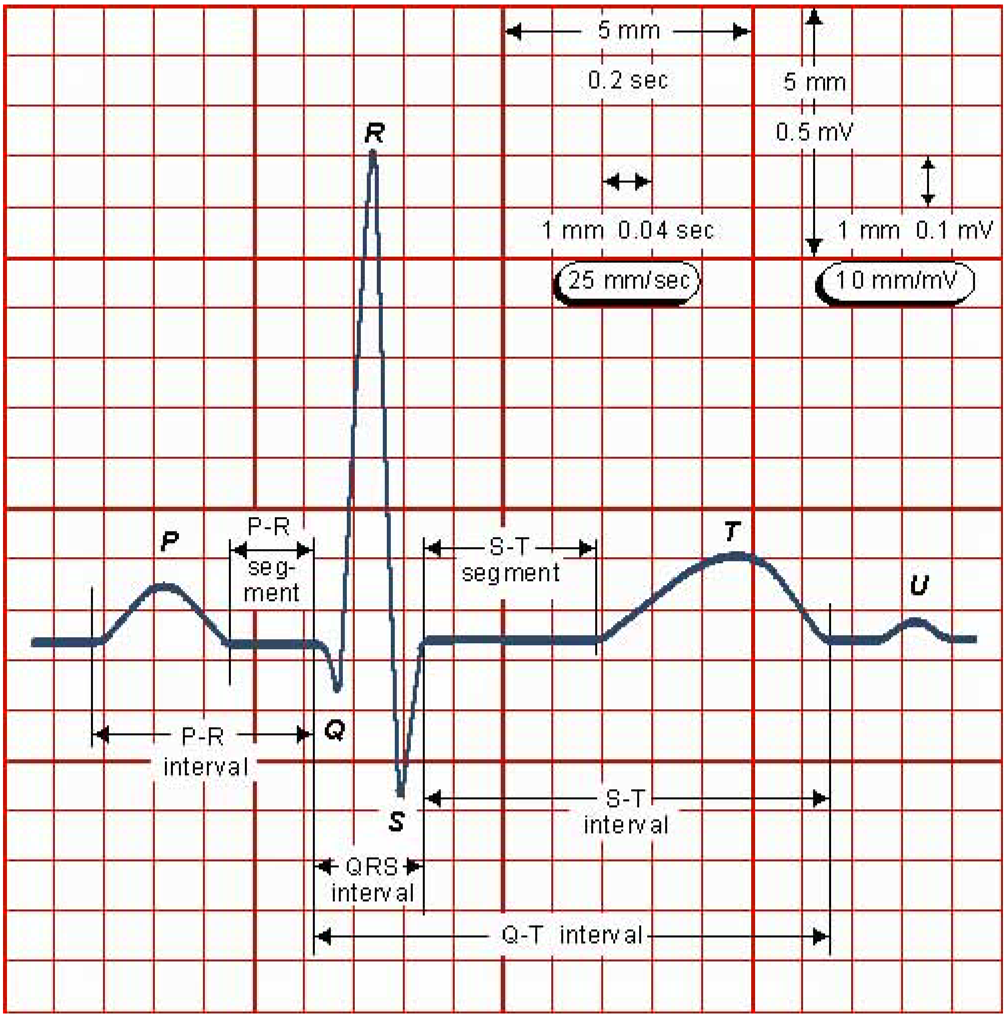
Your doctor performs an ECG by hooking you up to a series of electrodes scattered over your chest, arms, and legs. (Accurate placement is important.) Each electrode reads the same signal, but because of its unique vantage point, provides a different view of that signal. Think of it like watching a speeding train from the front coming at you, from behind racing away, and from the side whizzing by. It's the same train, at the same point in time, but each vantage point provides very different information about the train.

Here's a snippet of an EKG showing several electrodes tracking a heart. Notice how the electrodes start providing noticeably different information concerning the same beat about 2/3 of the way through.



All well and good you might say, but what does it mean? How do I read it? Does it mean I'm healthy or unhealthy? Can I run a marathon, or do I need bypass surgery? All good questions.

In order to understand better what your doctor sees when he looks at an ECG printout, let's focus on a single beat from a single electrode.



Alright, I agree. That's certainly pretty meaningless at first glance. However, with a little decoding, it starts to make much more sense. In fact, the heartbeat as represented in an ECG breaks down into four primary pieces: the PR interval, the Q wave, the QRS complex, and the T wave. Let's explore them for a bit. (Refer back to the graphic as needed.)

- The PR interval on the left side of the graph shows the electrical impulse for the contraction of the atria, immediately followed by its depolarization (or clearing of the electrical charge to that part of the heart muscle) so it can relax and gear up for the next contraction. As mentioned earlier, the actual contraction of the muscle follows the signal by about 1/10 of a second -- in this case during the PR segment. (See graphic.)
- The Q wave (labeled Q above) is the initial downward (negative) deflection related to the initial phase of depolarization of the ventricular heart muscle. Again, depolarization is preparation for receiving an electrical stimulus.
- The QRS complex in the center of the graphic shows the electrical stimulation of the ventricles, immediately followed by their depolarization. Not surprisingly (considering how much more powerful ventricular contraction is), the amplitude of the electrical signal for the ventricles is much larger than that of the atria.

- The T wave on the right side shows the repolarization of the ventricles in preparation for the next beat. Note: The ST segment represents the period from the end of ventricular depolarization to the beginning of ventricular repolarization. In English, the T wave represents the recovery period of the ventricle in preparation for the next beat.
    - Now, if you've really been paying attention, you might be asking yourself an obvious question, "Where's the corresponding T wave for the atria following their PR interval. Don't the atria have to repolarize just like the ventricles?" And the answer is, "Yes, they do." Good call there! The problem is that the repolarization of the atria happens during the QRS complex, and because the ventricular signal is so much stronger than the atrial signal, you can't see the atrial repolarization -- kind of like a flashlight turned on during the midday sun. Give yourself a pat on the back for catching its existence though.
- And lastly, we have the QT interval. The QT interval is not a separate section, but is a combination of the QRS complex and its following T wave. It represents the time between the start of ventricular depolarization and the end of ventricular repolarization. It is useful as a measure of the duration of repolarization.

So what's your doctor looking for when she examines your ECG? To put it simply, she's looking for normal intervals and normal amplitudes in all key segments of the wave. For example:

- The PR interval is indicative of the movement of the cardiac impulse from the atria to the ventricles via the atrioventricular node (see Chapter 1)), which is normally between 0.12 - 0.20 sec (3 - 5 small boxes wide). If the PR interval is greater than 0.20 sec, that's an indicator that an AV block is present (see Chapter 2)).
- The QT interval will vary depending on the heart rate, age, and gender of the patient. It increases with bradycardia (slow heartbeat) and decreases with tachycardia (rapid heartbeat). Men have shorter QT intervals (0.39 sec) than women (0.41 sec). The QT interval is also influenced by the electrolyte balance, drugs, and ischemia. Your doctor will be looking for any interval outside the norm.
- A QRS interval of 0.04 to 0.10 seconds -- no larger than half a large box -- and of normal amplitude.
- Differences in the sizes of the Q waves read from different electrodes at the same point in time are indicative of previous heart attacks -- the differences are usually caused by areas of dead muscle tissue. A trained cardiologist can accurately pinpoint the area of damage according to which leads are producing which signals.
- Inverted T waves may indicate ischemia, or low blood flow to the heart.
- Deviations in the ST segment can show ischemia and infarction (i.e., lack of blood flow to the heart muscle and dead muscle tissue). In general, a depression in the ST segment indicates ischemia while an elevation indicates infarction.

If you got lost in the last few bullet points, don't worry about it. The important point is to understand the "kinds" of anomalies your doctor is looking for -- not necessarily to identify them yourself. However, for those of you interested in keeping up with your doctor, here's a more detailed tutorial.

And for those of you who just want to walk away with something to hold onto, you can use your ECG to easily calculate your heart rate by counting the number of **large** squares between R waves (the high point in each beat).

- 1 square = 300 bpm

- 2 squares = 150 bpm
- 3 squares = 100 bpm
- 4 squares = 75 bpm
- 5 squares = 60 bpm
- 6 squares = 50 bpm

The easiest way to do this is find an R wave that coincides with the beginning of a large box and then simply count over to the next R wave. In our ECG snippet (two graphics above), we can find such a point in the middle of the graph. A quick count to the right shows 5 large boxes, or approximately 60 beats per minute. Is that cool or what? You can now read a good chunk of an ECG -- and without going to medical school.

Seeing the Heart

Listening to your heart and monitoring its electrical activity, may not be enough. Your doctor may also want to see the heart, and there are several ways to do that.

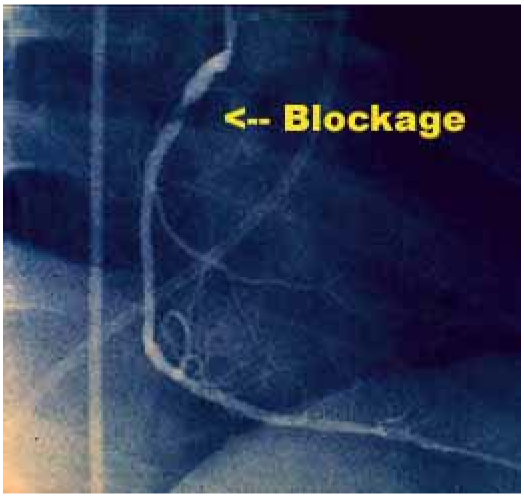
The most basic heart picture is the chest X-ray. Skilled doctors can actually interpret a great deal from an X-ray, but that's also the problem with the technology -- it requires a great deal of interpretation. That means its accuracy, at times, can be less than desirable.

Arteriogram/angiogram

You can think of the arteriogram (AKA angiogram, angiograph, etc.) as an X-ray on steroids. It's a procedure that uses a special dye (contrast material) and X-rays to see how blood flows through your heart.

An area of your body, usually the arm or groin, is cleaned and numbed with a local anesthetic. An IV (intravenous) line is inserted into the area. A thin hollow tube called a catheter is placed through the IV and carefully moved up into one of the heart's arteries. (X-ray images help the doctor see where the catheter should be placed.)

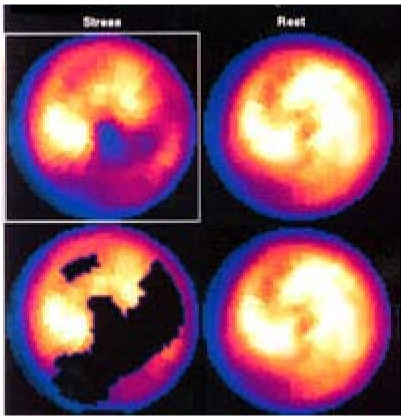
Once the catheter is in place, the dye (contrast material) is injected into the IV. X-ray images are taken to see how the dye moves through the artery. The dye helps highlight any blockages (dark areas) in blood flow.



Here's a short instructional film on how the procedure works.

Thallium Stress Test

Sometimes heart problems do not show up during normal activity; they only manifest under stress (i.e., an increased load on the heart). In those cases, an arteriogram won't reveal the problem. The thallium stress test, then, is used by your doctor to determine whether exercise causes a decreased blood flow to the heart muscle. This test incorporates elements from the ECG, the angiogram, and an MRI. An IV is inserted into your hand and ECG wires are hooked up to your chest. You then walk on a treadmill until you experience symptoms such as chest pain or shortness of breath, or until you are too tired to continue walking. During the whole procedure, your blood pressure and ECG are monitored continuously. Approximately one minute before you stop walking on the treadmill, the thallium is injected. Thallium is an isotope which is "taken up" by the heart and the coronary arteries. (It flows more easily through non-diseased arteries.) You then lie down on a table, and a scanner takes a picture of your heart. Areas where blood can't flow easily under stress appear dark. (See below, lower left corner.)



The thallium stress test certainly provides more information than a simple ECG. Unfortunately, stress tests do not detect atheromata present throughout the heart or other body arteries, nor do they reveal the vulnerable plaques, which are typically flat against the walls of the arteries and which are the cause of most heart attacks.

Echocardiogram

An echocardiogram uses high frequency ultrasound waves to produce a moving image of your heart. Such an image can help your doctor assess:

- The size of your heart -- both the thickness of the heart muscle and the size of the pumping chambers.
- How well your heart is pumping blood.
- Any valve problems: An echocardiogram can easily detect valve leaks and incomplete closure.
- Blood clots or tumors inside the chambers of the heart.
- Any holes in the walls of the heart.

It's the same technology used to look at babies in the womb. Check it out.

Full Motion MRI

The big new gun in heart diagnostics is the moving MRI. Recent advances in the technology now allow for full motion images of the heart that can be done quickly enough to even accommodate emergency room patients. This tool is proving to be one of the most accurate heart assessment tools yet.

Sometimes technology really does work.

Conclusion

The purpose of this chapter (in fact, this entire section on the heart) was not to turn you into a doctor. My goal was merely to take away some of the mystery and fear that comes from not knowing what's being done to you when it comes to your heart. There's no question that ignorance and the sense of fear and victimization that come with it contribute greatly to both the anxiety and depression so often associated with heart disease and its treatment. Now, though, you should be able to partner to some degree with your doctor when it comes to your treatment -- to be proactive, and less anxious.

Keep in mind, there are some doctors who won't like the fact that you can now ask questions and participate in your own healing -- to question a diagnosis or treatment option. Unfortunately, insecurity does not brook a challenge. My advice is to stop working with those doctors. Find a doctor that will work with you. Good doctors welcome informed patients.

And that concludes our discussion of the heart. In the next chapter, we will explore the circulatory system.

Chapter 4: Arteries and Veins

In this chapter, we're going to talk about the vascular system — your arteries and veins. Unlike our discussion of the heart, which required a great deal of anatomy, our discussion of anatomy today will be much simpler. As I've stated previously, my goal in this report is not to make you a doctor, but to help you understand enough about your body's systems and how they work so that you can communicate with your doctor and actively participate in your treatment. If you have high blood pressure, blood clots, or atherosclerosis, it's imperative that you fully understand how that happened, the physiological consequences of any medical treatments, and any viable alternatives that might be available to you.

That's what we will cover in this chapter.

Circulatory Systems

As we discussed previously, you have several distinct circulatory systems.

- The pulmonary system that carries **deoxygenated blood away from the heart** to the lungs, and then returns the refreshed oxygenated blood back to the heart.
- The systemic system that carries the **oxygenated blood away from the heart** out to every single cell in your body, and then returns the spent deoxygenated blood back to the heart so that it can be sent out through the pulmonary system.
- There is actually a third system, the portal system, which loops within certain organs or areas of the body, but that is beyond the scope of this report.

The important thing to understand about these circulatory systems is that they are "closed looped." Unless there is injury, no blood leaves them. As you will see, even the nourishment that every single cell in your body receives from your blood happens without that blood ever leaving the closed system. This becomes key when we talk about blood pressure.

The circulatory systems are comprised of:

- Arteries
- Arterioles
- Capillaries
- Veins

All told, these four components make up some 50,000 miles of passageways in the body. Let's take a look at them in more detail.

Arterial system

Arteries, arterioles, and capillaries make up the arterial system. Arteries and arterioles have only one function—to move blood throughout the body. That's all they do. They are channels, tubes, pipes if you will. As long as they are unclogged, flexible, and undamaged, they do their job. The primary difference between arteries and arterioles is one of size. Arterioles are just the smallest arteries you can see with the naked eye. Again, arteries and arterioles have only one function, to move blood. They do not feed any cells of the body—not even their own. That's actually a fun little bit of trivia. The arteries of your body are not fed by the blood that flows through them. They require their own network of blood vessels called the vasa vasorum (literally, vessels of a vessel) that feed them -- from the outside!

As I mentioned, I'm not going to get into naming all of the arteries in the body; but for the most part, arteries take their names from either the organs they supply (e.g.., the hepatic artery, which feeds the liver) or the areas through which they travel (e.g., the subclavian artery, which travels under the clavical—AKA, the collar bone).

Capillaries

Capillaries are quite different in function. They are not designed to shuttle blood. In fact, blood hardly flows through them at all as they are so small they allow only one blood cell at a time to pass through. Instead, the capillaries are the end point of the arterial system. It is in the capillaries that food and oxygen are exchanged with every cell in your body (except your cornea and the lens of your eye). Amazingly, of the 50,000 miles of circulation in the body, capillaries comprise over 49,000 miles.

Unlike the arteries, capillaries are invisible to the naked eye. They are smaller than a human hair—microscopic. And it is because they are so small and their walls are so thin, that capillaries serve as the exchange system for food and oxygen in the body. Keep in mind that every single cell in the body (except the cornea and lens) is near a capillary. That means that as blood passes through the ultra thin capillaries, it is easy for oxygen and tiny sugar and protein molecules (the end products of digestion) to "exchange" **through the walls** of the vessel and feed every single cell in the body.

Capillaries also serve as the connecting point between the arterial system and venous system that returns deoxygenated blood to the heart. The same exchange system that works to feed the cells of the body works in reverse. Cells pass their waste such as carbon dioxide back through the walls of the capillaries, where the blood cells recently relieved of their oxygen payload, can now pick up the CO2 waste from the cell and carry it back to the lungs for exchange with fresh oxygen.

Surprisingly, there's more "space" inside the tiny capillaries than can be filled by your entire blood supply. If all your capillaries were "open" simultaneously, your blood pressure would drop precipitously, and you would die. What happens, though, is that your body intelligently shunts blood into different capillaries as needed. When functioning properly, this is a pressure regulating mechanism. The body can open more capillaries to lower pressure, and close off sections if needed to raise pressure.

Note: Our bodies retain the ability to sprout new capillaries throughout our entire lives.

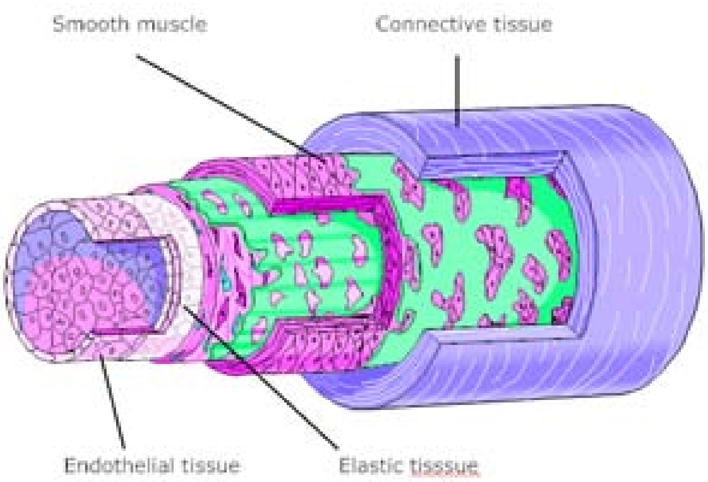
Venous System

The venous system returns deoxygenated blood to the heart, and for the most part, it pretty much parallels the arterial system in all aspects—just in reverse. Whereas the arteries start out large (the aorta) and end small (the capillaries), the venous system starts small (the capillaries) and ends large (the vena cava). Veins tend to run right next to their corresponding arteries, and in fact have similar names. The subclavian vein, for example, runs in tandem with the subclavian artery under your collar bone. The primary exception is the vena cava, which is the aorta's counterpart.

How arteries and veins are constructed

In this section, we start learning how problems occur. For it is their different construction (dictated by their different functions) that defines the nature of the things that can go wrong such as hardening of the arteries, high blood pressure, and blood clots.

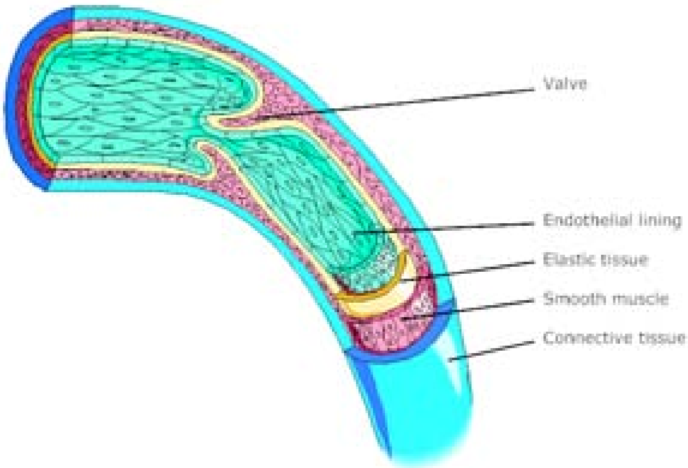
Arteries



Arterial walls are composed of elastic tissue and smooth muscle. It is their elastic nature and the presence of substantial muscle tissue that allows them to expand and contract as the heart beats. This allows them to even out the increase in pressure caused by each beat. This is one of the primary reasons why hardening of the arteries (atherosclerosis) increases blood pressure. If you pump more fluid through the same sized tube, pressure must increase. On the other hand, if the tube is flexible and can widen, the increase is less. (We will talk more about this later.)

Veins

Veins are thinner walled than arteries and have less elastic tissue, and much, much less smooth muscle tissue. Instead, veins [make use of valves] and the muscle contraction of your body's major skeletal muscles to squeeze blood along. This is the reason you're asked to get up and walk around on a long plane flight—to prevent blood from pooling in your legs. As a side note, the lack of muscle in the walls of veins makes them more susceptible to bleeding when injured since there's no muscle to clamp down.

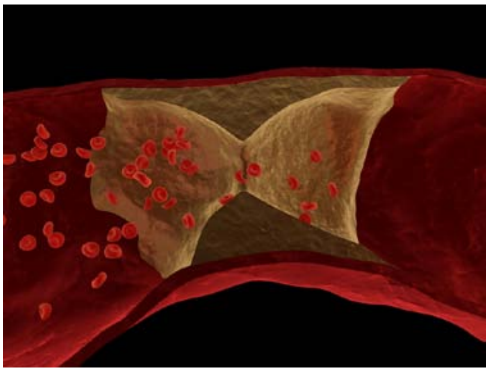


Problems that can occur in arteries

There isn't much mystery as to what the problem is—the build-up of arterial plaque on the walls of the arteries and arterioles. There is, however, a great deal of mystery as to what causes it.

The basic problem is that arterial plaque (a combination of protein, calcium and cholesterol) starts building up on the walls of the arteries. This causes the arteries to both harden and narrow. So far so good! But what causes that buildup?

The cholesterol theory



The primary theory lays the blame on cholesterol—that as cholesterol levels climb in the blood, this causes plaque to form on the walls of the arteries. But this theory begins to collapse under even the most elementary scrutiny. As I mentioned in my newsletter, the Cholesterol Myth, one of my favorite questions to ask doctors is, "If cholesterol is the main culprit in heart disease, why don't veins ever get narrowed and blocked?" And if you wanted to, you could throw capillaries into the equation too. Capillaries do not evidence the build-up of arterial plaque. (They do, however, clog with amyloid plaque in the brain.)

Think about this for a moment. If you have cholesterol circulating equally through the entire circulatory system, but it only causes plaque to build up in the arteries and arterioles, not the capillaries or veins, then how can cholesterol be the primary cause of the problem? If cholesterol caused plaque to form, wouldn't it form everywhere? Since it only forms in the arteries, doesn't the problem have to be something unique to those arteries?

The arterial wall theory

A more sophisticated version of the theory says that the build-up of plaque is triggered by damage to the arterial wall—the endothelial lining. The lining consists of a thin layer of endothelial cells that performs two critical functions:

1. It protects the "innards" of the artery from toxic substances in the blood.
2. It helps regulate the expansion and contraction of the arteries by releasing a bio-chemical (cyclic GMP) into the cells of the smooth muscle in the arterial wall that change the tone or firmness of the artery.

In an attempt to repair damage to the endothelium, your body will "patch" the damage with plaque. This produces one of two conditions—two sides of the same coin really.

Artherosclerosis (hardening of the arteries)

Damage to the endothelial lining is "managed" by the smooth muscle cells surrounding the lining. Smooth muscle cells respond to endothelial injury by rapidly multiplying and producing a fibrin/calcium/cholesterol patch. These patches, called plaques occur just *inside* the lining and thicken the artery's inner wall. Over time, given multiple injuries, the wall of the artery begins to harden and become dysfunctional, no longer expanding and contracting to regulate blood pressure —and steadily narrowing the passageway through which blood flows.

Arteriosclerosis (plaque buildup)

Another way of describing this process is that your body creates plaque to "paste over" any damaged areas—like a scab over a cut. Over time, given repeated injury, these plaques intrude more and more on the inner passage of the artery steadily compromising the ability of the artery to expand and contract and for blood to flow freely.

But it gets worse

The damage to the arterial wall also triggers an immune response with white blood cells flooding the area. This leads to a chronic inflammatory response in the blood vessel. Continued inflammation causes even more damage, which accelerates the process.

All of this, of course, brings up the $64,000 question: "Since the entire theory hinges on damage to the endothelial lining, what actually causes the damage to the lining, and why doesn't it happen to the lining of the veins?"

Once again, oxidized fats and LDL cholesterol are named as the key culprits. Other suspected culprits include:

- Free radicals.
- High blood pressure (yes, high blood pressure begets more high blood pressure).
- Diabetes.
- High homocysteine levels.
- High C-Reactive Protein levels.
- Low levels of vitamin C (similar to scurvy).
- Low levels of nitric oxide.
- Heavy metals.
- Aging.

Muscle matters

But once again, the question arises: "Are not all of these things present in the capillaries and veins too?" The answer, of course, is yes they are—which means there's still a missing piece in the equation. The answer, according to the pH theory, lies not in what flows through the arteries and veins (which is identical), but in their construction (which is different). The key difference between arteries and veins is in the amount of muscle tissue surrounding the endothelial lining. In arteries and arterioles, the smooth muscle is extensive. In veins, it is minimal. And in capillaries, it is totally absent. Why does this matter?

It matters because when muscle tissue is used it produces lactic acid. If your body is healthy (in an alkaline state) and has ready access to an abundant source of oxygen rich blood, that lactic acid can clear quickly. But for those people who eat a high acid forming diet and are in an acidic state, the lactic acid cannot clear quickly. (Remember, blood vessels do not have direct access to the oxygen in the blood that flows through them. They are dependent on the vasa vasorum.) It is the lactic acid that provides the final trigger that causes damage to occur in arterial linings, but not so in veins. It is the presence of accumulated lactic acid in the smooth muscles surrounding arteries that ultimately causes plaques to form.

But even beyond lactic acid, there's another area where muscle tissue matters: nitric oxide. The contraction of the muscles in the arterial walls is regulated by a signaling molecule that we referred to earlier called cyclic guanosine monophosphate (cyclic GMP) in the muscle cells. Cyclic GMP causes the arterial muscle to relax, in preparation for its next contraction. Cyclic GMP is triggered by nitric oxide, which is produced in the endothelial lining. The ability of the lining to manufacture enough nitric oxide to maintain artery dilation is one of its most crucial functions. As damage continues to build in the lining, it blocks nitric oxide-induced dilation, thus stiffening the arteries.

High Blood Pressure

If the arterial blockages happen in your coronary arteries, the result, as we've discussed previously, is coronary heart disease and a heart attack. If it happens in the carotid arteries leading to the brain, it can cause a stroke.

In most cases, however, the damage happens systemically, throughout your arterial system, and the result is high blood pressure. As a quick review, blood pressure is a measurement of the two pressures in your circulatory system as your heart beats. The increased pressure produced in your circulatory system by the contraction of the left ventricle is referred to as systolic pressure. The reduced pressure during relaxation is called diastolic pressure. These are the two numbers your doctor gives you when reading your blood pressure (e.g., 120 over 70). Both low and high blood pressure are dangerous, but low blood pressure is usually easier to manage. High blood pressure, on the other hand, tends to be more intractable and harder to manage—and therefore more dangerous.

Your body has many mechanisms for controlling blood pressure.

- It can change the amount of blood the heart pumps.
- It can change the diameter of arteries, and the volume of blood in the bloodstream.
- To increase blood pressure, it can pump more blood by pumping more forcefully or more rapidly.
- It can also increase pressure by narrowing arteries (particularly the arterioles), forcing the blood from each heartbeat through a narrower space than normal.
- It can seal off capillaries forcing the blood into a smaller space, thereby increasing pressure.

- The body can add fluid to the bloodstream (regulated by the kidneys) to increase blood volume and thus increase blood pressure.
- And it can remove fluid from the blood (also regulated by the kidneys), thereby decreasing pressure.

All of these things happen automatically, regulated by a healthy body, without your even thinking about it. In addition, blood-pressure measurements can vary throughout the day, affected by everything from:

- Food.
- Alcohol.
- Caffeine.
- Smoking.
- Stress.
- Climate.
- And the time of day.
    - Blood pressure changes that occur naturally during the day are the result of the body's internal (circadian) rhythms. In most people, blood pressure rises rapidly in the early morning hours, in anticipation of rising and beginning the day. This is not the result of the physical act of rising but is a preset system that automatically increases a person's blood pressure at that time. Likewise, pressure normally starts dropping early in the evening in anticipation of going to sleep.

All of these things mentioned so far, have nothing to do with clinical hypertension unless they result in secondary damage such as can be caused by smoking and alcohol or sustained stress. Clinical hypertension is a chronic and dangerous condition caused by:

- Constricted arteries.
- Hardened arteries.
- Malfunctioning kidneys.

If left untreated, chronic hypertension can cause:

- Damage to the heart muscle because of the extra load it puts on the heart
- Strokes.
- Kidney damage—which leads to more hypertension, which leads to more kidney damage, etc.

And ultimately, it kills you.

Problems that can occur in veins

As we've already discussed, veins do not have a substantial amount of muscle tissue to contract and squeeze blood along. That means that without physical activity to cause the skeletal muscles to squeeze the veins:

- Blood has a tendency to pool and stop flowing in veins—particularly in the legs where gravity works against you.
- Blood that isn't flowing tends to clot.
- Clots tend to propagate more clotting around the original clot.

- Cumulatively, this can form very large clots.

Large clots that stay in place and block the flow of blood cause phlebitis.

If the clot breaks free and starts traveling through the circulatory system, it's called a thrombus. At whatever point it lodges in a blood vessel and blocks it, it's called an embolism. If you think back to our discussion of the venous system, you'll remember that veins get steadily bigger as blood moves back to the heart. That means that clots that break free in the legs are unlikely to be stopped anywhere on their way back to the heart. The first place they are likely to lodge is when the right ventricle of the heart pumps them out into the pulmonary circulatory system on the way to the lungs. If the clot is fairly small, it will lodge in the lung itself and block the flow of blood to a section of the lung, killing it. This is called a pulmonary embolism. Larger clots can actually lodge in the pulmonary artery feeding an entire lung…killing the lung just like that. Or the clot can lodge at the juncture where the pulmonary artery divides between the two lungs, which will kill both lungs simultaneously…in an instant.

DVT, or deep vein thrombosis, is the term now commonly associated with clots that form as the result of prolonged sitting on an airplane. They tend to break free the next time you start moving again with any vigor. This can be several days or weeks after the plane flight itself, which means many people never connect the two events.

There is one other notable place that clots tend to form. As a result of low blood flow or damaged valves, clots can form in the left atrium of the heart. If the clot forms there, it's already past the pulmonary circulatory system so it can't affect the lungs. Unfortunately, the next stop for the clot is out into the systemic circulatory system, where it has a good chance of being pushed up into the brain causing a stroke.

What doctors do about these problems

Medical treatments for vascular problems never address the actual causes, but seek instead to force test results back into line. What is your doctor likely to offer?

Clogged arteries

Modern medicine really only has two approaches.

1. Surgically repair the damaged area (bypasses and angioplasties).
2. Use drugs to improve the flow of blood through the damaged area and minimize the production of cholesterol, which serves as one of the triggers.

Neither of these approaches, of course, actually deals with the real problem.

High blood pressure

When it comes to high blood pressure, doctors rely almost exclusively on pharmaceutical drugs. The four major classes of drugs are:

- **Diuretics**, which reduce pressure by making you pee out water from your body. Reduce the volume of fluid in your blood, and you reduce the pressure. Unfortunately, side effects can include dizziness, weakness, an increased risk of strokes, and impotence. (Not to worry, there are medications to alleviate the side effects.)
- **Calcium channel blockers**, which work to relax and widen the arteries—thus reducing blood pressure. Then again, a major side effect of channel blockers is a 60% increased risk of heart attack.
- **Beta blockers**, which work by weakening the heart so it won't pump as strongly, thereby reducing blood pressure. One of the major problems with beta blockers, though, is the increased risk of congestive heart failure.
- **ACE inhibitors** (the new drugs of choice), which like the calcium channel blockers, also work to relax and widen the arteries. Unfortunately, ACE inhibitors can produce severe allergic reactions, can be deadly to fetuses and children who are breastfeeding, and can cause severe kidney damage.

Again, none of these drugs deals with the actual cause of the high blood pressure. They are merely an attempt to force test numbers into line and prevent people from immediately dying.

Blood clots and DVT

If doctors are worried about clots (such as after bypass surgery), they put patients on blood thinners. The standard is Coumadin (warfarin). Aside from the usual jokes that Coumadin is essentially rat poison (which it is), it has serious side effects. It can cause severe internal bleeding that can be life-threatening and even cause death. You can always tell a person on warfarin by the extensive bruising all over their body since even the slightest bump or touch is enough to cause internal bleeding. It's a bit like using dynamite to open a locked door. It can do the job, but you need to be oh so careful or you'll blow up the building at the same time. There are better choices.

Note: Some people might think aspirin is a good alternative. It's not. While aspirin may be beneficial at keeping blood flowing through arteries, studies indicate it has no effect on preventing clots from forming in veins.

What are the options?

As it turns out, for most major heart problems, you have a world of alternatives—certainly safer and often far more effective than their medical counterparts.

Clogged arteries

- Studies have shown that dietary changes alone can unplug arteries.
- Proteolytic enzymes, particularly formulas that contain either nattokinase or lumbrokinase, can break down the proteins that hold plaque together stuck to arterial walls—effectively dissolving it.

- Proteolytic enzymes can also help dissolve scarring of the endothelial lining.
- And proteolytic formulas that contain seaprose-s, serrapeptase, and/or endonase can help reduce arterial inflammation that both constricts arteries in real time and contributes to future long term damage.
- Sufficient Omega-3 fatty acids in the diet also help reduce arterial inflammation and dramatically reduce the circulating levels of damaging NEFAs.
- Antioxidants such as SOD, pomegranate, grape seed extract (AKA OPCs), and pycnogenol help heal the endothelial lining, thereby preventing future plaque and helping to heal current plaque.
- Methylating supplements such as B6, folic acid, B12, TMG, and SAMe help reduce homocysteine levels, thereby reducing damage to the endothelial lining.
- L-arginine and noni extract assist the smooth muscle in arterial walls in obtaining sufficient nitric oxide to function properly.
- Regular heavy metal detoxing can reduce a major cause of irritation to the endothelial lining and a primary instigator of plaque formation.
- And raising body pH through proper diet and the use of supplements such as coral calcium reduces lactic acid levels in the arterial smooth muscle, thereby minimizing damage to arterial linings.

As you can see, there is a world of choices you can make that can dramatically change your vascular outcomes. Virtually all of them are covered if you're following the Baseline of Health Program.

High blood pressure

Pretty much everything you do to reduce clogging of the arteries will, by definition, help to reduce blood pressure. In addition, though, you can also consider:

- Lose weight. Simple laws of physics apply here. As we've already discussed, your blood vessels have to service every single cell in your body. The more body mass you have, the more pressure you need to force blood through the system. Lose weight; less pressure required.
- If you smoke, stop. Smoking constricts blood vessels and raises pressure.
- If you're stressed, try meditation or biofeedback. As part of your body's "flight and fight" mechanisms, stress increases heart rate and blood pressure to help respond to the short term stress of an attack from a saber toothed tiger. Twenty-four/seven stress was not designed into the system. Prolonged stress definitely impacts blood pressure levels. Even if you have clogged arteries, reducing stress levels can still help drop your blood pressure levels significantly.
- Herbs such as passionflower, apocynum venetum, hawthorne, and stevia (yes stevia) have all been shown in clinical studies to help lower blood pressure.

Blood clots and DVT

Proteolytic enzymes, particularly formulas that contain either nattokinase or lumbrokinase are just as effective at preventing clots, with wide ranging dosage tolerances. In other words, good proteolytic formulas work with minimal chance of side effects. In fact, a good systemic proteolytic enzyme formula that also contains enzymes such as endonase, seaprose-s, or serrapeptase can have multiple beneficial effects for the circulatory system in addition to reducing clotting. Such formulas can play a major role in reducing inflammation and scarring in the cardiovascular system and enhance cardio perfomance in athletes.

Conclusion

When it comes to most forms of heart disease associated with the arteries and veins, you have a world of alternatives—certainly safer and often far more effective than their medical counterparts. It's also worth noting again that if you are following the Baseline of Health Program, then you're already doing most of them.

Which brings us to the final chapters of our report on the anatomy, physiology, and diseases of the cardiovascular system—your blood. In the next chapter will begin our exploration of this most complex of subjects.

Chapter 5: Blood of my Blood

To this point, we've addressed the anatomy and physiology of the heart and circulatory system and discussed the problems associated with the cardiovascular system. In this chapter, we bring it full circle. If you think about it, everything that we've talked about so far culminates here. The heart, the arteries, the veins—what is their purpose? When all is said and done, they are merely a support system, a transportation system if you will, for blood. The cardiovascular system has only one purpose—to move blood through the body. By definition that makes blood pretty important, and as befits its importance, it is a vast topic that we're merely going to touch on in the next couple of chapters. To give you an idea of how vast, medical school courses focused on just the clotting mechanisms of blood can run an entire year. As I said, vast!

Throughout history, blood has both fascinated and awed us. It is central to many religious ceremonies, and early myths about blood have been used as the basis for everything from human sacrificial ceremonies to medical practice, and even poetry.

Blue-blooded, a term denoting royalty, was originally used by nobles of Castile who could see the "blue-blood" through their veins. In early England, red coverings were put on beds to treat smallpox, and strips of red cloth were used as cures for scarlet fever. Even today, many pills and medications are colored red, although this coloration has no medicinal value.

And let us not forget the vampire, the creature that lives on the blood of the living and keeps coming back from the dead to reappear in movie after movie after movie.

So what exactly is blood?

A big surprise for most people is that your blood is actually an organ, like your liver and kidneys. In other words, it is a "group of tissues of different kinds" that functions as one system and that performs a "specific" function or group of functions. With that in mind, let's take a look at this organ, at its composition and functions to better understand its importance and what can go wrong.

Now you might think that it would make sense to first explore what blood is made of before we explore what it does, but, in fact, the opposite is true. By first understanding the roles blood plays in our bodies, it will make it much easier to understand "why" blood is made the way it is. So, with that in mind, let's begin this chapter with a discussion of the specific functions that blood plays in our bodies.

Why we have blood

Blood serves three primary functions in the human body:

1. Transportation
2. Protection
3. Balance—what doctors call homeostasis

1. Transportation

Even when it comes to transportation, blood is not so simple. It actually transports four distinct categories of things: (1) gases, (2) nutrients, (3) waste, and (4) chemical messengers.

1. **Gases:** When most people think of blood, they think of the role blood plays in transporting oxygen to the various cells of the body. Correspondingly, most people are also aware that blood transports carbon dioxide (the gaseous waste from cellular metabolism) away from the body's tissues and back to the lungs where it can be exchanged for fresh oxygen. For most people, a complete exchange of gases for your entire blood supply happens approximately every single minute of every single day of your life. It's actually quite astounding, and for a trained athlete is even more amazing. For example, there's Lance Armstrong. Dr. Edward Coyle, director of the Human Performance Laboratory at the University of Texas in Austin measured and studied Armstrong's physiology for more than seven years. He found that Lance Armstrong's heart can pump nine **gallons** of blood per minute working at its hardest. That's twice the capacity of the normal person. He found that Lance's lungs can get almost double the amount of oxygen out of every breath compared to a normal healthy 20-year-old. And he found that Lance has more red blood cells to deliver oxygen to his body, which allows it to recover at an incredible rate. "An average person when going to exhaustion would have to stay stopped or wouldn't be able to move for 10-15 minutes and Armstrong is able to go right back to maximum in 1 to 2 minutes," says Coyle.

As you can see, the capacity of blood to perform even the simple function of exchanging gases is widely variable. At the end of this chapter, we will explore some of the things you can do to improve the ability of blood to perform this function—as well as all its other functions.

A note on carbon monoxide: When talking about gas exchange in blood, it's important to remember that blood cells actually prefer carbon monoxide to oxygen. Once a red blood cell grabs onto carbon monoxide, it becomes very reluctant to let go of it—either to exchange for oxygen in the lungs or carbon dioxide at the cellular level. That's why doctors usually treat carbon monoxide poisoning by forcing pure oxygen into the lungs to force the blood cells to swap out the carbon monoxide.

1. **Nutrients:** After digestion has broken food down to its fundamental components, those components—including sugars, proteins, fats, cholesterol, vitamins, and antioxidants—are circulated by the blood to fuel the body, nourish it, and provide the building blocks to rebuild it.
2. **Glucose** is the primary energy fuel which is "burnt" by the "metabolic fire" in each cell. The total amount of glucose in the blood is in the range of 3-7 g for a normal adult—with levels at their lowest in the morning and rising after meals. It should be noted that glucose is not the only sugar found in the blood. Other sugars such as fructose and galactose are also transported in the blood, but only glucose levels are regulated by insulin and glucagon.
3. **Protein** is the primary building block of the body for repairing organs and building muscle. Protein molecules, however, have to be broken down sufficiently to be used by the body. Large protein molecules that make their way into the bloodstream are not particularly useful to the body's cells and are, in fact, treated as allergens by the body.
4. **Cholesterol**, despite its bad reputation, is required to build and maintain cell membranes and as raw material for the production of all hormones. Cholesterol is insoluble in blood, but is transported in the circulatory system bound to lipoproteins, spherical particles which have an exterior composed mainly of water-soluble proteins. The type of cholesterol, HDL or LDL, is determined by the particular lipoprotein the cholesterol is bound to: LDL (low-density lipoprotein) and HDL (high-density lipoprotein).
5. **Vitamins** that make their way into the bloodstream need to be in a form that is useable by the cells of the body. Since the cells of the body do not have receptor sites for most vitamins, most supplemental vitamin isolates are actually toxic to the body and need to be bound to carbohydrates and proteins in the liver (conjugated) so that they are useable in the body.
6. **Antioxidants** need to be optimized in the blood not only to protect the arterial walls but to allow the blood to perform its function of bringing the antioxidants to every cell and organ in the body. If they're not in your blood because they weren't present in your food to begin with, then the blood can't bring them where they are needed.
7. **Waste removal**: It's not just gases such as carbon dioxide that need to be removed. Blood is also filled with a great deal of "waste" that also requires removal. When we refer to nutrients being "burnt" by the "metabolic fire" in each cell, it is also an apt analogy when it comes to waste. Cellular burning produces "waste ash" not unlike an actual fire. This waste needs to be removed from each cell and transported out of the body. Also, waste produced by the immune system's battle with invading bacteria and viruses needs to be removed, as do Circulating Immune Complexes, and used up cells (such as old blood cells), etc. All of this waste is transported about by the lymph and blood on its way out of the body.
8. **Hormones** are the body's chemical messengers. They tell the body what to do and when. Adrenaline, for example, is produced in the adrenal glands, but serves to tell the heart to speed up and the blood vessels to narrow in times of stress. HGH, on the other hand is produced in the pituitary gland. It is released in a series of 9-24 microscopic "pulses" throughout the day (mostly in the evening). Its release signals a number of body functions relative to aging and the production of other hormones such as DHEA and melatonin and various parts of the endocrine system, including the hypothalamus (considered to be the master gland). It is the role of blood to serve as the transportation system that carries hormones (and other chemical messengers) from where they are manufactured to where they are needed.

2. Protection

In addition to transportation, blood also plays several "protective" roles in the body.

- **Controls bleeding:** Whenever there is damage to the body, either internal or external, clotting factors in the blood work to seal off the damage, prevent further bleeding, and promote the repair of the damaged area.
- **Fights infection and repels invaders:** Many immune cells work hand in hand with your blood to fight infection by invading bacteria, viruses, and funguses.
- **Controls allergies:** Again, working with the immune system, your blood works to identify and remove allergens and Circulating Immune Complexes that compromise the integrity of the body.
- **Aberrant cells:** Works with the immune system to identify and eliminate cancerous cells.

3. Balance, or homeostasis

Your body depends on a very careful balance of a number of systems, and those systems operate within very narrow parameters. Fall outside those parameters by even a little and very serious illness or death can result. Some key systems that your blood keeps in balance include temperature, pH, and hydration.

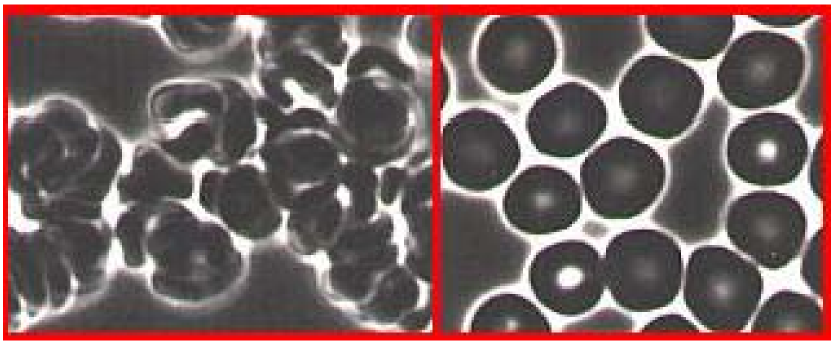
- **Temperature**: Healthy body temperature operates within a very narrow range of about 97 to 100 degrees Fahrenheit or 36.1 to 37.8 degrees Celsius. Go much over 100 degrees for very long and brain damage and death result. Go much lower than 97 degrees for any length of time and hypothermia sets in. Depending on the level of hypothermia, the effects can be anywhere from shivering, to loss of motor control, to death. In order to prevent extremes of temperature, your brain is constantly monitoring blood temperature. In situations of high temperature, your brain will move blood to the skin to promote the passing of heat off into the air. In cases of hypothermia, your brain will cause capillary networks to shut down and shut blood away from the skin into the brain and body core. An interesting note is that alcohol (think St. Bernard rescue dogs and brandy), which is often used to "warm people up" is potentially deadly. As a blood vessel dilator, it creates a false sense of warmth by opening up the shut capillaries and forcing blood out from the core back to the skin. This creates a sense of warmth in the skin but does so by shunting blood away from the internal organs and brain, thus potentially leading to severe hypothermia and killing you. Can you say, "Bad doggy?" Note: Your body also uses hormones transported in the blood to ramp up or slow down metabolic fires to help regulate temperature.
- **pH (your body's acid alkaline balance):** Our bodies function in a very narrow range of acid/alkaline balance (pH). Our blood in particular is very sensitive to these changes. Ideally, blood pH should be slightly alkaline at about 7.45. If it varies by even as little as a few tenths of a point, severe illness and death may result. Unfortunately, most of the food we eat is highly acidic (meat, dairy, sodas, alcohol, cooked grains). In the end, it becomes too much for our bodies to handle. If we don't correct the problem by "alkalinizing" the body, disease, sickness, and death are the inevitable result. In addition to being highly sensitive to pH changes itself, your blood plays a key role in helping to monitor and effect pH changes throughout the body. For more on what pH effects and how to balance alkalinity in the body see Chapter 14 of *Lessons from the Miracle Doctors*. The importance of pH really boils down to two things:
  - **Enzymes.** We've already discussed the importance of enzymes. They control every single metabolic function in our bodies, and they are integral to our immune system. As it says in

Anatomy and Physiology by Anthony and Thibodeau, "Enzymes function optimally at a specific pH and become inactive if this deviates beyond narrow limits."

- **Oxygen**. Every cell in our body requires oxygen for life—and to maintain optimum health. To put it simply, the more acid the blood, the less oxygen is available for use by the cells. Without going into a discussion of the chemistry involved, just understand that it's the same mechanism involved when acid rain "kills" a lake. The fish literally suffocate to death because the acid in the lake "binds up" all of the available oxygen. It's not that the oxygen has gone anywhere; it's just no longer available. Conversely, if you raise the pH of the lake, oxygen is now available and the lake comes back to life. Incidentally, it's worth noting that cancer is related to an acid environment (lack of oxygen). The higher the pH (the more oxygen present in the cells of the body), the harder it is for cancer to thrive.

The bottom line is that a balanced pH is vital. An extended pH imbalance of any kind threatens our well-being—threatens, in fact, our very lives. Managing the pH balance of all of our bodily fluids, tissues, and organs is so important that our bodies have developed systems to monitor and balance acid-alkaline levels in every cell and biosystem. And our blood plays a key role in maintaining that balance.

- **Hydration:** You can drink all the water that you want, but it has to make its way to the individual cells where it's needed. That happens in the blood. Blood has mechanisms that we'll learn about in the next chapter for controlling osmotic pressure and moving water in and out of cells—if it's available. The kidneys may regulate the amount of water in the blood, but the blood regulates the amount of water in the cells. Proper hydration is imperative, not only for maintaining proper fluid balance in the cells themselves, but for maintaining proper hydration levels in the blood itself. Too much water can wash important nutrients out of the blood and even prove toxic to the body. Too little water can lead to clumping of the blood cells, high blood pressure, and even edema, or swelling of the extremities. Yes, I know that doctors treat high blood pressure and edema as a condition of too much water and treat them with diuretics—and they are half correct. The problem is not so much "too much water" but "too much water in the wrong place."



Things to do

Even though we have merely overviewed the primary functions of blood in your body, we have enough information to start thinking about ways we can improve the ability of blood to perform those functions.

Transportation

- **Exercise**: We've already seen how exercise transformed the gas exchange capabilities of Lance Armstrong's body. If you can accomplish just 10% of that increase in your own body, it will be transforming.
- **pH balance**: Change your diet to use more fresh vegetables, which are alkalinizing and less meat, dairy, sugars, and cooked grains, which are acid forming.
- **Carbon monoxide**: As much as possible avoid excessive exposure to carbon monoxide. That means:
  - Don't smoke.
  - Avoid secondhand smoke.
  - Don't hang around running cars in closed environments.
  - Don't use charcoal grills in closed environments.
- **Digestive enzymes** play a major role in breaking down the foods we eat into forms that are easily transported in our blood and that are easily utilized by our cells.
- **Proteolytic enzymes** eliminate circulating immune complexes from the blood and quickly optimize the quality of the blood.
- **Sugar metabolic enhancers** prevent glycemic swings and help maintain proper sugar levels in the blood.
- **Blood cleansing** optimizes the performance of the blood.
- **Liver cleanses** to balance cholesterol. Understand, cholesterol levels are primarily regulated by the liver. Keeping the liver clean and balanced is essential to maintaining proper cholesterol levels in the blood.
- **Kidney flushing** helps the kidneys regulate blood fluid levels.

Protection

- **Supplementation**: Every single blood cell in your body is replaced every 120 days. You cannot build the same quality blood cells out of pepperoni pizza, beer, and Ding Dongs that you can out of real food. The ability of blood to clot properly is dependent on having the proper vitamins and minerals (such as vitamin K) present in the diet. If they're not present in the diet, then you must supplement.
- **Immune enhancers and pathogen destroyers** help control bacteria and viruses in the blood that tax the immune system.
- **Proteolytic enzymes** help eliminate circulating immune complexes, which significantly relieves the allergic burden on your body, thus taking a great deal of burden off of your blood in accomplishing that objective.

Homeostasis

- **pH balance**: Our bodies have developed a system for maintaining pH balance in all of our body fluids. To understand this system better, we need to take a look at what changes pH (usually making us more acid), and how our bodies respond to that change. When they are metabolized, carbohydrates, proteins, and fats produce various acids in our bodies. Proteins produce sulfuric acid and phosphoric acid. Carbohydrates and fats produce acetic acid and lactic acid. Since these acids are poisonous to the body, they must be eliminated. Unfortunately, they can't be eliminated as acids through the kidneys or large intestine as they would damage these organs. **How Can We Help?**

- Change your diet. Follow the guideline laid out in Chapters 6 and 7 of *Lessons from the Miracle Doctors*.
- In addition, there are several special alkalinizing agents available.
- Your health food store has alkalinizing teas or drops available.
- There are machines from Japan that will "micronize" your water. What it actually does is take your tap water and divide it in two. One stream is acidic and can be used for washing and cleaning. The other steam is alkaline and is used for drinking. It works really well. Unfortunately, it's really expensive—about $900-1,200.
- One of the best alternatives is to simply magnetize your water. Applying a magnetic field to a pitcher of water for a short period of time will make it more alkaline, depending on its mineral content. It also offers the added advantage of lessening the surface tension of the water, which makes the water wetter and more usable by the cells of your body.

- **Hydration:** As stated earlier, one of the primary roles of blood is to maintain proper hydration. When you start to dehydrate, your body starts trying to store water in order to survive. Instead of passing the water out through the kidneys, it starts to stockpile it in the bloodstream. It is this stockpiling resulting from dehydration that often leads to higher blood pressure. That means that in many cases the more fundamental solution to higher blood pressure lies not in using diuretics to flush out excess water but in addressing the underlying problem of dehydration. It might seem counterintuitive, but you need to drink more water to alleviate the dehydration, which then allows the body to eliminate the excess water it was storing as a response. Bottom line: you want to properly hydrate…and you want to cut down on excessive use of diuretic drinks such as coffee, tea, and many sodas.

Conclusion

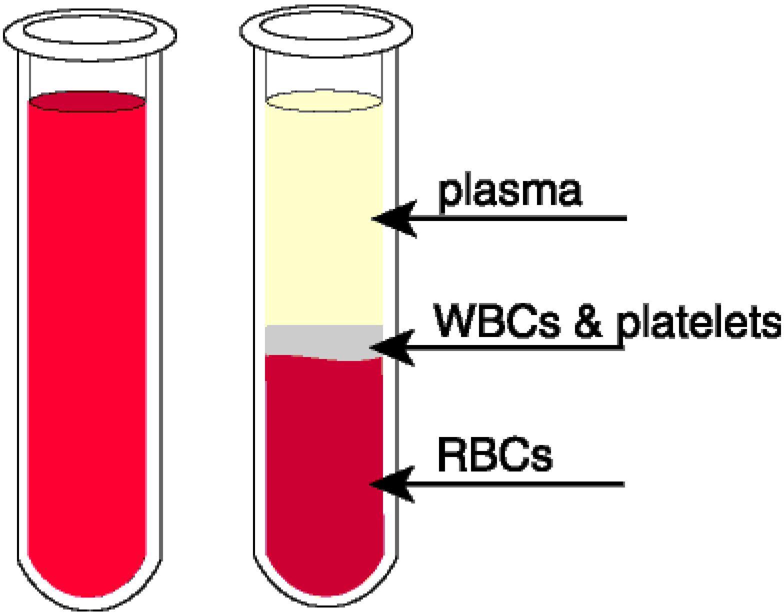
As we've seen, just by exploring some of the basic functions that blood performs, it opens the door to exploring how much we can influence the performance of those functions by our dietary and lifestyle choices. In the next chapter, we will explore in some detail the actual composition of the blood. This actually takes you into your doctor's world since most blood tests actually are designed to measure the amounts of key components. Understanding these components and your doctor's tests will open up choices to you that your doctor might not otherwise present.

Chapter 6: Blood: It's Thicker than Water

In the last chapter, we discussed the three primary functions of blood in the human body: transportation, protection, and balance. In this chapter, we're going to examine the composition of blood and how that determines its functionality. Why is this important? Two reasons:

1. When your doctor runs tests on your blood, he/she is primarily looking at the individual components—like hematocrit, albumin, platelet, and white cell counts. Knowing what your doctor is talking about and what the levels mean will empower you to be an active participate in any treatment. (In the next chapter we will cover these tests in detail.)
2. Knowing what the pieces are and what affects them will give you access to a world of alternatives that your doctor is unlikely to inform you about—or to be inforfmed about themselves, for that matter.

So let's begin. In simple terms, blood is 55% plasma and 45% formed elements (red cells, white cells, and platelets). Ah! But in that simplicity is a world of complexity. (Note: don't get lost in the details. Just follow the basic principles. In the next chapter, we'll refocus on the important parts.) For now, let's just explore.



Plasma

Plasma is the clear yellow liquid that serves as the transportation agent in blood. It is mostly water, some 91.5%, in fact. The rest is 7% protein and 1.5% other solutes.

Proteins in blood plasma

The proteins in blood function primarily as clotting agents and antibodies. Abnormal levels are indicitive of everything from autominnune disorders to cancer to heart disease. The key ones are:

- **Albumins 50-60%:** Serum albumin is the most abundant blood plasma protein and is produced in the liver. The human version is called human serum albumin, and plays a key role in regulating blood volume by maintaining the osmotic pressure of the blood compartment. It also works as a binding agent for bilirubin, free fatty acids, testosterone, calcium and some drugs. Low albumin may be caused by liver disease, kidney disease, burns, malnutrition, late pregnancy, genetic variations, and even bad posture. High albumin is often caused by dehydration.
- **Globulins 38%**: This is a generic term to describe several different families of proteins which have larger molecules than albumin and are less soluble in pure water. They include:
    - **Alpha globulins**, which control and inhibit certain blood enzyme activity. Malignancy and acute inflammation can increase the levels of alpha globulins in the blood. A low level is often indicative of liver disease.
    - **Beta globulins**, including:
        - **Plasminogen**, which converts to plasmin, when needed, to help break down blood clots.
        - **Angiostatin**, which inhibits the formation of new blood vessels and may play a role in cancer therapy.
        - **Sex hormone binding globulin**, which like albumin plays a role in the transportation of sex hormones through the bloodstream.
    - **Gamma globulins**, which function as antibodies and play a major role in immune function. Low gamma globulin levels are seen in people who donate blood too often or have immune system problems.
- **Fibrinogen 7%**: Fibrinogen is converted, as needed, into fibrin. Whenever there is trauma to the arterial system, fibrin forms itself into a mesh at the site of the injury to capture blood platelets and form a temporary plug over the wound site. Fibrinogen levels are a reflection of clotting ability and activity in the body. Chronically low levels may be related to decreased production due to an inherited condition or to an acquired condition such as end-stage liver disease.
- **Other proteins,** such as C-reactive protein, comprise the rest of the proteins—about 1.5%. High levels are a marker for systemic inflammation and are a predictor of heart disease.

Other solutes in blood plasma

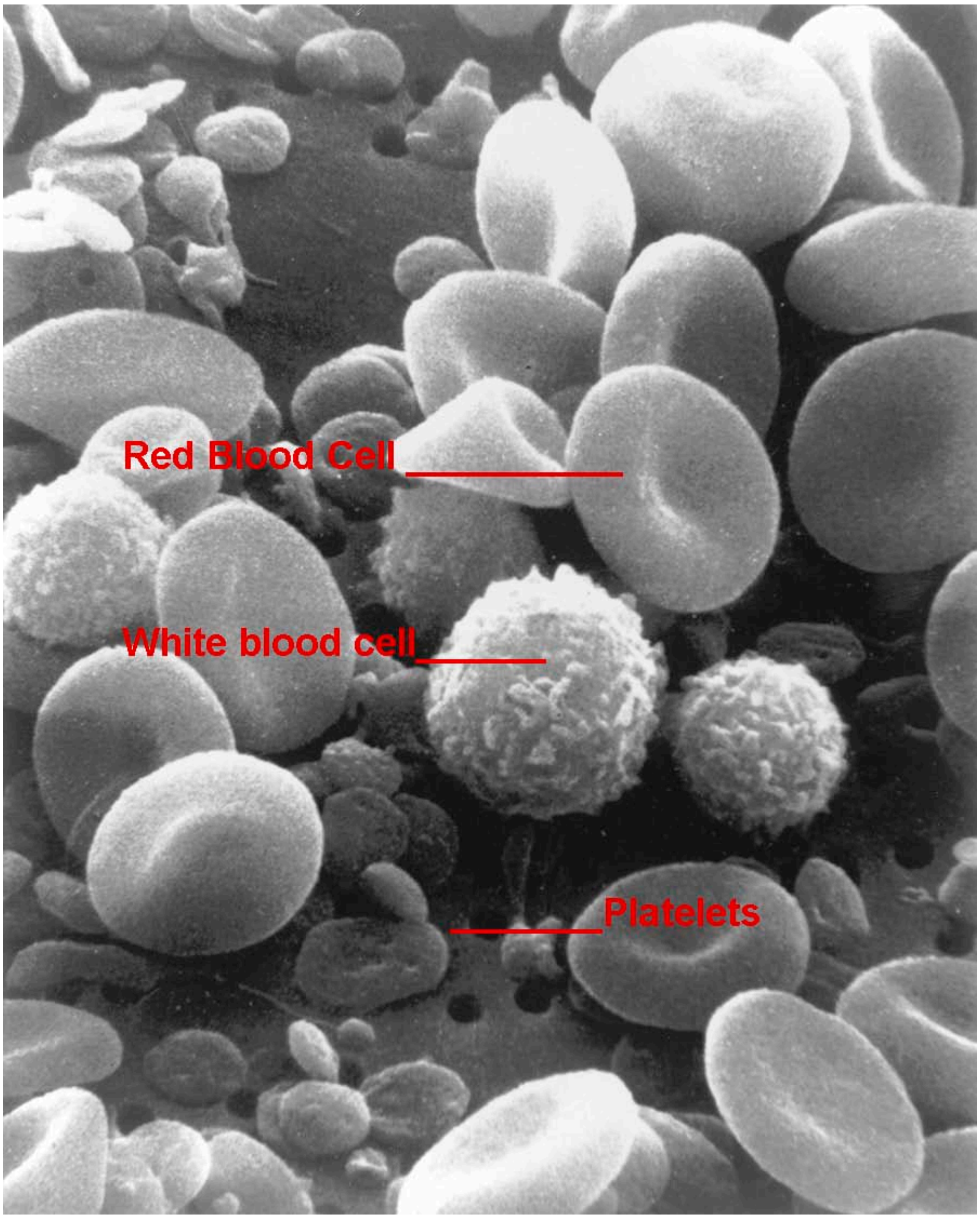
The non-proteins dissolved in blood plasma make up about 1.5% of the plasma and include things such as:

- **Electrolytes:** These are the minerals dissolved in your blood (and other body fluids) that contain free ions and carry an electric charge. **It is important that the balance of electrolytes in your body be maintained, because they affect the amount of water in your body, blood pH, muscle action, and a host of other important processes including the beating of your heart.** Electrolytes exist in the blood as acids, bases, and salts such as sodium, calcium, potassium, chlorine, magnesium, and bicarbonate. You lose electrolytes when you sweat, and they must be replenished or your body will lose the ability to perform effectively, or even die.
- **Nutrients**.
- **Gasses** (oxygen, carbon dioxide, and carbon monoxide if you're unlucky).
- **Regulatory substances** (such as insulin to regulate blood sugar and various immune regulating molecules).
- **Vitamins**.
- **Waste** such as urea.

Formed elements

As we said earlier, plasma comprises 55% of blood. The other 45% is made up of the non-soluble "formed elements." Specifically, we're talking about:

- Platelets
- White blood cells (leukocytes)
- Red blood cells (erythrocytes)



This is a scanning electron microscope image from normal circulating human blood.
One can see red blood cells, several white blood cells including lymphocytes,
a monocyte, a neutrophil, and many small disc-shaped platelets.
National Cancer Institute Bruce Wetzel/Harry Schaefer (photographers)

Platelets

Although platelets are often classed as blood cells, they are actually fragments of large bone marrow cells called megakaryocytes. As fragments, they are generally disc-like, but irregular in shape. In effect, they look like broken plates—thus their name. In normal blood there will be between 250,000—400,000 per ml of blood. The role of platelets is to assist in blood clotting. During normal blood clotting, the platelets clump together, or aggregate at the site of an injury.

Essentially, they are part of the body's initial blood clotting response. When there is external or internal trauma, or there is damage to endothelia cells (such as those that line the inside of the blood vessels) or collagen has been exposed in internal tissue, the body rushes platelets to the site of the injury, where they clump together to form the initial plug to seal up the wound.

This all sounds simple enough, but the control mechanisms are, in fact, remarkably elegant.

When collagen is damaged it releases ADP (Adenosine diphosphate). ADP is what is known as an agonist, a substance that binds to a specific receptor and triggers a response in a specific cell. By itself, ADP is a strong agonist, but its effect is greatly amplified in the presence of adequate levels of serotonin. (If levels of either ADP or serotonin are low, the clotting effect is significantly lessened.) ADP works by triggering platelets to change shape, release granule contents, and clump together. Upon exposure to activating agonists, such as ADP and serotonin, platelets break down arachidonic acid in the blood to form thromboxane A2, which plays a major role in the activation and recruitment of more platelets to add to the plug. ADP also causes adhesion of platelets to atherosclerotic plaques and to the walls of the injured arteries.

But we're not done yet.

Once the leak is plugged and the "emergency" is over, the blood then works to form a more permanent clot. In fact, it is the formation of the original clot that triggers the humoral coagulation system, leading to the creation of a more permanent clot. Or to put it another way: clotting begets clotting. Even as platelets plug the injury site (a process called *primary hemostasis), secondary hemostasis* is already kicking in. In secondary homeostasis, proteins in the blood, called *coagulation factors* (fibrinogen, prothrombin, etc.), respond in a complex cascade to form fibrin strands which strengthen the platelet plug. The coagulation cascade of secondary hemostasis is very complex and actually follows two separate pathways. It is beyond the scope of this report, but for those who are interested in learning more, check it out here.

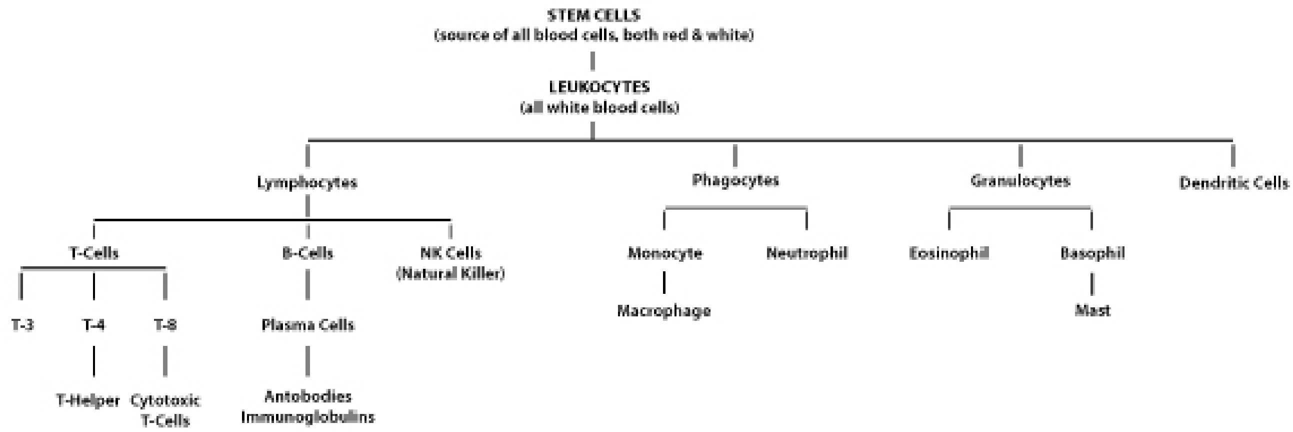
The key things to remember about the clotting process are:

- It is finely tuned
- It is self regulating. Certain proteins initiate the process. Other proteins reinforce the process. And still other proteins (such as plasminogen) keep it from running out of control—in other words, stop the clot from spreading throughout your entire body.
- Remember, clotting begets clotting. Thus the need for bio-chemicals in the blood such as plasminogen to moderate the process.

It should be noted that hemophiliacs have platelets. What they're missing is one or more of the "follow up factors" (usually Factor VIII) that are necessary to produce more stable clots. Whereas, severe hemophilia was at one time pretty much an eventual death sentence, not so much any more. Doctors simply replace the missing clotting factors with clotting factors extracted from human blood donated to blood banks. (Incidentally, obtaining clotting factors is not a problem since they are removed from all blood used for transfusions so that the blood does not clot prematurely.) There are no natural treatments that are as effective. This is one place where doctors definitely trump natural healers.

Leukocytes - white blood cells

All blood cells, both red and white, begin as stem cells in your bone marrow. These undifferentiated cells begin to assume individual characteristics and become either red cells (the oxygen carriers) or white cells (the cells of the immune system). Incidentally, the literal translation of the word leukocyte is "white cell." White cells make up about 1% of your blood and number about 5-10 thousand per ml.



Further differentiation divides the leukocytes into four main types of cells. (Since white cells really are the cornerstone of your immune system, not your cardiovascular system, we will limit our discussion in this report to a quick look.)

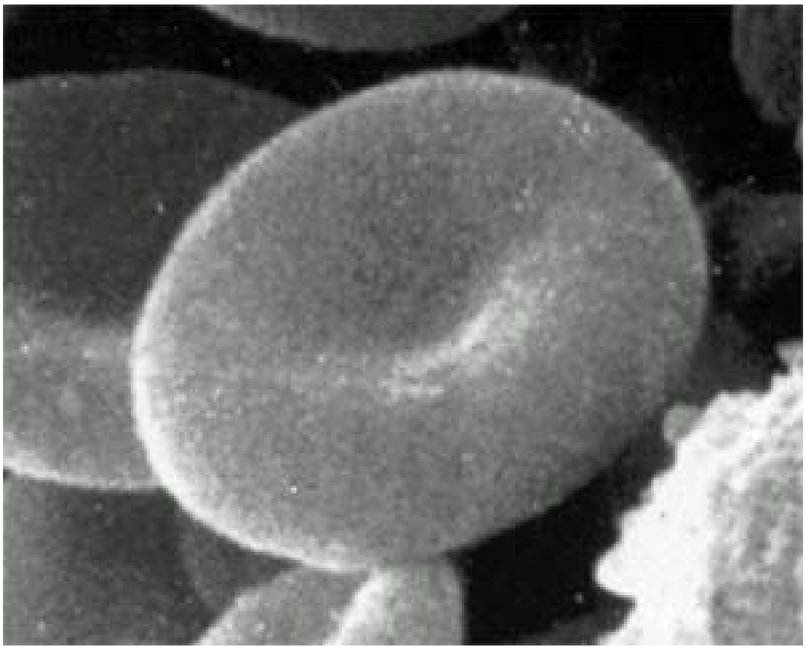
- Lymphocytes
  - T-cells - distinguish between normal healthy cells and invaders, including mutated rogue cells.
  - B-cells - make one specific antibody to defend against one specific invader.
  - NK-cells - attack a whole range of microbes and tumor cells.
- Phagocytes
  - Neutrophils - main bacteria fighters.

- Monocytes - along with the neutrophil, the major microbe-eating and killing cell in the blood. When monocytes leave the blood and enter the tissue they are converted to macrophages.
- Macrophages - attack foreign invaders and eat up worn out cells and other waste in the body.

- Granulocytes
    - Eosiniphils deal with allergies.
    - Basophils are allergy processing.
    - Mast cells—mount a response to parasite and bacterial infection.
- Dendritic cells wrap up antigens and spent lymphocytes and carry them to the lymph nodes for removal from the body.

Note: in leukemia, the number of white cells climbs from 5-10 thousand per ml to as much as 100-400 thousand malignant cells per ml.

Erythrocytes - red blood cells



When people think of blood, it's really the erythrocytes they're thinking of. It's the erythrocytes that give blood its red color. In fact, the name erythrocyte means "red cell." The erythrocytes also perform the function most people equate with blood—carrying oxygen to the cells and carbon dioxide out of the body. Red blood cells make up about 45% of blood's total volume and number about 4.8 - 5.4 million cells per ml. This volume is expressed by doctors as the "hematocrit level." A level of 45% is obviously cool; less than that is anemic — with levels below 30% considered severely anemic. Another term that's important when talking about red blood cells is "hemoglobin." Hemoglobin is the iron-based metalloprotein molecule inside the red blood cells that actually carries the oxygen and carbon dioxide. The name hemoglobin comes from the joining of the two words *heme* and *globin*, reflecting the fact that hemoglobin is made from a globular protein with an embedded heme group. Each heme group, or cofactor, contains an iron atom, which is responsible for the binding of oxygen. There are approximately some 250-300 million hemoglobin molecules in each blood cell, and they comprise about 1/3 the total hematocrit volume—weighing in at 13-14 grams.

The design of a healthy red blood cell is important. It's very, very small, about 6-8 microns (.00025 inches) in diameter, and its shape is that of a bi-concave disc. Both its size and shape are optimized for carrying and easily exchanging gases. Red blood cells can also easily fold to facilitate their movement through tight spaces in tiny capillaries. One other interesting fact about erythrocytes is that they have no nuclei. They don't need it since they have only one function: to transport and exchange gases. In fact, fact red blood cells are designed to have a high affinity for oxygen and a moderate affinity for carbon dioxide. This affinity is further augmented (and regulated) by body and blood pH. pH is geared for the release of carbon dioxide and the uptake of oxygen in the lungs, but a slight adjustment in pH regears the blood cells for release of oxygen and the uptake of carbon dioxide at the tissue level. It's brilliant!

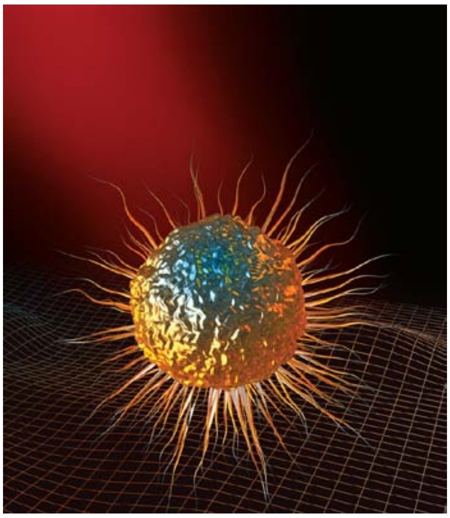
Note: in the last chapter we talked about hemoglobin's preference for carbon monoxide, which can lead to carbon monoxide poisoning. In fact, hemoglobin prefers carbon monoxide over oxygen by a factor of 200 times!! It refuses to let go of the carbon monoxide, keeping it in circulation for quite some time. You literally have to force oxygen into the blood to dislodge it.

It should be noted that red blood cells have a very short life cycle of about 120 days. That means that every four months you replace every single red blood cell in your body. This means that **the production rate of red blood cells is phenomenal—around 2.5 million new cells per second, or a mind boggling 200 billion new cells each and every day of your life.** To accomplish this feat, your body needs several key nutrients...all present 24/7:

- Amino acids (proteins) for producing the globular protein part of the hemoglobin.
- Iron for the production of the heme non-protein cofactor portion of the hemoglobin.
- Vitamins B12, B6, and folic acid.
- Nickel and cobalt as trace minerals.
- Erythropoietin (EPO), a hormone, is produced in the kidneys and plays a key role in regulating production of red blood cells. It has a history of usage as a blood doping agent in endurance sports such as bicycle racing, triathlons and marathon running. Production and release of EPO is governed by:
    - The need to keep the normal oxygen carrying capacity of the blood at a steady state based on the normal turnover of erythrocytes.
    - The oxygen content of tissues. Low oxygen levels in body tissue leads to increased production or EPO.

The making of blood cells—both white and red

Again, all blood cells, both red and white, begin as stem cells in your bone marrow. As stem cells mature, they undergo changes in their gene expression. This limits the cell types they can become and moves them closer to a specific cell type. Each successive change moves the cell closer to its final choice of cell type and further limits its potential cell type until it is fully differentiated. This is really an incredibly cool subject, and we could spend days on it—not very practical at this time. So let me focus on some of the highlights, to give you an idea of how brilliantly it all works.



Bone marrow stem cell

Under the influence of various bio-chemicals in the body, the human bone marrow stem cell becomes one of two different cells:

1. Common lymphoid progenitor
2. Common myeloid progenitor

Again, under the influence of various bio-chemicals, these two types of cells are transformed. After undergoing several intermediary stages, the common lymphoid progenitor evolves into T-cells, B-cells, NK-cells, and dendritic cells. The common myeloid progenitor follows a more complex evolution. It first evolves into four entirely different types of cells:

1. Megakaryoblasts
2. Mast cells
3. Myoblasts
4. Proerythroblasts (aka rubriblasts)

These four types of cells then follow straight line evolution through several intermediary stages as follows:

- Megakaryoblasts actually go through a couple of evolutions, and then literally break apart—into a multitude of pieces—thus forming platelets.
- Mast cells become mast cells after a single evolution from common myeloid progenitor cells so no further evolution is required.
- Myoblasts break into four separate pathways, which ultimately evolve into: basophils, nutrophils, eosinophils, and macrophages.
- Which leaves the proerythroblasts, which largely under the influence of EPO (the kidney hormone discussed above), go through five evolutions to ultimately become red blood cells.

The important thing to understand here is that this is an incredibly complex process that requires everything to be in place and proper balance to be maintained in order to function correctly. With this in mind, it's not hard to see why you can't build the same blood cells out of pepperoni, pizza, beer, and Ding Dongs that you can out of real food that's packed with real nutrients, vitamins, minerals, and trace minerals. If you're light just one component at a critical juncture in the process, the resultant cells will be compromised. If you have some extra hormone-like chemical (from the 100,000 plus that have been released into the environment over the last hundred years) intervene in the process, you can send the cell evolution off into uncharted waters.

Proper nutrition matters. Toxicity matters. And yes, genetics matters.

Sickle cell anemia

Sickle cell anemia occurs when a person inherits two abnormal genes (one from each parent) that cause their red blood cells to change shape. Instead of being flexible and disc-shaped as described above, sickle cells are more stiff and curved—in the shape of a sickle, which is where the disease gets its name. Sickle cells are also stickier than normal, which makes them tend to stick together causing the blood cells to clump and clog blood vessels. Also, unlike normal red cells that last 120 days, sickle cells are fragile and tend to last only 10-20 days, which usually leads to anemia.

At the present time, there is little that doctors can do to treat sickle cell anemia other than try and manage the complications as they arise. And there is little that alternative health can do to change the underlying condition. However, that does not mean that there is nothing that you can do. It means that it is more imperative than ever that someone with sickle cell anemia do everything they can to optimize the functionality of the blood cells that they have since they have so little margin for error.

Conclusion: the whole is greater than the sum of its parts

In the end, it's not just individual cells we're talking about here. Blood is not just the sum of its parts. It's an integrated whole—an organ, as we discussed in the last chapter. All the parts interrelate and function as one unit. Each part affects the other.

- Change the pH and you affect the ability of blood to capture oxygen.
- Change the pH and you affect the ability of blood to release carbon dioxide.
- Change the pH in one direction and you shut the immune system down.
- Change it in the other direction and you jack it through the roof.
- Compromise the white cells, allowing bacteria and viruses to remain in the blood (bacteremia and viremia), and you compromise your health—opening yourself up to everything from cancer to rheumatoid arthritis to Crohn's disease.
- Allow those pathogens to grow in the bloodstream (septicemia) and you die.
- Allow fats to accumulate in the blood and you thicken the blood and cause erythrocytes to clump together—making them more likely to clog in narrowed arteries (i.e., heart attacks).

Again, it comes down to the Baseline of Health. You need to clean out everything that's toxic and antagonistic to your body, and you need to provide your body with all the nutrients and building blocks it needs in the forms that can be utilized by the body's cells. You need to detox regularly. Your exposure to toxic metals, chemicals and xenoestrogens is non-stop. And taking isolated vitamin supplements that are unusable by your body's cells, does not make up for a bad diet.

All of the steps that we discussed in the last chapter about how to optimize the function of blood, apply yet again when it comes to optimizing the composition of blood.

Things to do

- Exercise dramatically improves the gas exchange capabilities of your blood cells.
- Digestive enzymes play a major role in breaking down the foods we eat into forms that are easily transported in our blood and that are easily utilized by our cells.
- Proteolytic enzymes help eliminate circulating immune complexes, which significantly relieves the allergic burden on your body, thus taking a great deal of burden off of your blood. They also quickly optimize the quality of the blood—unclumping it, making it less sticky—thereby improving its ability to transport oxygen
- Sugar metabolic enhancers prevent glycemic swings and help maintain proper sugar levels in the blood.
- Blood cleansing optimizes the performance of the blood.
- Liver cleanses reduce fats in the bloodstream. Keeping the liver clean and balanced is essential to maintaining proper cholesterol levels in the blood.
- Kidney flushing helps the kidneys regulate blood fluid levels and helps regulate EPO hormone levels.
- Supplementation: Every single blood cell in your body is replaced every 120 days. You cannot build the same quality blood cells out of pepperoni pizza, beer, and Ding Dongs that you can out of real food. The ability of blood to clot properly is dependent on having the proper vitamins and minerals (such as vitamin K) present in the diet. If they're not present in the diet, then you must supplement.

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- pH balance: Our bodies have developed a system for maintaining pH balance in all of our body fluids. To understand this system better, we need to take a look at what changes pH (usually making us more acid), and how our bodies respond to that change. When they are metabolized, carbohydrates, proteins, and fats produce various acids in our bodies. Proteins produce sulfuric acid and phosphoric acid. Carbohydrates and fats produce acetic acid and lactic acid. Since these acids are poisonous to the body, they must be eliminated. Unfortunately, they can't be eliminated as acids through the kidneys or large intestine as they would damage these organs. How Can We Help?
    - Change your diet. Follow the guideline laid out in Chapters 6 and 7 of Lessons from the Miracle Doctors.
    - In addition, there are several special alkalinizing agents available.
    - Your health food store has alkalinizing teas or drops available.
    - There are machines from Japan that will "micronize" your water. What it actually does is take your tap water and divide it in two. One stream is acidic and can be used for washing and cleaning. The other stream is alkaline and is used for drinking. It works really well. Unfortunately, it's really expensive—about $900-1,200.
    - One of the best alternatives is to simply magnetize your water. Applying a magnetic field to a pitcher of water for a short period of time will make it more alkaline, depending on its mineral content. It also offers the added advantage of lessening the surface tension of the water, which makes the water wetter and more usable by the cells of your body.
- Hydration: Dehydration contributes to both thickened blood and edema at the same time. You get the worst of both. Bottom line: you want to properly hydrate…and you want to cut down on excessive use of diuretic drinks such as coffee, tea, and many sodas.

That's it for now. In the next chapter, we'll explore blood types and how they relate to health—and yes, diet. And we'll also look at some of the blood tests your doctor runs on you and what they mean.

Chapter 7: Blood of My Ancestors

In this chapter, we wrap up our report on the cardiovascular system as we explore blood types and blood tests. Once again, the goal is not to help you graduate medical school, but to help you learn enough so that you are not clueless in your doctor's office and understand the options (particularly the non-medical ones) that are available to you. Specifically you're going to learn about:

- The importance of blood type.
- How it affects diet.
- What doctors test for when they check your blood and what the results mean to you.

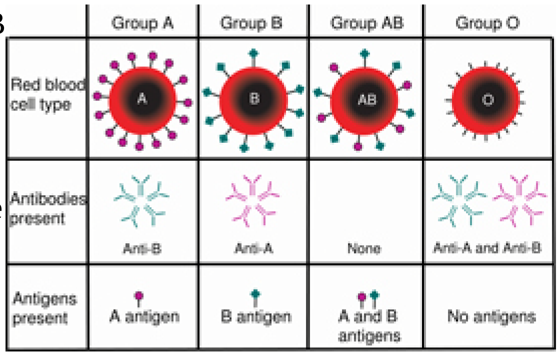
Blood type

At face value, blood type probably is not that important to you. Its value is primarily to doctors when doing transfusions. But if you scratch below the surface, an exploration of blood type reveals a great deal about the nature of blood and the human organism in general. It also, thanks to the popular blood type diet program, serves as a launching point for a discussion of the proper human diet. With that in mind…

There are two primary systems for classifying blood type: the ABO system and the Rhesus system. They are similar, just governed by different antigens.

ABO system

Your blood type is inherited from your parents. You receive one gene from your mother and one from your father, which combine to establish your blood type. These two genes determine type by causing certain molecules such as sugars, proteins and glycoproteins (a combination of both sugars and proteins) to appear on the surface of your blood cells. The genes also cause defenders that protect against similar (but not identical antigens) to appear in your plasma. These defenders are known as antibodies. Your plasma recognizes your personal glycoprotein/antigens (also known as agglutinogens) as part of your "self," as belonging in your blood. But the antibodies in your plasma will treat non-identical glycoproteins as allergens and attack the blood, causing the cells to clump together—thus the need to match blood types when getting a transfusion. Let's explore this concept further.



People are divided by blood type into one of four categories: A, B AB, and O. People with type A blood have the A antigen, while people with type B blood have (surprise) the B surface antigen. Those with blood type AB have both antigens, and type O blood types have no antigens on their surface. Someone with type A blood, for example, will reject a type B blood transfusion because the antibodies in their blood will recognize that the antigens attached to the donated blood are outsiders—not part of the "self." All blood types can accept type O blood transfusions since it has no antigens on the surface of its blood cells so it doesn't trigger any antibodies.

For more detailed information on ABO blood types and how they get inherited, check out Wikipedia.

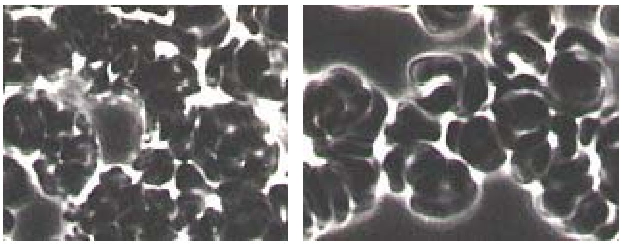
Rhesus system

The Rhesus system is the second significant blood group system used in human blood transfusion. Of the different Rhesus antigens found on the surface of blood cells, the primary one is the RhD antigen because it is the most likely to stimulate an immune response in the body. The name Rhesus comes from the type monkey that was used in the first studies that identified this factor. When the Rhesus antigen is present, the blood group is described as positive. When it's absent, the blood group is described as negative. In other words, you either have, or do not have, the Rhesus factor on the surface of your red blood cells. This means that every ABO blood type has a corresponding positive or negative Rhesus suffix attached, as in:

- Positive—you have the RhD antigen (as in Type O positive).
- Negative—you don't have it (as in Type AB negative).

Problems

Problems with transfusions are more likely to occur with mismatches in the ABO system than the Rhesus system. If you are exposed to a blood group antigen that is not recognized as belonging in your body, the antibodies in your blood plasma will bind to those blood cells causing them to clump together and die.



A different problem can occur in pregnant women. About 12% of pregnant women carry a fetus with a different blood type from their own (remember, the child's type is the result of pairing genes from both parents, not just the mother), and sometimes the mother forms antibodies against the red blood cells of the fetus, which can lead to low fetal blood counts, a condition known as hemolytic disease of the newborn, with less than 1% significantly affected. But even at less than 1%, because of the total number of births involved, the numbers of affected children is actually quite large.

Separating out blood's components

A certain amount of donated blood is actually separated into pieces (fractionated) in order to maximize its benefits and extend shelf life. These pieces/products include:

- Red blood cells
- Plasma
- Platelets

- Clotting factors (Although clotting factors are now mostly synthesized using recombinant DNA techniques to eliminate the risk of disease transmission to hemophiliacs who are dependent on a regular supply of clotting factors.)

The blood type diet

So why are we talking about diet in the middle of a discussion about blood? Well, a couple of reasons. First, people want to know. We receive several dozen questions a month at the Foundation asking what we think of the blood type diet. But more importantly, in answering questions about the diet, we get to explore some of the evolutionary history of blood—which can be very helpful when it comes both to understanding it and optimizing it.

The premise behind the blood type diet combines the principles of the ABO groupings explained above and the evolutionary theory of blood groups first proposed in the 1950's. The basic idea is that blood types evolved from the lifestyles and diets of different groups of humanity; therefore, you need to eat the diet natural to the group of humanity from which you are descended. In other words:

- Type O evolved from early hunters who lived primarily on meat. Thus, type O's should eat lots of meat.
- Type A came from early farmers. Thus, type A's should eat mostly a vegetarian diet.
- Type B evolved from nomadic tribes associated with a strong immune systems and flexible digestive systems. This is the only type that can thrive on dairy products.
- Type AB is the most recently evolved type and should eat a cross between the nomadic diet and the vegetarian diet.

So does the diet hold up to scrutiny?

Perhaps, not so much. First, it's important to remember that the evolutionary theory of blood groups is only a theory that is unlikely to stand the test of time. It turns out that environmental factors probably play a much bigger role in the evolution of blood types and also explain why certain types are concentrated in certain geographical areas.

The evolution of blood types

Nature is filled with tradeoffs. A person with lots of body fat has insulation in cold latitudes, but sweats unbearably in the tropics. A large muscular person is stronger, better able to fight and conquer, but also requires many more calories to maintain themselves than a smaller person. The same traits have advantages and disadvantages depending upon the circumstances, and so with blood types. Each type is protective against certain diseases and conducive to others.

As we've already discussed, blood types are genetically inherited, but the environment can influence which blood types are passed on. An example is seen with the Black Plague, which killed millions of people in Europe in the 13th and 14th centuries. As it turns out, the Black Plague was caused by a bacterium that is covered by sugar molecules that closely resemble the B marker on red cells. That means that since people who were blood type B back in the plague years didn't make antibodies to that antigen, they didn't have any antibodies in place to protect them against the plague. Hence they died in greater numbers than the other blood types which carried the antibodies.

And, in fact, by the 15th century, fatalities from the plague had decreased significantly as type B blood was systematically phased out in that part of the world. The bottom line is that the distribution of blood types in Europe (low percentages of Type B as opposed to Asia) is not so much the result of diet and occupation, but of natural selection based on disease.

Other examples abound. For example, people with type O blood are susceptible to certain bacteria and viruses that can cause diarrhea and ulcers, but have a decreased susceptibility to SARs. With that in mind, we would expect to see, based on natural selection, a greater concentration of type O blood in Asia, where respiratory diseases such as SARs tend to be more common, than in Europe. And, indeed, such is the case. As you can see, a particular blood type may predispose you to one disease while simultaneously protecting you against another.

Variation in the blood type distribution throughout the world reflects these environmental factors coupled with the tendency of populations to marry and reproduce within their own groups. As people throughout the world intermingle to a greater extent, the distribution of the different blood types is likely to become more uniform throughout the world.

Back to the blood type diet

The evolutionary theory of blood types aside, the cornerstone of the diet is the premise that certain proteins/glycoproteins in food, called lectins, ape the glycoproteins on red blood cells, thus triggering immune reactions from the matching blood type. This premise does not actually require the evolutionary theory to be correct to work. Even if the theory is wrong, the effect can be true. So is it?

Again the answer is probably, not so much.

Yes, there is no question that different foods definitely have high allergy potential for many people, but the problem appears to be less with the lectins, than with the ability of the digestive tract to fully break down the proteins in the food. As I've discussed in several newsletters archived at Jonbarron.org, the use of digestive enzymes with meals and proteolytic enzymes between meals can often help reduce food allergies dramatically.

In fact, there is little evidence that lectins, other than a handful of exceptions such as ricin, present a problem for the human body of any blood type.

But doesn't it work for some people?

Absolutely!

Simple math works in its favor. If you tell an O, an A, or an AB not to eat dairy because they don't have the right blood type, then you've just told the vast majority of people in the world not to eat dairy. Considering all of the problems associated with homogenized, pasteurized, commercial dairy, a whole lot of people are going to feel significantly better on the diet…regardless of blood type. (Chalk that up in the win column for the diet.) On the other hand, you've also just told a lot of Asians (they have the highest percentage of type B's in the world) that they'll thrive on dairy. Probably not such a good thing since about 90% of all Asians suffer from lactose intolerance. (And that would need to be chalked up in the loss column.)

Anyway, I've detailed my feelings that diet should be based on comparing the teeth, stomachs, and digestive tracts of humans to other animals in Chapter 6 of *Lessons from the Miracle Doctors*. That kind of comparison will give you a more accurate (make that more objective) read on what the body was actually designed to eat. You can download a free copy at http://www.jonbarron.org/book/book.php.

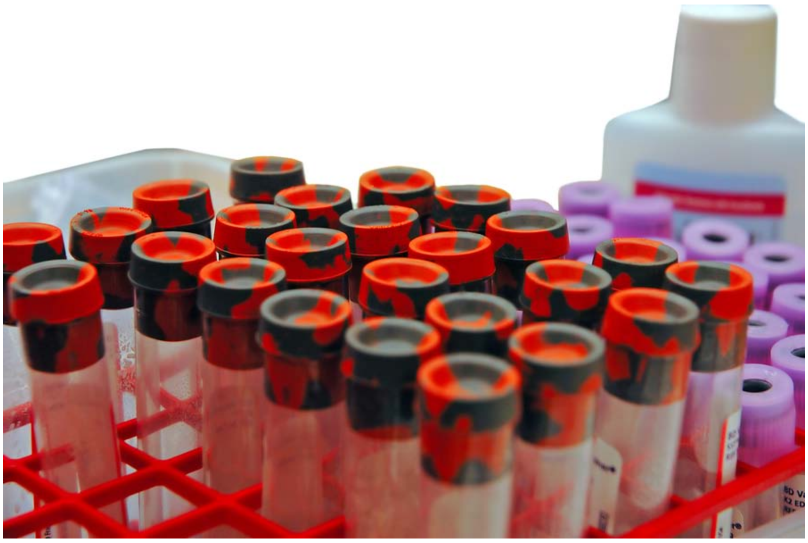
But enough on the blood type diet. Let's get back to the issue at hand: blood. More specifically, let's talk about blood tests—how to understand them and what they mean to you.

Blood tests

Blood tests are the number one tool doctors use to understand the state of your health. Since blood flows throughout your entire body, it picks up bits and pieces of everything and gives clues not only to its own condition, but to the presence of disease in organs such as the liver, kidneys, thyroid, pancreas, and endocrine system.

Since blood tests are so wide ranging, I'm going to limit my discussion in this chapter to those tests that impact the cardiovascular system itself. But before we look at some of these tests in detail, it is important to realize that results can fall outside the "normal range" for many reasons that have nothing to do with illness. Age, race, sex, diet, level of exercise, supplements, drugs, etc. can all impact blood test results and move them outside the normal range. In other words, the definition of what is normal is somewhat arbitrary. In fact, most labs set their ranges so that some 5% of healthy people will fall outside the acceptable levels on any given test. Since a normal blood workup will usually include 20-30 tests, falling outside the range on one or two of them does not necessarily indicate a problem—unless other factors are present. It's also worth noting that the "normal range" is now being "redefined" by the blood test results of ever increasing numbers of people who eat badly, don't exercise, and are actually very unhealthy. When you consider that sperm counts have dropped by more than half in the last 50 years, falling outside the norm on many tests may not be such a bad thing.

Let's now take a look at some of the blood tests your doctor runs. Note: I'm not going to give numbers for the most part since they would just be information overload at this time. Instead, I'll just talk about what high and low numbers might mean. It will be easy enough for you to see where your numbers fall when you get your results back from your doctor.



Complete Blood Count (CBC)

There are actually many tests that can be performed as part of a CBC. In most cases, they should all be done after fasting for at least 12 hours. The most important are:

- **Hemoglobin** (Hgb) and **Hematocrit** (Hct): We covered this in the last chapter. Hematocrit tests reference the number of red blood cells you have. Hemoglobin tests reference the oxygen carrying capacity of those cells. Low numbers suggest anemia. High counts can be suggestive of anything from abnormal bone marrow function to lung disease—or living at high altitudes or athletic blood doping for that matter.
- **Platelet Count** (PLT): Again, as covered in the last chapter, platelets are a marker of your body's ability to initiate blood clots. Low values can be caused by immune system problems, certain cancers, side-effects from drugs, viruses, antigen/antibody problems that cause the platelets to stick together, or even certain B vitamin deficiencies. High platelet counts are often seen in rheumatoid arthritis.
- **Mean Corpuscular Volume** (MCV): This is a measure of the average red blood cell volume and is used to support a diagnosis of anemia.
- **White Blood Count**: And once again, as covered in the last chapter, white blood cells are the front line soldiers in your immune system. High counts are indicative of infection and leukemia. Low counts are indicative of bone marrow and spleen problems.

Electrolytes: These are your potassium, sodium, chloride, and CO2 levels.

- **Potassium** is controlled very carefully by the kidneys. High levels of potassium are markers for kidney problems, certain medications such as ACE inhibitors, adrenal exhaustion, and excessive use of potassium supplements. Low levels can indicate poor diet, diarrhea, excess water intake, and excessive alcohol consumption.

- **Sodium** is also regulated by the kidneys and adrenal glands. Low sodium is indicative of diuretic usage, excessive water consumption, and athletic workouts without replacing electrolytes. High levels are often related to dehydration and diet.
- **CO2** reflects the acid status of your blood. Low CO2 levels can be due either to increased acidity from uncontrolled diabetes, kidney disease, or high acid forming diets. Low CO2 is a marker for chronic hyperventilation.

Minerals

- **Calcium** is controlled in the blood by the parathyroid glands and the kidneys. An elevated level is usually associated with parathyroid problems. Excess vitamin D can also be a factor. Low calcium too can be caused by parathyroid problems, drugs like Fosamax and diuretics, and a high acid forming diet (which draws calcium out of the bones to serve as a buffer.
- **Phosphorus** is also largely stored in the bones. It is regulated by the kidneys, and high levels may be due to kidney disease or parathyroid problems.

Proteins

Albumin and **Globulin** tests measure the amount and type of protein in your blood. They are a general index of overall health and nutrition. Low gamma globulin levels are seen in people who donate blood too often or have immune system problems. Low albumin may be caused by liver disease, kidney disease, burns, malnutrition, late pregnancy, genetic variations, and even bad posture. High albumin is often caused by dehydration.

Blood fats

These are the tests for cholesterol and triglyceride levels.

- Cholesterol: The overall cholesterol level matters less than the cholesterol ratio of HDL cholesterol to LDL cholesterol. The ratio is obtained by dividing the HDL cholesterol level into the total cholesterol. For example, if a person has a total cholesterol of 200 mg/dL and an HDL cholesterol level of 50 mg/dL, the ratio would be 4:1. The goal is to keep the ratio below 5:1; the optimum ratio is 3.5:1. That said, cholesterol is probably a less significant marker than most doctors believe.
- Triglycerides, on the other hand, are a big deal. Triglycerides are the body's storage form for fat. They are primarily regulated by the liver. Most triglycerides are found in your body's fat tissue. Some, however, circulates in the blood to provide fuel for muscles to work. Elevated levels have been associated with heart disease, especially if over 500 mg/dL. High triglycerides are also associated with pancreatitis.

Blood sugar

This topic really belongs in a report discussing the pancreas, but for now.

- **Glucose**: This is a measure of the current sugar level in your blood. High values are associated with eating before the test, and diabetes. The normal range for a fasting glucose is 60 -109 mg/dl.

Diabetes is diagnosed when you see a fasting plasma glucose of 126 or more. Note: Europeans tend to test for blood sugar just 2 hours after eating, rather than using a fasting level. This tends to increase the number of people who are classified as diabetic.

- **A1c (Glycohemoglobin)**: This test measures the amount of glucose chemically attached to your red blood cells. Once the sugar is attached, it stays there (except under very unusual circumstances) for the life of the cell. That means it doesn't move up and down multiple times a day and is not dependent on what, or when, you last ate. Since blood cells live about 3 months, it tells us your average glucose for the last 6 - 8 weeks. A high level suggests poor blood sugar control.

Enzymes

Most enzyme tests relate to other parts of the body, particularly the liver, but one—the CPK test—is indicative of heart health.

- **CPK** is the first enzyme to be elevated after a heart attack (3 to 4 hours). If CPK is high in the absence of heart muscle injury, it's a strong indication of skeletal muscle disease.

Other cardiac risk factors

- **C Reactive Protein (CRP)**: A high or increasing level of CRP in your blood suggests that you have an acute infection or inflammation. In a healthy person, CRP is usually less than 10 mg/L. High levels also turn out to be a great indicator of heart disease, significantly outperforming LDL cholesterol as a predictor of cardiovascular risk.
- **Homocysteine** is an amino acid normally found in small amounts in the blood. High levels of homocysteine are related to the early development of heart and blood vessel disease. In fact, it is considered an independent risk factor for heart disease. High homocysteine is associated with low levels of the methyl donor nutrients: B6, B12, folic acid, trimethylglycine, and SAMe. Methyl groups convert homocysteine, into methionine, which is an essential amino acid. Methylation is inhibited by poor diet (excessive protein and fat intake or inadequate nutrition), alcohol, caffeine, smoking and genetic predisposition.
- **Lipoproteins** are tiny particles that circulate in the blood. They contain cholesterol, fat, and protein in varying amounts depending on the body's needs. The lipoprotein molecule is similar to LDL cholesterol. Both lipoprotein (a) and LDL are rich in cholesterol and contribute to atherosclerosis of the blood vessels. Test results that show abnormalities in the amounts or kinds of lipoproteins in the blood are predictors of an increased risk of atherosclerosis.

Again, blood tests are wide ranging and can help in determining the health of almost every organ and system in the body. All we covered above are those tests that reflect on the health of the cardiovascular system itself. The next time your doctor wants to run a blood panel on you, this should give a head start in understanding what he/she is looking for. It should also give you a head start in understanding what you can do about any "odd" results you may get.

Conclusion

That's it. That finishes our report on the blood and our complete report on the cardiovascular system as a whole. So what have we learned?

Well, among other things we've learned that even though cardiovascular disease is the number one killer in the world, cardiovascular health is definitely possible, and heart disease is even reversible! We've explored:

- The basic anatomy and physiology of the heart so that we could understand why disease happens and why certain alternatives work better than others
- The natural remedies that can actually heal your heart
- How to understand what your doctor tells you about the condition of your heart so you can be proactive in choosing your treatment
- Why you get high blood pressure and blood clots, the side effects of medical treatments, and alternative solutions that might offer a more satisfying end result
- How diet and nutrition play a major role in optimizing the functions of your blood
- Exactly what those functions are and the world of alternatives available to you that can optimize those them
- And finally, what blood type really means to your health and how you can use that to your advantage

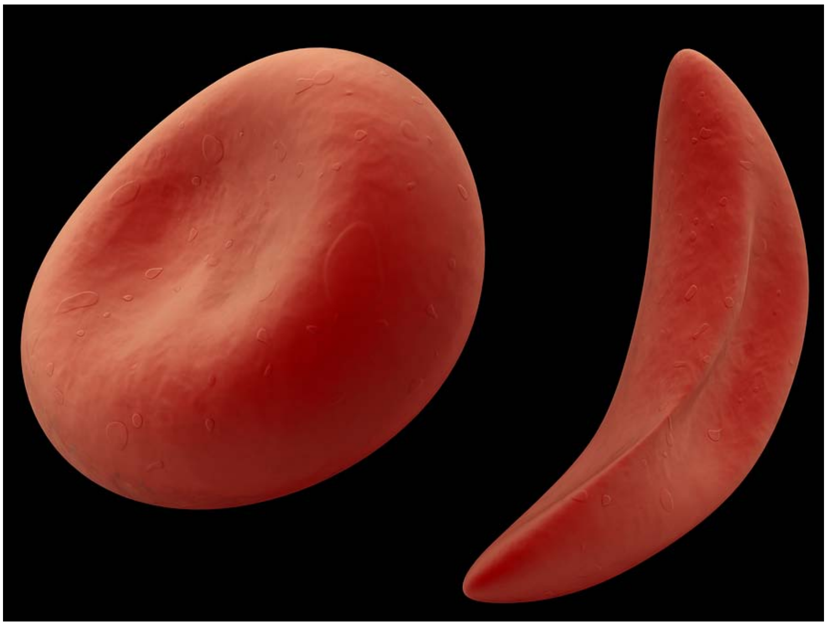
All in all, we've covered a lot of ground – probably more than you can remember at the moment. But that's why you have your own copy of this report, so you can use it as a permanent health reference. And any time you want to recall the specifics on how to improve the quality of your blood and the health of your cardiovascular system, just read back over the report, but particularly the last chapter.

And now for something completely different

Let's close with a bit of a mindbender—something that takes us out of the mundane world of blood tests and back into the magical world of the body.

Earlier, when we talked about the evolution of blood types, we discussed how nature makes tradeoffs—how certain blood types can have advantages or disadvantages depending upon circumstances. This also turns out to be true for one of the world's major blood "disorders"—sickle cell anemia.

Certain people have a type of blood that appears deflated and shaped like a sickle. People in this group are predisposed to sickle-cell anemia. You might wonder what possible advantages there could be to sickle cell anemia, why nature has chosen to pass this blood "disorder" down through the ages. We certainly know what the disadvantages are, but what possible benefits could there be to sickle cell anemia? And the answer is that deflated, sickle-shaped blood cells actually protect you from malaria. And the very people who possess this type of blood have ancestors who used to live in places where malaria was a major cause of death, such as central Africa. In other words, what we call a genetic disease in the United States and Europe actually started out as a life saving benefit in tropical climates.



The body is truly amazing, is it not?

Appendix: Protocol Summary and Product Recommendations

Diet and Supplements

Every single blood cell in your body is replaced every 120 days. You cannot build the same quality blood cells out of pepperoni pizza, beer, and Ding Dongs that you can out of real food. The ability of blood to clot properly is dependent on having the proper vitamins and minerals (such as vitamin K) present in the diet. If they're not present in the diet, then you must supplement.

Vitamins and Minerals

- The B vitamins can help rebuild the heart.
- Mineral deficiencies particularly in calcium, sodium, magnesium, potassium, and many of the trace minerals can have a profound effect on the electrical efficiency of the heart since they are responsible for running it. Supplementing with minerals and liquid trace minerals can make a profound difference. Magnesium supplementation, in particular can change the shape and condition of heart valves.
- Methylating supplements such as B6, folic acid, B12, TMG, and SAMe help reduce homocysteine levels, thereby reducing damage to the endothelial lining.

Herbs

Nature can be very strong, very healing, and very effective. Many herbal formulas accomplish things in two to three days that prescription medicines cannot accomplish in weeks, if at all. The keys are that the formula has to be well designed, the herbs used have to be of sufficient quality, and you have to use enough of them. Given those three conditions, herbal formulas can perform miracles. Look for herbal formulations made from organic or wild-crafted herbs. Look for formulations designed by real herbalists. Look for a company whose quality you trust; then stick with it.

- Immune enhancers and pathogen destroyers help control bacteria and viruses in the blood that tax the immune system. Specifically, regular use of immune enhancers and pathogen destroyers decreases the risk of most inflammatory heart disease and the incidence of viral and bacterial infections that can adversely affect the heart.
- Regular supplementation of a tonic made with cayenne and Hawthorne berry can rebuild the strength of the heart.
- Herbs such as passionflower, apocynum venetum, hawthorne, and stevia (yes stevia) have all been shown in clinical studies to help lower blood pressure.
- Sugar metabolic enhancers such as Nopal cactus, Konjac mannan, Gymnema sylvestre, and High galactomannan fenugreek extract can prevent glycemic swings and help maintain proper sugar levels in the blood.

Enzymes

In essence, enzymes are the stuff of life. By allowing reactions to happen at far lower energy thresholds, they make life happen where otherwise there would be none. Supplementing with a specially designed proteolytic enzyme formula (sometimes called a systemic enzyme formula) between meals, so that the enzymes can enter the bloodstream and augment the functions of your metabolic enzymes, can confer tremendous health benefits.

- Proteolytic enzymes can provide nutritional support for your body as it works to clean out the coronary arteries and repair damage to epicardial tissue surrounding the heart. They can also help dissolve scarring of the endothelial lining. In addition, they can help eliminate circulating immune complexes, which significantly relieves the allergic burden on your body, thus taking a great deal of burden off of your blood in accomplishing that objective – in effect, quickly optimizing the quality of the blood.
- Proteolytic enzyme formulas that contain either nattokinase or lumbrokinase, can also break down the proteins that hold plaque together stuck to arterial walls—effectively dissolving it. They are also effective at preventing clots, with wide ranging dosage tolerances
- Systemic proteolytic enzyme formulas that contain seaprose-s, serrapeptase, and/or endonase can help reduce arterial inflammation and scarring that both constricts arteries in real time and contributes to future long term damage. In fact, a good systemic proteolytic enzyme formula that a can have multiple beneficial effects for the circulatory system in addition to reducing clotting. In addition, these formulas can enhance cardio perfomance in athletes.
- And finally, a good proteolytic enzyme formula can reduce the incidence of periodontal disease, which reduces the chances of an acute coronary event.
- Digestive enzymes play a major role in breaking down the foods we eat into forms that are easily transported in our blood and that are easily utilized by our cells.

Antioxidants

Different antioxidants target different free radicals. Taking a supplement with a single antioxidant that targets one group of free radicals still leaves you vulnerable to the ones not targeted. Also, keep in mind that different antioxidants work in different areas of the body. The herb Ginkgo biloba, for example, works in the brain and cardiovascular system, whereas curcumin is active in the colon and silymarin in the liver. You need to take an antioxidant "formula" that works in all areas of the body—or in this case, all areas of the cardiovascular system.

- Antioxidants such as SOD, pomegranate, grape seed extract (AKA OPCs), and pycnogenol help heal the endothelial lining, thereby preventing future plaque and helping to heal current plaque.

Detoxing

The medical community absolutely understands the principle and efficacy of detoxing. They just insist on using their own terminology and methodology, which allows them to trash more natural, more efficacious, and less harmful means of doing the same thing. Whereas the medical community relies on things like IV chelation, lithotripsy, pharmaceutical statin lipotropics, and cholecystectomy (gallbladder removal); the alternative health community looks to intestinal, heavy metal, kidney, liver, gallbladder, and blood detoxes.

- The use of heavy metal chelators such as cilantro and chlorella can reduce the risk of an acute coronary event.
- Regular heavy metal detoxing can reduce a major cause of irritation to the endothelial lining and a primary instigator of plaque formation.

- Blood cleansing optimizes the performance of the blood.
- Liver cleanses to balance cholesterol. Understand, cholesterol levels are primarily regulated by the liver. Keeping the liver clean and balanced is essential to maintaining proper cholesterol levels in the blood.
- Kidney flushing helps the kidneys regulate blood fluid levels.

Miscellaneous

Not vitamins, minerals, or detoxes.

- CoQ10 can reenergize every single cell in the heart, thus improving its ability to respond to an electrical stimulus and pass the signal on to its neighbor in a timely manner. In addition, it can literally remold the size and shape of the heart after the onset of congestive heart failure.
- The use of Omega-3 fatty acids can help reduce arterial inflammation and reverse damage caused by NEFAs (an excess of Omega-6 fatty acids in the blood.) In addition, shifting the balance of Omega-6 to Omega-3 fatty acids can eliminate a major source of potassium imbalance which can trigger heart attacks.
- The use of avocado soy unsaponifiables can reduce the incidence of periodontal disease, which reduces the chances of an acute coronary event.
- L-arginine and noni extract assist the smooth muscle in arterial walls in obtaining sufficient nitric oxide to function properly.
- Studies have shown that dietary changes alone can unplug arteries. In fact, a proper implementation of the Mediterranean Diet can literally cut mortality rates in half.

Lifestyle changes

- Proper dental care can reduce the incidence of periodontal disease, which reduces the chances of an acute coronary event.
- And As usual, it's not just about pharmaceutical drugs and surgical procedures. Following the principles of the Baseline of Health Program can change your heart…and your prospects for long-term survival.
- Regular exercise can strengthen the heart and improve its efficiency even in your eighth and ninth decade of life. In this report, we discussed how exercise dramatically improved the gas exchange capabilities of Lance Armstrong's body/blood cells. If you can accomplish just 10% of that increase in your own body, it will be transforming.
- As much as possible avoid excessive exposure to carbon monoxide. That means:
    - Don't smoke.
    - Avoid secondhand smoke.
    - Don't hang around running cars in closed environments.
    - Don't use charcoal grills in closed environments.

- Lose weight. Simple laws of physics apply here. As we've already discussed, your blood vessels have to service every single cell in your body. The more body mass you have, the more pressure you need to force blood through the system. Lose weight; less pressure required.
- If you smoke, stop. Smoking constricts blood vessels and raises pressure.
- If you're stressed, try meditation or biofeedback. As part of your body's "flight and fight" mechanisms, stress increases heart rate and blood pressure to help respond to the short term stress of an attack from a saber toothed tiger. Twenty-four/seven stress was not designed into the system. Prolonged stress definitely impacts blood pressure levels. Even if you have clogged arteries, reducing stress levels can still help drop your blood pressure levels significantly.
- And raising body pH through proper diet and the use of supplements such as coral calcium reduces lactic acid levels in the arterial smooth muscle, thereby minimizing damage to arterial linings. You can also help raise pH by changing your diet to include more fresh vegetables, which are alkalinizing and less meat, dairy, sugars, and cooked grains, which are acid forming. Other options for raising pH include
    - Your health food store has alkalinizing teas or drops available.
    - There are machines from Japan that will divide your tap water in two. One stream is acidic and can be used for washing and cleaning. The other steam is alkaline and is used for drinking.
    - One of the simplest alternatives is to apply a magnetic field to your water for a short period of time. This will make the water more alkaline, depending on its mineral content. It also offers the added advantage of lessening the surface tension of the water, which makes the water wetter and more usable by the cells of your body – more hydrating.
- As stated in this report, one of the primary roles of blood is to maintain proper hydration. When you start to dehydrate, your body starts trying to store water in order to survive. Instead of passing the water out through the kidneys, it starts to stockpile it in the bloodstream. It is this stockpiling resulting from dehydration that often leads to higher blood pressure. That means that in many cases the more fundamental solution to higher blood pressure lies not in using diuretics to flush out excess water but in addressing the underlying problem of dehydration. It might seem counterintuitive, but you need to drink more water to alleviate the dehydration, which then allows the body to eliminate the excess water it was storing as a response. Bottom line: you want to properly hydrate…and you want to cut down on excessive use of diuretic drinks such as coffee, tea, and many sodas.