Living with Stroke

A Guide for
Patients and Their Families

Fifth Edition

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Contents

CHAPTER 1

Heart and Soul: Understanding the Brain and Heart Connection

"I never gave much thought to my body. It did what it was supposed to . . . until my stroke."

—Sam, a sixty-two-year-old banker

Stroke affects people in different ways. Sometimes there is a numbness, a tingling, an inability to speak, or an abrupt dizziness, as the following examples show.

- It was early. The rest of the family was asleep. Hal peered into the bathroom mirror. He touched his beard and made a face. He opened the medicine cabinet, took out his shaver, and, without warning, dropped it on the ground. Hal couldn't move his right hand. He couldn't bend down to pick it up. He started to yell, but his voice felt like cotton . . .
- Allison had had a terrible nightmare. The sky was dark; it was filled with swirling, spinning clouds. She was trying to

walk through the cloudy landscape, but the fog, the moisture, and the wind were stopping her. The clouds were encircling her, choking her. Allison's eyes opened; she jolted awake. But the nightmare had not left. She could not see; she could not speak . . .

- Bill was climbing up the stairs with his new laptop computer when the pain struck. It only lasted a moment. A burst of light. A sharp headache. A tingling in his fingers. For one moment, he couldn't breathe or swallow. And then, as suddenly as it happened, it lessened. Bill was left with a thick tongue, a bit afraid, but he was definitely alive . . .
- Louise had been looking forward to this trip for years. The four-hour train ride was a piece of cake. When she saw her old friend, they hugged. They cried. It had been a long, long time. But now, under the comforter of the living room sofa bed, Louise was afraid. She was trembling. She couldn't see very well—even when she turned on the lamp. She was confused; she didn't know where she was. Her left arm felt numb. Her neck hurt and she was developing a headache . . .

These four people are experiencing strokes, some more serious than others, that hit them without any warning, any expectation. Why did this happen? Why now?

To understand why people have a stroke, you first must understand how the body functions—and malfunctions. You have to understand its vital connections, especially between the brain, the heart, and the blood that flows between them.

Because strokes, by definition, occur in the brain, let's begin at the top.

Brain Storming

Whoever coined "There's more here than meets the eye" could very well have been a neurologist. Frankly, it's not much to look at. A brain looks like a well-used sponge.

But appearances lie. The brain is bursting with energy. It consists of billions of nerve cells called neurons. And these neurons are settled in specific locales that are responsible for everything from the way we eat to the food we like. And this so-called "sponge" can soak up so much information that nothing, not even the most sophisticated computer in the world, can compare to it. Nothing.

As with most things, organization, delegation, and record keeping are crucial factors in its success. Despite its lumpy appearance, the brain is very active and very well organized—and in touch with all its "employees."

The Adjunct Staff: The Peripheral Nervous System

Veins, arteries, and nerves—all are intertwined, all are intricately spread throughout our bodies. When we touch a hot plate with our fingers, when we step on a nail, when we bang into the corner of a table, when we sip an ice-cold glass of champagne, whenever our senses are involved, so is our peripheral nervous system, sending our sensations, or stimuli, to our brain for responses. In normal brain functioning, the brain sends messages back down to those nerve endings, telling us to move our fingers from the hot plate or feel the pain of the nail, the table corner, the ice-cold ache of sipping a drink. The peripheral nervous system is like a vast messenger service, the adjunct staff so important to any successful organization.

But without the brain's interpretation, our sensations would mean nothing. We would feel nothing. When a part of our brain malfunctions, through either an accident or a stroke, we can lose the ability to identify, understand, and feel our sensations. They may become meaningless.

The Corporate Entrance: The Central Nervous System

The central nervous system (CNS) is like the North Star. It is the central operational system, or "office," where the peripheral nervous system, traveling from our fingers, our toes, our muscles, ends up. Specifically, the CNS consists of the spinal cord and the brain.

Secretarial Staff: The Brain Stem

This is the first stop in "the office." Because the brain stem resembles the brain of our cold-blooded friends, evolving more than 500 million years ago, it often is called the "reptilian" brain. And for snakes, lizards, and the like, this is as good as it gets. But for humans, the brain stem is only part of the whole—albeit a major part: it is vital for basic life-sustaining functions. Here, moving up from the spinal cord, you'll find the following:

The **medulla**—it doesn't get more life sustaining than this. The medulla is responsible for blood pressure, heart rate, even breathing in and out.

The **pons** is a type of bridge, connecting the medulla to the rest of the brain. But it doesn't just sit there, collecting tolls. The pons is home to the reticular formation, a mass of nerve fibers responsible for muscle tone, reflex actions, and alertness.

The **midbrain** is exactly that, a midpoint between the higher-functioning areas of the brain and the "reptilian" parts. Here, too, are more reticular formation functions, including eye muscle control and alertness.

Some Brain Facts

- The brain weighs almost three pounds.
- The brain is approximately the same size as a large cantaloupe.
- The brain consists of about 100 billion nerve cells.
- The number of ways that these nerve cells can be connected to each other is greater than the number of atoms in the entire universe.

The Office Coordinator: The Cerebellum

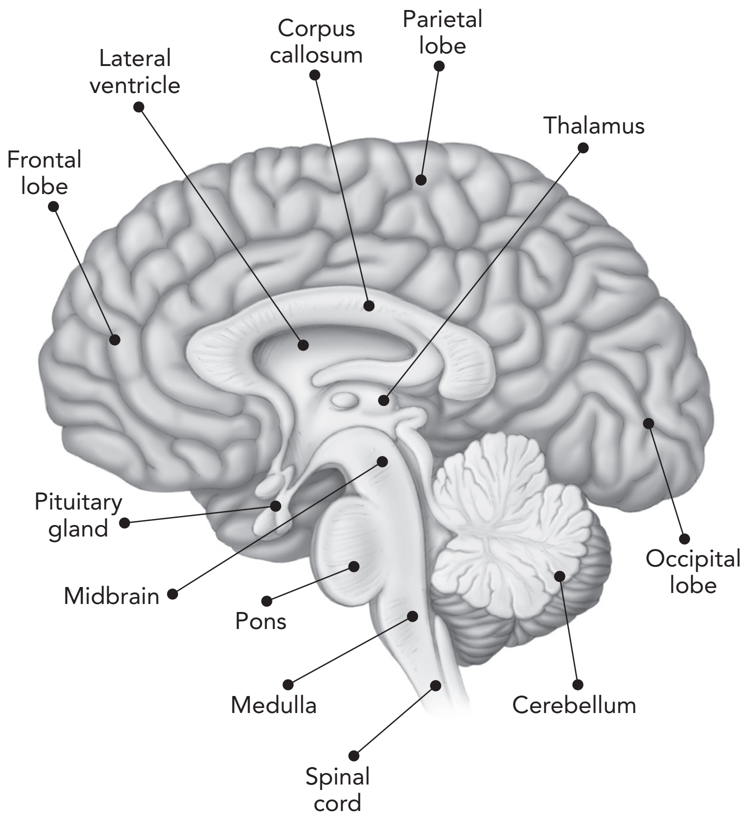
Just behind the brain stem, and slightly above it, sits the cerebellum, a mass of tissue that coordinates our every movement. It helps us keep our balance, allowing us to hold a glass of water steady. The cerebellum also coordinates the movements of our speech muscles.

Working with the cerebellum are the **basal ganglia,** located in the higher parts of the brain, helping to smooth the way we move. Obviously, a stroke in either of these two areas of the brain can affect our balance and our movements.

The Executive Assistant: The Diencephalon

This locale of the brain is the gateway to the higher-functioning areas of the brain. Situated right above the brain stem, the diencephalon is home to two crucial vice presidents.

The **thalamus** is a relay station that sorts out the messages traveling to the brain and decides which areas get what. It might send a message to several areas of the brain at once. When you step on a nail, for example, the pain will shoot through your brain stem to your thalamus and on to your memory storage bank. You might remember when you were a kid and had to get a tetanus shot because you stepped on a rusty nail. You might activate your



The different parts of the brain.

thought processes, realizing that it isn't smart to walk around without shoes. The thalamus might bounce thoughts back and forth between those of your more curious, youthful days, your physical pain, and your fear of perhaps needing another shot.

The **hypothalamus** sounds like a relative—and it is. Although it's quite small, it wields much influence. Appetite control; sexual arousal; feelings of thirst, of sleep, of excitement; body temperature regulations; hormonal balance—the hypothalamus handles these and more, including a role in regulating moods and emotions.

The Executive Vice President: The Limbic System

Nowhere is the link between the parts of the brain more interrelated than that of thought and emotion. Pain, anger, joy, elation—none of these would signify anything without linking them to our thoughts. The limbic system, a structure of interlocking nerve cells that lies between the diencephalon and the part of the brain that governs intellect, enables us to feel and express our emotions. You can feel the pain of that summer day when you were exploring by the sea, when you stepped on that rusty nail. You can remember the loneliness you felt at the resort's clinic, with its antiseptic walls and its kindly nurse. You can even feel embarrassed that you did it again as an adult, that you actually stepped on a nail because you were barefoot—even though you'd just told your child to put on his shoes.

The Boss: The Cerebrum

At last, the higher-functioning areas of the brain that separate us from lower animals. Here are our thoughts, our memories, our perceptions; and, like a presidential cabinet, it's divided into several separate, but equally important, areas.

The **amygdala** and the **hippocampus** take care of our thoughts and our memories. They give meaning to our emotions; they connect our thoughts, our senses, to the past. They are responsible for the layers of memory, thought, and emotion that occur when, as adults, we step on that nail.

The **cerebrum** is the chunky brain stuff, the gray and white matter that makes up the majority of our brain. Covering it like an outer shell are layers of nerve cells, more gray matter, called the **cortex.** This part of the brain is responsible for our ability to move an arm or leg and to feel the different sensations. In short, here is where we learn, how we walk, how we understand, how

Adjoining Rooms

New studies have found that memory is not simply stored in one place. When a sensation is perceived, the hippocampus is responsible for retrieving various memories from different areas of the brain. The memory of a particular emotion, the ability to move in a specific way, the link back to other times—all these are collected and carried to the hippocampus through relaying neurotransmitters in the brain. The nearby amygdala gives these memories their emotional impact, their color, and their magic.

we communicate. Here is what, indeed, makes us human: the ability to form relationships, plan our future, and solve complex problems. A stroke in this area of the brain can affect our speech, our memory, our personality, our sensations, and our strength.

The Interoffice Network: The Right and Left Hemispheres

Look in the mirror. Imagine a line going straight down the middle of your head, dividing it into two perfectly similar mirror images. Indeed, it's as if there were a line dividing your brain into perfect halves. We call these exact replicas the right and left hemispheres of the brain. Despite the use of "right brain–left brain speak" by pop psychologists to help people find everything from their "inner selves" to great relationships, there are very real—and different—functions for each hemisphere.

The **corpus callosum** is a bridge, rich in nerve fibers, that connects the two halves of the brain, the right and left hemispheres.

The **left hemisphere** is most responsible for language, for speech and word usage. It is also the part of the brain most involved in reading, calculating, writing, and other forms of communication. It is responsible for movement and sensation on the right side of the body.

Location! Location! Location!

Ask any realtor and he or she will tell you: location is everything.

And that includes stroke. In fact, location is its most important characteristic.

Always remember: where a stroke occurs is much more important than how big it is.

The **right hemisphere,** on the other hand, gives language its color. It controls your visual memories, your "artistic" abilities to draw, dance, or play music. It is also responsible for your ability to see the bigger, long-range picture—as well as movement and sensation on the left side of the body.

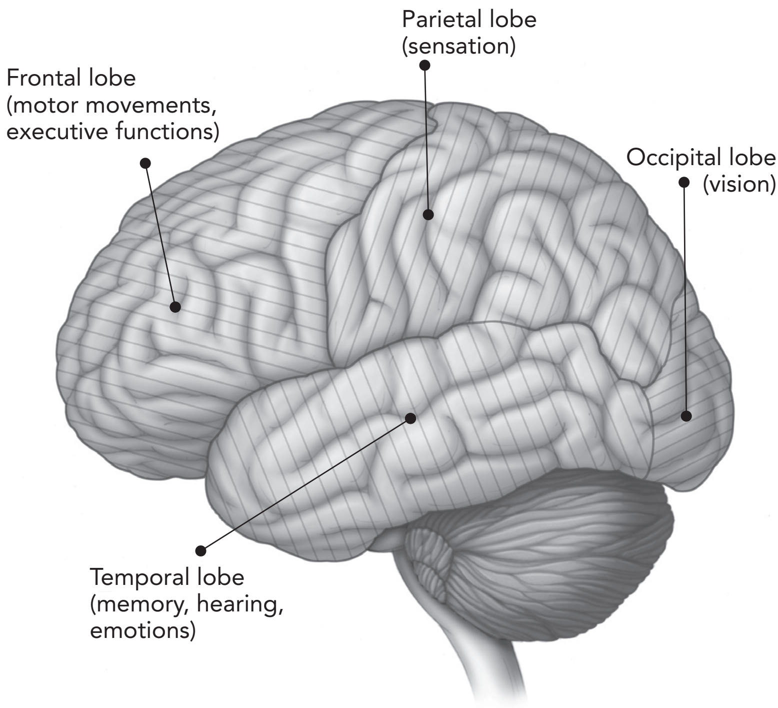
But both hemispheres are needed to complete a whole. You might be able to speak if your left hemisphere is intact, but your right side gives that speech its rhythm, its inflection, and its personal texture and dash.

When a stroke occurs in one hemisphere, the opposite side of the body will be affected. In other words, if the left hemisphere of your brain is injured, the right side of your body might be paralyzed or weakened, and vice versa.

There are also different emotional symptoms. A left-hemisphere stroke can cause depression, but a stroke in the right hemisphere might create complete denial of the illness. (We'll be discussing all the different symptoms in both right- and left-hemisphere strokes in later chapters.)

Branch Offices: The Lobes of the Brain

Yes, it's true that your brain has specific locales that are responsible for different brain functions. It's also true that your brain is divided down the middle, into two separate, but equal, halves. But there's more. Each half has four lobes, each with different



The lobes of the brain.

functions, each affecting you in different ways if a stroke happens to strike.

The **frontal lobes** could be considered the chief executive officers of the brain because they control so much of who we are: impulses, motivation, social interaction, communication, and voluntary movement. The "motor strip" that is responsible for all movement on the opposite side of the body is located in the frontal lobes—which are also responsible for our "executive functions": our ability to plan and to organize, to concentrate and to make decisions, to set goals, and even our capability to retrieve memory from storage. They are, as the name implies, in the front of the brain, and a stroke here could make a person incapable of saying what she means. It could make her agitated and impulsive. It might "flatten" her emotions, making her unable to generate new thoughts or plans. She might lose the ability to move all or part of the opposite side of her body.

The **temporal lobes** are our "temples" to memory. They hold our remembrances of both recent and distant pasts; they hold our learned fund of knowledge and information. Furthermore, the temporal lobes affect our emotional thought as well as our ability to hear and to appreciate music; they process the perceptions that flood the brain, making sense of our world. Located just behind and just below the frontal lobes, they also are crucial for who and what we are. A stroke here could make a person forget what he just said. It could make him unable to remember how to perform a task he has done a thousand times before.

The **parietal lobes** are very "sensitive." Situated just above the ears and in the back half of the brain, they are responsible for our sense of touch. They also are necessary when it comes to academics. They help us understand what we read and where things are in space. A stroke here can impair a person's ability to recognize an object. It can prevent her from comprehending the words she reads. She could feel numbness on the opposite side of her body. She could be unable to identify objects placed in her hand.

The **occipital lobes** control our vision. They are literally "the eyes in the back of your head." A stroke here can cause blindness or loss of a part of a person's vision. He might lose the ability to see the left side of his world if the stroke was in the right occipital lobe.

But the sites and arenas of brain function are only part of the picture. As with all relationships in life, communication is key. The different areas of the brain and the central nervous system itself must "speak" to each other. Messages must be relayed.

Whether it is stepping on that rusty nail, understanding the words in *War and Peace,* or simply breathing in and out, the brain must receive information—and send out a response.

Communication Network

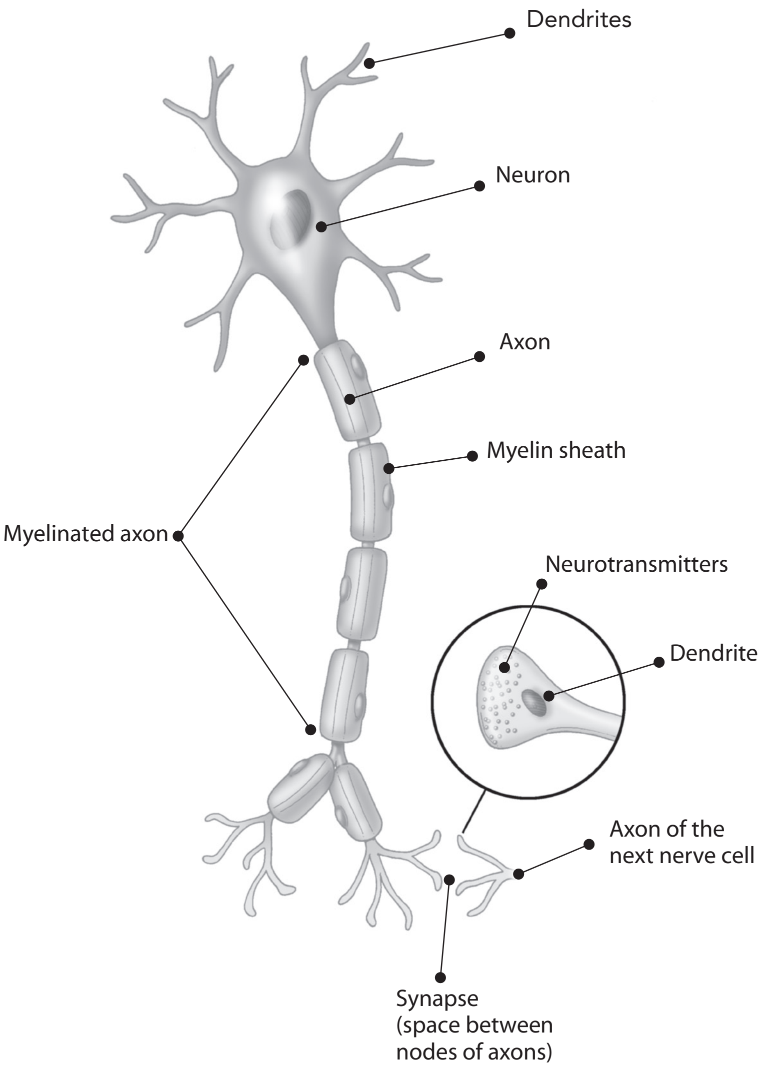
Messages are relayed throughout the brain by a network of brain cells, **neurons,** and the "cables" that connect them: **axons.** The messages travel by both electrical impulses and by the release of chemicals called **neurotransmitters.**

Let's say you step on that ubiquitous nail. The "ouch!" of pain travels up the nerves from your foot, moving merrily along the axon. Suddenly, it reaches a space at its next stop in the spinal cord. This space is called a **synapse.** The next neuron lies in wait, but the electrical version of the message "ouch!" cannot reach it—at least not yet.

But the body is a master of problem solving. That same electrical charge that carried "ouch!" along the axon now triggers the release of a chemical: the neurotransmitter. This neurotransmitter crosses the synapse space to a **receptor,** waiting and ready, on the next cell. As soon as the chemical-conducted "ouch!" touches the receptor, it turns back into an electrical impulse and the message "ouch!" continues on its way toward the brain.

This process continues throughout the nervous system, through every area of the brain, at a fast and furious pace: countless messages bouncing back and forth, commands being shouted, information being stored, perceptions being understood, millions and millions of messages perfectly relayed in less than a second, every hour of the day.

Even more fascinating is the fact that chemical neurotransmitters know what electrical charge will trigger them. They will be triggered by only one "Mr. or Ms. Right." The electrical charge



A neuron, complete with axon, dendrites, and synapses.

must match up with a specific chemical for the message to jump the synapses. Without the right message, a chemical neurotransmitter will not be triggered. It will lie dormant, silent, quiet.

This is all well and good when the brain is functioning normally, when specific messages are being relayed. Unfortunately, when a stroke strikes, some of the brain cells and axons can be damaged and messages just won't get through. Damaged synapses and neurons can create imbalances, affecting mood, emotions, and thought. A stroke in the temporal lobe can affect the connections there, preventing memory retrieval. A damaged synapse in the right hemisphere might prevent movement on the left side of the body.

Yes, strokes take place in the brain, but their beginnings may start far away and travel to the brain—via a clot in the blood that is pumped, filtered, and carried to and from the brain via the heart.

The Pulsing Heart

The brain feeds on oxygen, which is extracted from red blood cells. It's assured a constant supply from the high-speed pumping action of the heart, which, despite the soul-searching words of poets and philosophers, is actually a "hard-body" muscle that is about the size of a fist.

This "fist," however, can squirt a jet of life-sustaining blood several feet. You can feel this jet of blood surging through your body by taking your pulse. Each beat of your pulse pushes out about one cup of blood into your bloodstream.

But quality is more important than quantity. Believe it or not, our bodies contain only about twelve pints—or twenty-four cups—of blood. This is equivalent to approximately six quarts of milk or the weight of one Thanksgiving turkey.

However, these twelve pints pack a mighty wallop.

The Ultimate Recycling Machine

The twelve pints of blood pumped by the heart are, in effect, used over and over again. They go around and around in an endless circle throughout our bodies, delivering the blood's oxygen to all our organs and taking away their wastes.

This process is called circulation. Briefly, here's how it works:

1. The heart is divided into four chambers, the right and left atrium and the right and left ventricle. The oxygen-filled blood from the lungs comes into the **left atrium** of the heart. It moves into the **left ventricle** and is pumped out into the bloodstream through . . .

2. . . . the **aorta,** the "king" of all arteries. From the aorta, blood, carrying our body's fuel and food, travels through its passageways called **arteries.** The walls of the arteries are very elastic; they are muscular tubes that branch out, becoming smaller and smaller, until they are only one cell thick . . .

3. . . . and fuel and oxygen can pass through them. These tiny arteries are called **capillaries.** The hungry cells in the body, from the muscles to the brain, from the kidneys to the liver, "eat" their fill and deposit carbon dioxide through their cell walls. The depleted, waste-carrying blood now begins its journey home through . . .

4. . . . the **veins.** The blood is now more sluggish. The heart has used most of its energy to pump oxygen-rich blood into the body; it has less "oomph" for the return trip. Thus, the veins have little "pockets" or valves that catch any "backflow" to make sure the blood keeps moving toward the heart

and doesn't get backed up. The veins get bigger and bigger until they reach the . . .

5. . . . **right atrium** of the heart. As the heart pumps and clenches, this blood is pushed into the . . .

6. . . . **right ventricle,** where it travels to the lungs and fills up once again with oxygen. This oxygen-rich blood journeys back to the left side of the heart, and the cycle begins anew.

The Blood's Push and Pull

Like the water in your house, circulation needs pressure to keep moving. Your blood pressure is what keeps your blood flowing and moving in a rhythmic way through your arteries.

When you get your blood pressure taken, the upper number in the reading, called the **systolic** pressure, reflects how hard your heart has to squeeze and contract to push the blood through your arteries. A high reading means that your heart is having to squeeze too hard to keep your blood moving.

The lower number, or the **diastolic** pressure, reflects the pressure in your arteries while the heart rests between beats. A high number here means that the pressure remains elevated even when your heart is resting between beats.

How Important Is Oxygen to the Brain?

Without it, the brain's entire electrochemical process will not work.

Without it, brain function in that oxygen-deprived locale will not take place.

Without it, we will lose consciousness within five to ten seconds.

Without it, we will experience brain damage within minutes.

Blood flow, its rhythm and pressure, can be affected by hereditary factors, kidney disease, weight gain, and cholesterol, a waxy substance that is carried through the bloodstream. As it builds up, cholesterol is deposited on the arterial walls. Eventually, the walls of the arteries thicken to the point where blood may not get through. If these deposits occur in the arteries feeding the heart, this can result in a heart attack. If they accumulate in the arteries feeding the brain, this can result in a stroke.

Because both high blood pressure and elevated cholesterol are important factors in stroke, we'll be discussing them, as well as the other risks, in more detail in the next chapter.

Food for the Brain

The brain has a hungry man's appetite. It needs 20 percent of the total blood supply to get the oxygen and food that it needs.

The crucial arteries through which the heart pumps blood up to the hungry brain are called the **carotid arteries.** Both the right and the left carotid arteries are all-important, branching out into a series of arteries in the front of the neck and into the brain. These arteries grow smaller and smaller as they travel, allowing all the areas of the brain, from the thalamus to the hippocampus, from the frontal to the temporal lobes, to get "served" with oxygen-rich blood.

But the carotid arteries do have a partner. Blood also travels to the brain through the **vertebral arteries.** These go up the vertebral column in the back of the neck, to form the basilar artery in the brain stem.

A stroke will have different symptoms if it occurs within the carotid system or within the areas of the brain fed by the vertebral arteries, and we'll be discussing these in more detail later.

We now have seen how the brain and the heart are connected. But before we close, let's briefly go over the chemistry of their common thread.

Life-Sustaining Fluids

Blood. We can be upset by the sight of it or donate it to save a life. But whatever the "gut feeling," blood is literally a carrier—of life. Think of it as a highly reputable moving van, a transporter that carries necessary food to our cells. And there is much more than meets the eye in its red color. If you put a drop of blood under a microscope, you'd see all of the following:

Plasma is the liquid that holds the blood cells; it gives the blood its consistency.

The **red blood cells** (or **corpuscles**) hold the food. They contain the oxygen and the other nutrients (in the chemical form of glucose) that the body needs to survive. After the various organs finish their "meal," these red blood cells head for the veins, carrying back the "empty plates" to the heart. Red blood cells also give the blood its red color.

The **white blood cells** are the "superheroes." They respond to "foreign invaders," both by fighting infection and by increasing in number when infection or inflammation threatens the body.

The **platelets** are responsible for clotting. When you cut yourself, platelets "rush in" and begin to create a web, a microscopic gauze of fiber, that traps other blood cells to stop the flow of blood.

Problems can arise, however, in the most well-oiled machine—and the human body is no exception. Clotting is crucial if you fall and hurt your knee, if you step on that ever-present nail. However, especially as we get older, our arteries can narrow and develop rough areas, which draw the attention of the platelets.

Pain in the Neck

The vertebral column in the neck is particularly vulnerable to bone spurs. These spurs can compress the arteries traveling through them and, consequently, may affect their blood supply.

Although not so serious as a stroke in the carotid system, these spurs may cause dizziness in elderly people, especially when they bend their heads back. Perhaps you, or someone you love, have experienced this phenomenon when getting a shampoo at a beauty salon. As you bend your head backward into the sink, you might experience some dizziness, which usually stops as soon as you sit up.

But, here, clotting is not so simple as a Band-Aid and a scab. Platelets don't always know when to stop their clotting action on these internal "cuts." Red blood cells soon will join in the fray; the clotting mass will get bigger and bigger. Passageways can become clogged, preventing blood from moving through the artery.

When this clotting takes place in the brain, it can result in stroke—and we'll be covering this phenomenon in more detail in Chapter 3.

Coming Together

Let's go back for a moment to that nail. There you are, on that hot summer day, walking barefoot on the sand. You step on that nail.

Pain immediately shoots up your nervous system to your brain, which sends out a response. "Ouch!" Your body goes into action. Your heart starts to pump a bit faster. You look down at the source of your pain and notice the blood on your foot. Clotting begins.

Other messages are sent: you remember the last time you stepped on a nail, that hot summer day when you were a child,

Some Blood Facts

- Blood is bright scarlet red in the arteries, but a deeper crimson in the veins.
- Blood is heavier than water but only by a small amount.
- The blood in men weighs more than the blood in women.
- Altitude affects our blood. Higher altitudes increase the amount of red blood cells in our system so that they can carry more oxygen.

when you'd been on a glorious vacation. Your memory is bittersweet and tinged with fear: you probably will need a tetanus shot. You admonish yourself: you should have been wearing shoes. You should have known better.

Your emotions affect your heart rate. Blood continues to surge. You might feel flushed.

And all these connections, all these responses, emotional, mental, and physical, occur in a fleeting moment of time.

This, then, is the heart, brain, and blood connection, a powerful triumvirate. As we have seen, all three play a critical role in our health—and in a possible stroke.

But there's more. The heart, the brain, and the blood are responding to something else. That's where the risk factors of stroke come in.