The Healthy Body Handbook
A Total Guide to the Prevention and Treatment of Sports Injuries

David C. Saidoff, P.T.
Stuart Apfel, M.D.
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Published by Demos Health
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This is a sample from The Healthy Body Handbook
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To: Debby, Elisha, Yishai, and Barak
   David C. Saidoff, P.T.

To: Sari, Chaim, Avi, Shira, Ariella, and Rivka
   Stuart C. Apfel, M.D.
Interestingly, the exact percentage of individuals who suffer from a fear of dogs is unknown. However, it is estimated that up to 50% of the population may experience some level of fear or anxiety when encountering dogs. This fear can range from mild discomfort to intense panic, and it can affect daily life, social interactions, and even career opportunities.

The underlying causes of dog phobia are complex and multifactorial. Some individuals may have had negative experiences with dogs, such as being bitten or startled, which can trigger fear responses. Additionally, genetic and environmental factors may contribute to the development of this phobia. Understanding the root causes is essential for developing effective treatment plans.

Several strategies can be employed to manage dog phobia. Exposure therapy, where the individual slowly and safely interacts with dogs under controlled conditions, is often recommended. Cognitive-behavioral therapy, which involves identifying and challenging negative thoughts and beliefs, can also be effective. Medications may be prescribed in some cases to manage anxiety symptoms. It is crucial to consult with a healthcare provider to determine the most appropriate treatment plan.

In conclusion, dog phobia is a common and treatable condition that affects a significant portion of the population. By understanding the complexities of this phobia and employing evidence-based strategies, individuals can work towards overcoming their fear and living full, fulfilling lives.

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A healthy, strong body is essential to the enjoyment of life. We have written The Healthy Body Handbook is about learning to be proactive and keeping our bodies is top condition. It deals with the many conditions that affect individuals of all ages, from overdoing an exercise routine or simply rushing into sport activity after a period of inactivity, which can result in overuse and injury. Today the emphasis in sports is on taking the time to learn how to care for ourselves and prevent injury. A key concept is to pace yourself, learn to warm up, stretch before and after exercising, and not throw yourself headlong into exercise. This is as essential to wellbeing as it is to strength and stamina building. This handbook teaches about the dangers of the mind pushing the body beyond its limits. It educates you on exercising the “right way” and learning to avoid injuries and overuse through knowledge, patience with oneself, and appropriate exercise.

The Healthy Body Handbook will help you understand the basic structure and function of the musculoskeletal system of the human body. This knowledge is essential to the prevention of many health problems. It is written in a straightforward and readable format and is generously illustrated. Some chapters discuss specific areas of the body; others discuss conditions that affect the whole body; and the last chapter offers instructions for staying fit. There is also a detailed chapter that discusses a variety of strategies for pain relief. The information in this book will empower you to be proactive about your health, make positive lifestyle choices, prevent injuries, and participate fully in the healing of injuries—especially those that are sports-related.

The body sends out many warning signals of impending overuse and the resultant potential for injury. With the Handbook you will learn to listen to these signals, evaluate them, and make healthy decisions. It also includes information about the remedies and procedures your doctor is likely to recommend if you have been injured or have an illness. All of the chapters are self-contained; you can read any chapter independent of the others if you are interested in a specific condition, or read the book from cover to cover in order to become fully informed as to everything you can do to stay healthy and avoid injury.

The primary theme of this book is the lifelong necessity of exercise—without overdoing it! To this end, we have included detailed advice regarding various exercises and the appropriate regimen for stretching and strengthening, both of which are essential to warding off age-related problems. A healthy body also supports a healthy intellectual and emotional life. As the great American naturalist and philosopher Henry David Thoreau said, “Methinks that the moment my legs begin to move, my thoughts begin to flow.”

Daily life in modern society can be overwhelming. There is just too much to do and there are too many demands requiring our attention. The Healthy Body Handbook stresses the importance
of slowing down! Exercise should be fun. Do not push your body beyond its biomechanical limits. Respect your body and make time to give it the rest it needs. Take the middle ground and always seek balance.

Investing in your health is as essential as investing in your financial portfolio, so be proactive, take good care of yourself, and live a long and prosperous life.

David C. Saidoff, P.T.
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1 The Musculoskeletal System

■ The Basics

The Musculoskeletal System is a marvel of balance and symmetry. More than 650 muscles are connected to the 206 bones of the skeleton. Together with the joints, tendons, and ligaments, the muscles and bones in the body comprise a musculoskeletal system that functions like a system of struts and levers. This system allows us to move and function within our environment.

Our bodies are designed using engineering principles that make us appear flawed when compared to other life forms. If a person could drive his legs as quickly as an ant, he would be able to run at speeds close to 100 miles per hour. However, at this speed his bones would break and his muscles would be torn to shreds! An engineer cannot increase power output by simply designing a larger model of the same machine. Although the human body is only about 25% efficient (about 75% of the energy we generate is lost), it still works efficiently when compared to man-made machines. When we reach our physical limits, we simply build machines such as bulldozers, cranes, and automobiles to compensate for our limited strength and stamina.

■ Muscles

The skeletal muscles are located beneath the skin, and they convert chemical energy into mechanical movement. Muscles exist in two states: contraction and relaxation. When muscles contract, they create movement; when they relax, they do not. A muscle cannot push, it can only pull. During contraction, muscles shorten by almost one-half, bringing their points of attachment closer together. This pulling force is first exerted on a tendon, which in turn pulls on a bone. By attaching to bones, muscles are arranged to act like levers.

There are about 6 trillion muscle fibers in the body—about two-thirds more muscles than bones—which provide a muscular, contoured surface to our figure. Each fiber is thinner than a hair and can support up to 1,000 times its own weight. Muscles thrive on exercise, and resting them too much causes them to shrink. It is for this reason that the limb will be thinner when a cast is removed from an arm or leg. The unused muscles have become atrophied, or shrunken.

■ Interesting Facts About Muscle

Breasts are composed of adipose tissue—another word for fat—and no amount of exercise will make a woman’s breasts larger. Unlike muscle, fatty tissue does not have the ability to contract and, therefore, it cannot be exercised and enlarged. However, exercising the large pectoralis muscles located beneath the breasts may make the bosom appear to be somewhat more pronounced.

The muscle bearing the longest name is the levator labii superioris alaeque nasi. Contraction of this...
Skeleton and muscles

Bones constitute the general framework of the body, supplemented by cartilage, the softer material covering the ends of many bones. Bones support the body’s weight, provide the levers needed for movement, and protect the soft internal organs. The bones are moved by muscles which are inserted into them by fibrous structures known as tendons. All muscle can contract, either under voluntary or involuntary control.

Ribs are strong enough to protect the heart and flexible enough to permit lung expansion.

Humerus

Radii

Ulna

Pelvis

Pubic bone supports kneeling and provides support for the leg muscles.

Joint damage
due to various types of arthritis is very common.

In rheumatoid arthritis, permanent damage is caused to both cartilage and bone.

Main superficial muscles
(front view). In the average person muscle tissue accounts for just over a third of body weight. The maximum force a muscle can generate depends on its mass. The force of its contraction is concentrated on a restricted area of bone by tendons, which have a tensile strength similar to that of bone and about half that of steel.

facial muscle, which connects your upper lip to your nostril, results in an “Elvis Presley” lip curl. The sartorius, your longest muscle, extends from the knee to the waist, while your latissimus dorsi (“lats” for short) covers the largest area. It spreads, wing-like, across your upper back. The sit muscle—the gluteus maximus—is strong enough to help us climb stairs, and the masseter muscles, which are located on the sides of the jaw, can generate a biting force of up to 150 lbs. The eye muscles have the fastest reaction time.

The smallest muscle in the body is the stapedius. It is about 1/20 of an inch in length and thinner than a dime; it is attached to the stapes bone, which is the
smallest bone in the body. The stapes bone is located in the middle ear, where it sends vibrations through the eardrum. Another interesting fact: when you frown you use 43 muscles, but when you smile you only use 17. Moral: Be happy and save energy!

**Tendons**

A *tendon*, known as a *sinew*, is a flexible, strong cord that attaches the end of a muscle to a bone. Tendons are an intermediate form of tissue that links muscle to bone and, like strings on a marionette, they make motion possible. By blending with the surface fibers of the bone (the *periosteum*), tendons carry the pulling force from the muscles to the bone, allowing the bone to move. A tendon cannot stretch for, if it did, the muscular force would be lost. While many tendons are short, others, like those belonging to the forearm muscles, are quite long. They pass through the wrist and allow movement of the hand and fingers. As a result, tendons often permit control from a distance. Tendons are enveloped in a delicate membrane known as a *synovial sheath* that protects them and provides nutrients.

The most familiar tendon is the *Achilles tendon*, which connects the calf muscles to the heel bone. This muscle-tendon-bone complex enables us stand on our toes: when the calf muscle contracts, it pulls upward on the heel by way of the Achilles tendon.

The *hamstring tendons* are the great tendons of the thigh muscles. They may be felt on either side of the back of the knee. Athletes often “pull a tendon.” This refers to a stretch or tear of tendon fibers that results in a painful and disabling condition.

**Bones**

Most people think of bones as dead material but, in fact, they are like trees. They are quite alive and without their support we would collapse into a blob of jelly. Bones provide a rigid framework that supports the body, and they also provide the surface where muscles are anchored. In this way, bones provide the levers needed for movement. Acting as a chassis, the skeleton allows us to twist and bend through a wide range of movement unequalled by any man-made machine. Bone has the equivalent strength of steel-reinforced concrete, although it only accounts for 14% of body weight. Steel bars of comparable strength would weigh about 4 to 5 times that much! Bones also protect our vulnerable internal organs.

Bones are anything but dead and inert. In fact, bone is one of the most biologically active tissues, a living organ with a host of responsibilities beyond supporting and protecting the body. Bone is made up of one-third water and contains virtually all of the body’s mineral supply. It is responsible for moving calcium, phosphorus, and other essential trace elements to wherever they are needed. In addition, the soft core of bone—known as the *marrow*—manufactures blood cells. Every minute, about 180 million red blood cells die, and most of the new ones are created in the bone marrow, along with the white blood cells that protect the body from infection.

Like a well-organized factory, a division of labor occurs within bone that is shared between its different types of cells. *Osteoblasts* create more bone by creating a protein-like substance known as *osteoid* that traps calcium, which is then mineralized; *osteoclasts* remove or remodel bone by secreting enzymes that dissolve bone; and *osteocytes* govern bone metabolism.

Bones disappear as we grow to adulthood. We start off with 350 bones at birth, but many of them fuse as we mature, reducing the number to 206 in the full-grown adult. Bones come in all sizes and shapes. The largest bone is the thighbone, or femur. It is a myth that women have an extra rib.
**Ligaments**

Ligaments (from the Latin *ligare*, “to bind”) are tough, fibrous bands that are found where bones meet at joints. They bind the two connecting bones together. Ligaments act as tie-pieces between bones by fastening around or across bone ends in bands—for example, the ribs or the bones of the forearm. In this way, ligaments guide the movement of joints and prevent excessive motion, which can cause injury. In activities such as gymnastics, which involve remarkable agility and often astounding suppleness, the joints are regularly moved in ways they were not intended to be moved. While beautiful to watch, these activities eventually undermine the protective function of the ligaments and cause joint problems in later years.

**Joints**

Getting around on Earth requires living things to have joints. Whether your means of locomotion is hopping forward like a kangaroo or rabbit, scuttling sideways like a crab, moving on all fours, or walking around like we humans do, living bodies must have joints. Otherwise, our only means of getting around would be to roll, log-like, in different directions—and that would not work well at all!

A joint is a connection between two or more

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bones such as the knees or elbows. Some joints, such as those in the spine, have a limited range of movement. Others, such as those making up the hips, knees, elbows, wrists, fingers, ankles, and toes, allow for a good deal of movement. The body has several types of joints, classified according to how much movement they allow. For example:

- **Fixed joints** occur as seams between the pieces of bone making up the skull.

- The joints at the knees and fingers move back and forth in one direction only, or open and close like hinges on a door. These are called **hinge joints**.

- The joint between the two topmost vertebrae (bones in the spine) is considered a **pivot joint** because it allows the highest bone to pivot on the lower one so that the head can turn from side-to-side.

- The very flexible joint that connects the thumb to the hand is called a **saddle joint** because of the saddle-like shape of its two ends. This joint allows the thumb to move in two directions: from side-to-side and from back to front.

- The shoulder and hip joints are called **ball-and-socket joints** because the bulbous head of one bone is round and fits into a hollow depression on the other bone.

A joint is endowed with the type of movement necessary for its particular function. Relatively little movement is needed in the back because the spine needs protection. In contrast, our hands would be little better than claws without the unique shape of a saddle joint—imagine trying to pick up a cup of coffee without your thumb! The opposable thumb allows us to pick up small items such as needles or tiny screws. On the other hand, it is a real advantage to have a wide range of movement at the hip or shoulder joints. Ball-and-socket joints allow for a very wide range of motion and are used for just getting around and much more. With almost 360-degree movement capability, the shoulder has different uses for different creatures. Gibbons use their shoulders to swing from tree to tree; moles use them for digging; birds use them to fly; antelopes use them to run; and human shoulders enable the hand to be placed in virtually any position—something extremely valuable when we are holding and using tools.

The weight of our bodies, our relationship to gravity, and simply moving around cause the ends of the bones to rub against each other. Eventually, this friction can be destructive to the joint. All movable joints, whether man-made (such as a door hinge) or biological, are prone to wear and tear. Automobiles and other man-made machines often wear out for this very reason. Unlike biologic systems, they do not have the ability to go to sleep and wake up refreshed. On the other hand, because we are alive, we have the capacity to heal, and any minor wear can be compensated for. For example, the body has evolved a special strategy to protect the joints from friction by covering the ends of the bones with **cartilage**—a smooth, springy, and spongy material that limits friction by acting like a shock absorber.

The space between the bones is called the **joint cavity**, which is enclosed by a **joint capsule**, a sac that covers both ends of the joint. Lining the inner capsule is a special layer of tissue called the **synovial membrane**, which releases a slippery lubricating fluid that keeps the bone ends from rubbing against each other. Synovial fluid provides nutrition to the cartilage and is essential for keeping it healthy. Because of cartilage and synovial fluid, friction within a joint is kept so low—even less than two pieces of wet ice rubbing against each other—that it beats the best low-friction materials designed by engineers!
ever, this friction-reducing strategy eventually gives out with increasing age because the tissues that maintain it age. This wear and tear of the cartilage is the cause of osteoarthritis.

The tough ligaments that protectively wrap the joint comprise the outer capsule and keep it stable when it is moving. Ligaments also narrowly restrict movement of the joint so that only those portions of the joint ideally suited to take on wear are exposed to friction. Continuous stretching damages these ligaments and allows portions of the joint that were never meant to be in contact rub against each other. This frequently occurs in athletes.

**Muscle Balance – Agonist and Antagonist**

The muscles that make up the musculoskeletal system are paired, so that when one contracts, the other relaxes. For example, when you make a muscle in your arm, your biceps bunch up in the center of your upper arm. At the same time, the triceps muscle on the back portion of the arm relaxes as it stretches and becomes elongated. The muscle that contracts (the biceps) is the prime mover and is therefore called the agonist, while the muscle that is relaxed and elongating (the triceps) is called the antagonist. However, when the elbow is straightened, the triceps becomes the agonist and the elongating biceps assume the role of antagonist.

There is a constant interplay between muscles during ordinary motion. The agonist and antagonist muscles on either side of a joint must be in proper balance for the joint to work properly. Both muscles must be able to stretch and contract, in turn. Like other types of soft tissue, muscles easily adapt to the changing positions of the adjacent...
joints. While this enables us to move, favoring one joint position over another will bias one muscle group over its opposite. If a position is held too long, one muscle will become permanently bunched up and the other will become excessively elongated.

The normal balance between them will be affected when one muscle gets stronger than its paired opposite. For example, an executive who spends lots of time in the sitting position will develop tight hamstring muscles because the sitting position favors shortening of the hamstring muscles and lengthening of the opposite muscles, the quadriceps group in the front of the thigh. This muscle imbalance between the muscles in front of and behind the thigh may cause problems and it will become difficult to straighten her legs. The executive will feel a stretching pain behind her knee because the hamstring muscle has become less flexible. This condition is called “tight hamstrings,” and it can be corrected by regular stretching. Without regular stretching, these muscles will become more or less permanently tight in what is called a contracture.

Contractures of the hamstrings can be a major problem because they affect the nearby joints such as the knee, hip, and pelvis. Because they are large, long muscles, they attach on the pelvis and, if they are overly tight, they will pull too hard on the pelvis. This, in turn, upsets the pelvic posture and may strain the lower back and cause pain. Typically, as we grow older, paired muscles become excessively tight on one side and weaker on the other side.

It is essential that muscles have the right amount of contraction as well as flexibility in order to maintain healthy muscles and the joints they surround. Maintaining this balance between paired muscles is accomplished by both strengthening and stretching. Because muscle balance and good posture are so important, it is essential to perform regular stretching exercises.

### You Have Lots of Nerve!

A neuron, also called a nerve cell, communicates by transmitting electric signals between the brain or spinal cord and the entire body, much like a tele-
phone system. This vast communication network is known as the *nervous system*, and it involves approximately 28 billion nerve cells, each of which is connected to thousands of others. It is similar to using a telephone system; when you dial a telephone number, you generate a series of impulses that travel along the telephone wire to an exchange that automatically connects the call to the number dialed.

The nervous system has two main components: (1) nerves that make up the brain and spinal cord, which form the *central nervous system* (CNS), and (2) those that link the central system to the rest of the body, which form the *peripheral nervous system* (PNS). The peripheral nervous system is made up of cells that perform certain functions according to instructions from the CNS, and others that provide information that is relayed back to the central system. The CNS houses all of the controls that allow information to be gathered and processed.

*Afferent* nerves carry information, such as the feeling of stepping on a thumb tack, back to the brain and spinal cord, whereas *eff erent* nerves are sent from the brain and spinal cord to the legs to make them jump away from the thumb tack. A typical nerve cell consists of a cell body with many *dendrites* that receive information from other cells in the form of impulses. A long filament called the *axon*, which originates in the center of the nerve cell, sends out messages to other nerve cells. A *motor* 

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The sensation of stepping on a sharp object is carried to the central nervous system (brain and spinal cord) by a sensory neuron, and the excited withdrawal reflex reaction occurs through a motor neuron.
nerve sends axons out from the brain and spinal cord to muscles that move the skeleton, whereas sensory nerves such as those involved in sight, hearing, taste, smell, or touch send information about experience and the environment to the brain and spinal cord for processing.

The speed with which information is sent depends on how much insulation covers the nerve fiber. Nerve fibers have an insulating sheath called myelin that wraps around the nerve fibers and speeds up the rate of electrical impulse. The thicker the sheath, the faster the impulse. Fibers lacking insulation conduct impulses at a speed of $\frac{1}{2}$ miles (2.4 km) per hour, whereas those with thick myelin sheathing conduct impulses of nearly 325 miles (523 km) per hour. One reason that newborn babies cannot walk is because they have not yet developed the insulating myelin sheath around the nerves leading to their legs. In diseases such as multiple sclerosis, the myelin sheath degenerates and normal function is impaired.

Nerves transmit electrical impulses that are passed along in a “spark-gap” manner and are therefore not continuous. At the end of each nerve is a synapse that connects it to another nerve or to a muscle. When a nerve impulse reaches the end of an axon, it triggers the release of chemicals known as neurotransmitters that travel across the tiny gap that lies between two nerve cells—the synaptic junction. Each nerve cell chemically communicates with surrounding cells via these neurotransmitters. For example, if a neighboring cell is a muscle fiber, that muscle will contract. There are many types of chemical neurotransmitters: acetylcholine, norepinephrine (known as noradrenaline), serotonin, and dopamine. Excessive dopamine in the brain is associated with schizophrenia, while dopamine deficiency is associated with Parkinson’s disease, in...
other words, the illness produced depends on which neurotransmitters are involved.

**Nerve Cells Are Specialists**

Neurons are highly specialized cells that are quite vulnerable to many types of injuries and disease. Nerve cells are more sensitive to poisoning by alcohol and drugs because they are specialized and the damage is often permanent and irreversible. Nerve cells are less tolerant than other types of cells to oxygen deprivation and will die within a few minutes if they are deprived of the oxygen and nutrients delivered via the blood. This deprivation can occur as the result of a stroke in the brain or spinal cord. The same thing occurs in *carpal tunnel syndrome* at the wrist. The nerves in the brain and spinal cord (the CNS) are incapable of repair if damaged, although nerves of the arms and legs (the PNS) are capable of some repair. If a nerve is cut at the wrist or compressed as in carpal tunnel syndrome, it can heal and normal function may return.

The peripheral nerves wind down through the arms and legs, around bones, under muscles, behind tendons and ligaments, and beneath skin and fascia. Fortunately, they can elongate and bend during our body movements. The downside is that they may become entrapped, inflamed, or injured. If we break a bone, a sharp shard may tear a nerve. If we hold our wrists in one position and use our fingers for long periods of time—as we do when typing or playing the piano—fluid buildup can compress the nerves and prevent the delivery of sufficient oxygen and nutrients. When the wrist tendons are overworked and swell, the median nerve passing between them into the hand is compressed, resulting in carpal tunnel syndrome. (See chapter 24)

Another problem that occurs as we grow older is that without proper stretching of our arms and legs,
the soft tissue surrounding our peripheral nerves may become accustomed to poor posture and become taut. This excessive soft tissue tautness is experienced as inflexibility, which may press on the nerves within the arms and legs. This may cause painful compression of the nerve at various sites throughout the body (known as fibrosseous tunnels) in which the nerve is pressed between soft (fibrous) and osseous (hard bony) tissue. This may result in pain, weakness, and wasting in the muscles controlled by that nerve. When no symptoms occur, the nerve becomes stressed and is more likely to develop problems if it is compressed at another point along its length. For example, if the median nerve is compressed or pinched near the neck, it will become stressed along its entire length and be more likely to succumb to carpal tunnel syndrome at the wrist. This is known as a “double crush” (see chapter 24) and may be avoided by regular stretching exercises that keep the spine, legs, and arms flexible.