Introduction

In a 1989 article in the *Psychiatric Bulletin*, consultant psychiatrist Denise Coia and senior occupational therapist Anne Joice from the Florence Street Hospital, Glasgow, UK, asked, "Is occupational therapy the forgotten specialty within the mental health community?" In their article, Coia and Joice lamented that despite high-quality evidence for occupational therapy's positive contribution to mental health, psychiatrists rarely recommended it.

Is this benign neglect observable today? Is it restricted to the mental health field? Unfortunately, the situation has improved only slightly. According to 2009-12 Medicaid data from all fifty states, only 3.7 to 6.3 percent of eligible adults with autism spectrum or other intellectual disabilities received occupational therapy. However, 20.5 to 24.2 percent of eligible children received occupational therapy. These data show the underuse of occupational therapy for this patient group even though there is ample evidence that it significantly benefits them.

Individuals on the autism spectrum or with intellectual challenges are not the only patient groups benefiting from occupational therapy. Ample evidence also exists that:

- Sensory, motor, and oral interventions provided by occupational therapists reduce the length of hospital stays during infancy.
- Occupational therapy-inspired early intervention programs for preterm infants improve cognitive outcomes through preschool.
- Pediatric play-based activities involving modeling and prompting, prescribed and carried out by occupational therapists, improve social behavior in early childhood.
- Occupational therapists who provide sensory integration interventions can address maladaptive behaviors in older children with sensory processing issues.
- Occupational therapy reduces disease severity in patients with multiple sclerosis.
- Cognitive skills training, a key occupational therapy intervention, improves job retention among adults with serious mental illness.
- Working with an occupational therapist helps older adults stay cognitively healthy and occupationally functional longer.

Is occupational therapy one of modern healthcare's "best-kept secrets?" Why is an obviously important and highly beneficial medical specialty still neglected?

When Grey House Publishing approached me to edit this volume on occupational and physical therapy, I recalled the cadre of brilliant students I have had the privilege of teaching who were accepted into physical therapy and occupational therapy programs and are working as physical and occupational therapists. Some of these remarkable young men and women often had to spend hours explaining to their family, friends, and colleagues (and, sometimes, their professors) what occupational therapy was and what occupational therapists do. Also, many bright, emotionally intelligent high school and college students have the skill set for occupational therapy but have no idea what it is or what it entails. What if we could give them a volume that succinctly and informatively explains it?

This present volume strives to make occupational therapy the no-longer-forgotten medical specialty. Occupational therapy is a science-based profession. Therefore, occupational therapists must have a solid foundation in human anatomy, physiology, functional anatomy, movement dynamics, neurology, psychology, and pathology. Second, therapists must understand physical and mental rehabilitation. Additionally, therapists must have a creative edge to visualize what tools, home modifications, and therapeutic steps might help their patients live longer, better, and independently. Occupational therapists help individuals of all ages improve their ability to perform everyday activities or occupations. The goal of occupational therapy is to enable people to participate in activities that are important and meaningful to them, despite any physical, cognitive, or emotional challenges they may face.

A healthcare field that closely collaborates with occupational therapy is physical therapy. Physical

therapy treats movement disorders that result from surgery, injury, disease, genetic conditions, and aging. Functional movement is a hallmark of good health. The "meat and potatoes" of physical therapists (also known as physiotherapists) are exercises that improve patient mobility, coordination, and strength. Some exercises are assigned by the physical therapist and done by the patient at home. Other special exercises are done in the clinic to improve movement and everyday life activities. Physical therapists also use physical manipulation, mechanical devices (such as traction, braces, restraints, slings, corsets, elastic bands, and several others), and electrophysical agents (including heat, cold, electricity, ultrasound, radiation, assistive devices, or those, and other interventions) to increase range of motion, relieve pain, increase local blood flow and break up scar tissue.

Physical therapists can also help prevent or delay mobility loss by promoting fitness and developing wellness and health programs for patients that promote active lifestyles. Because occupational and physical therapy share many treatment goals, techniques, and outcomes, physical therapy is included in this volume.

Our volume has articles on human anatomy and physiology, musculoskeletal and neurological conditions, and rehabilitation strategies to illustrate the foundational knowledge of occupational and physical therapists. Occupational and physical therapists work with individuals with various conditions or disabilities, such as developmental delays, physical injuries, neurological disorders, mental health conditions, or aging-related issues, and a representative selection of these conditions and injuries is clearly explained.

Since occupational therapists, and some physical therapists, often work with children, this volume has a range of articles explaining various pediatric conditions and the types of interventions an occupational therapist might recommend.

Although neither occupational nor physical therapists prescribe medications (in other countries, physical therapists can prescribe some medications), much of their work overlaps with patients on prescribed pain relievers and psychopharmaceuticals. Therefore, we included a section on some of the more commonly used medicines observed in occupational and physical therapy practice.

One of the "superpowers" of occupational therapists is their skill in assessing and treating patients with difficulties performing activities of daily living. Occupational and physical therapists use activity analyses to treat patients who live in a community but require rehabilitation. They assess their client's abilities and limitations and develop personalized treatment plans to address their needs. This volume has an article on patient examination and diagnosis; treatment tips are scattered throughout.

An article on assistive devices and technologies educates readers about the various assistive devices and technologies, home modifications, and adaptive equipment that occupational therapists recommend enhancing their client's independence and safety.

Finally, a cardinal role of occupational therapists is collaboration and patient advocacy since they collaborate with other healthcare professionals, such as physicians, physical therapists, speech therapists, and psychologists, to provide holistic care. They also advocate for their client's rights and promote inclusive environments that support their participation in society. Therefore, this work includes articles on Medicare, and the many medical specialties occupational therapists collaborate with.

Occupational therapy is guided by a philosophy that goes beyond symptom treatment. As a medical specialty, occupational therapists encourage patients through activities to work towards an improved quality of life regardless of their disabilities. Because of its hybrid nature, occupational therapy is the only medical profession employed by the Health and Social Services Departments. This volume hopes to present occupational therapy in this light—an indispensable medical specialty that deserves to come out of the shadows and take its rightful place in modern healthcare.

—Michael A. Buratovich, PhD

Further Reading

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Body Systems and Development

Bones and the Skeleton

Specialties and related fields: Exercise physiology; Orthodontics; Orthopedics; Osteopathic medicine; Podiatry; Sports medicine

Definition: bones are hard tissues that form the skeleton, the structure underlying the softer tissues of the body; they provide support while allowing flexibility

KEY TERMS

calcitonin: a hormone made and released by the thyroid gland that lowers the level of calcium in the blood by stimulating the formation of bone

collagen: a protein found in bone and other connective tissues; collagen fibers are well suited for support and protection because they are sturdy, flexible, and resist stretch

hormones: molecules made in the body and released into the blood that act as chemical messengers for the regulation of specific body functions

matrix: in bone, the matrix is a solid nonliving material that is a composite of protein fibers and mineral crystals

osteoblast: a bone cell that can produce and form bone matrix; osteoblasts are responsible for new bone formation

osteoclast: a large bone cell that can destroy bone matrix by dissolving the mineral crystals

osteocyte: the primary living cell of mature bone tissue

tissue: a collection of similar cells that perform a specific function

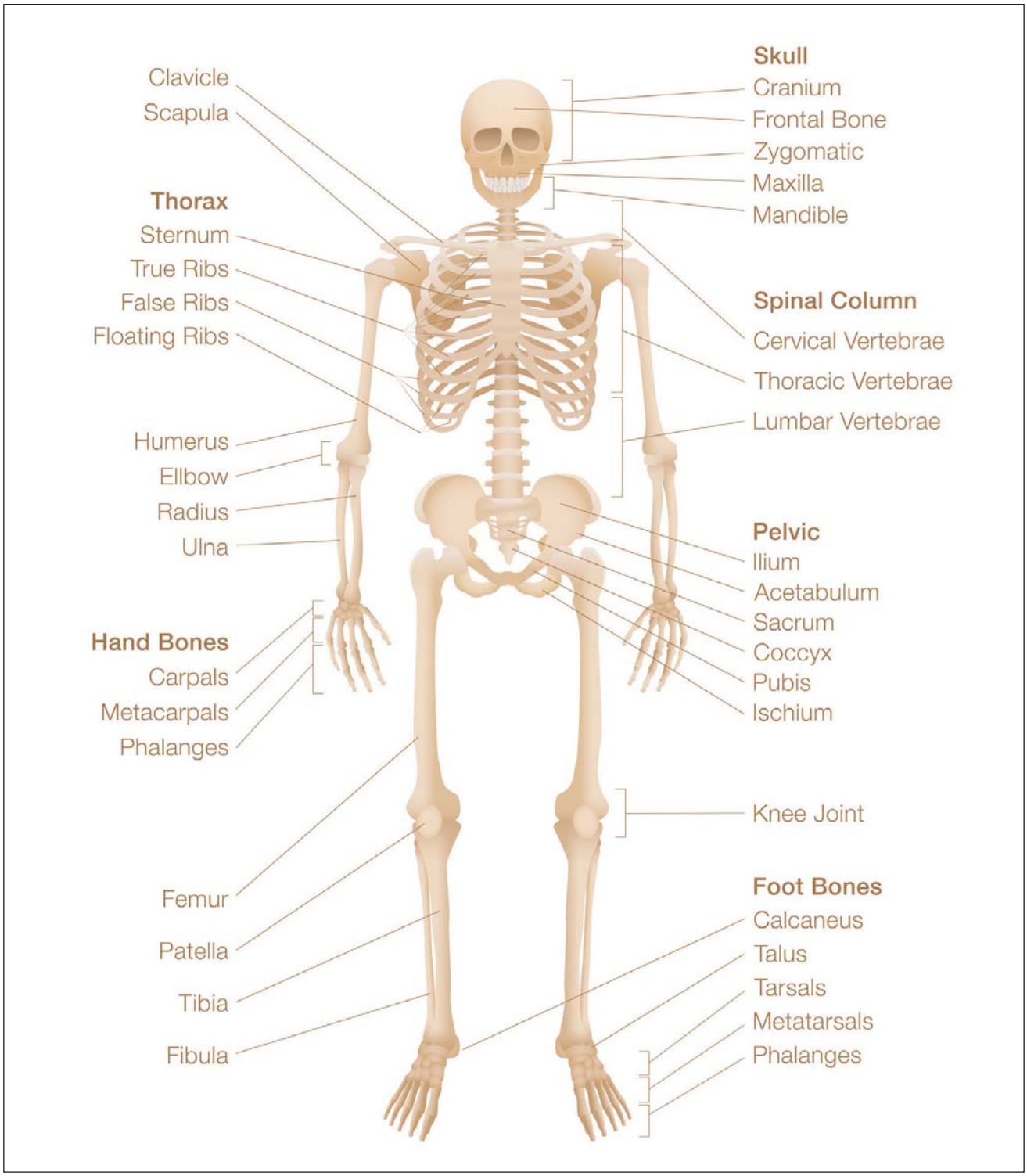
STRUCTURE AND FUNCTIONS

Bones are active throughout life: the 206 skeleton bones establish the body's size and proportions and interact with all other organ systems. Disorders of the skeleton can have profound effects on the other organ systems and serious health consequences for the organism.

Bone, or osseous tissue, contains specialized cells and a solid, stony matrix. The living cells in bone account for less than two percent of the total bone mass. The unique hardened quality of the matrix results from layers of calcium salt crystals such as calcium phosphate, which is responsible for about two-thirds of a bone's weight, and calcium carbonate.

Despite the great strength of the calcium salts, their inflexible nature means they can fracture when exposed to sufficiently great bending or twisting forces or sharp impacts. Because the calcium crystals exist as minute plates positioned on a framework of collagen protein fibers, the resulting composite structure does lend a certain degree of flexibility to the bone matrix.

Based on the internal organization of its matrix, bone is classified as either compact (dense) bone or cancellous (spongy) bone. Compact bone is internally more solid, while cancellous bone is made from bony filaments (trabeculae) whose branching interconnections form a three-dimensional network. The bone marrow usually fills the cavities of the cancellous bone network, the primary location for blood cell formation in adults.



The human skeleton contains 206 bones. Image via iStock/PeterHermesFurian. [Used under license.]

Connective Tissue

Specialties and related fields: Biochemistry; Hematology; Orthopedics; Rheumatology

Definition: a tissue category composed of adipose (fat), blood, bone, cartilage, ligaments, and tendons; the function of connective tissue is to connect, support, bind, protect, and store materials

KEY TERMS

adipocyte: a cell whose specific function is to store fats and associated nutrients, hormones, etc.

collagen: the main structural protein in the extracellular matrices of the body's various connective tissues

fascia: a thin layer of connective tissue that surrounds each structural component of a body like a protective coating

intracellular: refers to the space between cells in a tissue structure

sclera: the white part of the eyeball that is visible when the eyelids are withdrawn

STRUCTURE AND FUNCTIONS

Cells, the structural and functional units of life, are organized into tissues, a group of different types of cells and their nonliving intracellular matrix, or glue, that performs a specialized function. The four groups of tissues are: epithelial (covering and lining tissue; also glands); connective (adipose, blood, bone, cartilage, ligament, and tendon); muscle (skeletal, cardiac, and smooth); and nervous (brain and spinal cord).

Connective tissue typically has cells widely scattered throughout a large amount of intracellular matrix (i.e., a substance in which the cells are embedded), unlike epithelial tissue, which typically has cells arranged in an orderly manner and has a limited amount of intracellular matrix.

Connective tissues are categorized as loose (areolar), dense, and specialized. Some connective tissues are difficult to classify, with the distinction between "loose" and "dense" not clearly defined. Dense connective tissue may also be called "fibrous connective tissue" because of the large quantity of collagen or elastin fibers.

Because tissues are defined as a collection of different cells, several types of cells may be found in various types of connective tissue: fibroblasts, which secrete collagen and other elements of the extracellular matrix, thereby creating and maintaining the matrix; adipocytes, which store excess caloric energy in the form of fat; and mast cells, macrophages, leukocytes, and plasma cells, which have immune functions and, therefore, an active role in inflammation. The matrix components are different in the various types of connective tissue. They may include fibers, amorphous ground substances (glycoproteins, proteins, and proteoglycans), and tissue fluid. Each type of connective tissue has a characteristic pattern of cells and a specific amount and type of matrix. For example, a bone matrix includes minerals, while blood has plasma for a matrix.

Loose connective tissue is the most common type of connective tissue; it holds organs in place and attaches epithelial tissue to underlying tissues. Loose connective tissue can be further categorized based on the type of fibers and how the fibers are arranged: collagenous fibers, which are composed of collagen and are arranged as coils; elastic fibers, which are composed of elastin and can stretch; and reticular fibers, which join connective tissue to other tissues. Loose connective tissue has a relatively large number of cells, a matrix, or both, and a relatively small amount of fibers. Loose connective tissue is found in the hypodermis and fascia (the connective tissue that loosely binds structures to one another).

Dense connective tissue is identified by the high density of fibers in the tissue and the low density of cells and matrix. The type of fiber that predominates determines the type of dense connective tis-

sue. Dense collagenous connective tissue, for example, contains abundant collagen fibers and is found in structures where tensile strength is needed, such as the sclera (white) of the eye, tendons, and ligaments. Dense elastic connective tissue contains abundant elastin fibers in structures where elasticity is needed (e.g., the aorta).

Specialized connective tissues include adipose tissue, cartilage, bone, and blood. Adipose tissue is a form of loose connective tissue that stores fat. It is found in the fatty layer around the abdomen, in bone marrow, and surrounding the kidneys. Cartilage is a form of fibrous connective tissue. It comprises closely packed collagenous fibers embedded in a gelatinous intracellular matrix called "chondrin." While the skeleton of human embryos is composed of cartilage, cartilage does not become bone but is replaced by bone. The replacement is not universal; cartilage provides flexible support for the ears (external pinnae), nose, and trachea. Bone is a type of mineralized connective tissue containing collagen and calcium phosphate. Cells found in bone include osteoblasts, which form new bone for growth, repair, or remodeling, and osteoclasts, which break down the bone for growth and remodeling. The living cells are found in spaces in the calcified matrix. These spaces are lacunae interconnected by small channels called "canaliculi" that eventually join up with blood vessels in the bone organ. Thus, living cells can obtain nutrients and expel wastes even in a solidified matrix.

Blood, too, is a type of specialized connective tissue. Blood may seem to be an unlikely connective tissue. Still, it fits the definition: different cells widely dispersed in an intracellular matrix, working together to perform a specific function. The matrix is liquid and contains enzymes, hormones, proteins, carbohydrates, and fats. Unlike other connective tissues, blood has no fibers. Blood does have several types of cells: red blood cells or erythrocytes, white blood cells or leukocytes (with subdivisions of monocytes, macrophages, eosinophils, lymphocytes, neutrophils, and basophils), and platelets or thrombocytes.

DISORDERS AND DISEASES

Like any other tissue, connective tissue is subject to disorders and diseases. Some disorders are inherited (passed from generation to generation through deoxyribonucleic acid (DNA) in chromosomes). In contrast, other disorders are related to environmental factors (such as deficiencies of specific nutrients).

Some inherited connective tissue disorders are Marfan syndrome and osteogenesis imperfecta.

Marfan syndrome is caused by mutations in the *FBN1* gene on chromosome 15, which encodes a protein called fibrillin 1, an elastin component. *FBN1* mutations are inherited as autosomal dominants, which means that even if there is one normal copy of the gene, a single mutated copy of the gene is sufficient to cause Marfan syndrome. In Marfan syndrome, fibrillin 1 is either less abundant or dysfunctional. Consequently, fewer functioning microfibrils in the extracellular matrix reduce tissue integrity and elasticity.

Poor connective tissue integrity means that the signaling molecule transforming growth factor-beta (TGF-β) is not effectively sequestered by it. Therefore, TGF-β signaling is excessive in the body leading to more growth. The most prominent physical features of Marfan syndrome involve the skeleton. The long bones grow markedly, and individuals with Marfan syndrome are tall with long arms and legs (marfanoid habitus).

Marfan syndrome individuals also have long, thin fingers and toes (arachnodactyly). The spine often has a sideways curve (scoliosis), the joints are hyperflexible, the palate is narrow and crowds the teeth, and the eyes have a downward slant to them and have an increased risk of retinal detachment and lens dislocation. Rib overgrowth causes the rib

dedicated to controlling involuntary functions such as breathing, maintaining blood pressure and heart rate, and responding to hot and cold. The middle portion of the brain coordinates movement. The middle brain also coordinates information from the upper portions of the brain and generates emotions. The uppermost and outermost portions of the brain (the cerebrum) process the information from the senses and generate responses, such as telling the body to move. The cerebrum also performs such intellectual functions as reasoning.

The cardiovascular system is composed of the heart and blood vessels. Its job is to pump blood containing oxygen and foodstuffs (sugars, proteins, and fat) to every body part. Blood comprises red and white blood cells suspended in plasma, a pale yellow fluid flowing through the cardiovascular system. Red blood cells are the carriers of oxygen, the body's main energy source. White blood cells help fight disease and are delivered to parts of the body that are hurt or diseased. The plasma contains platelets that help the blood to clot when necessary. Blood also transports wastes the body produces from tissues to organs that can dispose of them. For example, carbon dioxide is produced by the tissues when oxygen is used for energy. Blood carries carbon dioxide back to the lungs to be removed from the body in exhaled air.

Blood is pumped by the heart in a circuit in the cardiovascular system (also called the circulatory system). The heart has four chambers, two atria, and two ventricles. Blood enters the heart through the left atrium, a small pocket of muscles that help pump blood into the left ventricle. The ventricle is a larger chamber with a thick wall of muscle that can pump very hard; it pushes blood into the arteries. The left ventricle pumps blood into the body's main artery, the aorta. The aorta often branches into smaller arteries, which branch into capillaries. Every part of the body has millions of tiny capillaries just big enough for a blood cell to pass through them; blood cells must fold to get through some capillaries. In capillaries, oxygen and foodstuffs leave the blood, and then carbon dioxide and other waste products enter the blood to be taken away. Blood flows from the capillaries into small veins, which join to make larger and larger veins. The largest veins, the venae cavae, empty into the heart in the right atrium. The blood is pumped from the right atrium to the right ventricle. The right ventricle pumps blood through the lung and back into the left atrium to start its journey again.

The lungs are the major organ of the respiratory system. The function of the respiratory system is to bring fresh air into the lungs, get it very close to the blood, and expel used air. Air enters the respiratory system through the nose and mouth, which connect to the main windpipe, the trachea. The trachea branches into smaller airways called bronchi. Bronchi, in turn, branch into smaller airways, bronchioles. The ends of bronchioles form many rounded sacs (alveoli) that resemble a bunch of grapes. These air sacs have very thin walls shared with the walls of the lung's capillaries. This close arrangement of air and blood provides a minimum distance for oxygen to travel into the blood and for carbon dioxide to leave the blood.

Air is moved into the lungs when the muscles of respiration contract and expand the lungs. The diaphragm is a large muscle sheet separating the chest from the abdomen. When the diaphragm contracts, it pulls the lungs down. At the same time, muscles on the chest wall contract, pulling the lungs up and out. This expansion of the lungs causes air to be sucked into and fill the air sacs. During exhalation, the respiratory muscles relax, the lung collapses somewhat, and air rushes out, carrying carbon dioxide with it.

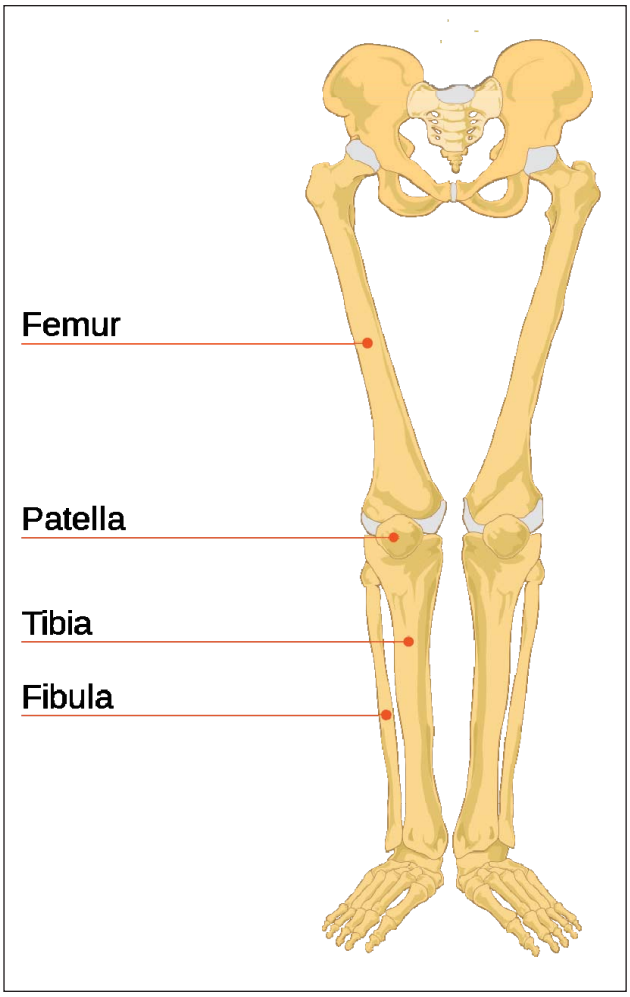
Blood, specifically red blood cells, is specialized to carry large amounts of oxygen and carbon dioxide. Red blood cells contain hemoglobin, a special substance that attaches to these gases. When the

knee: the complex articulated joint between the thigh and the lower leg
lateral: on the outer side; toward the little toe, when in reference to the leg
leg: the lower extremity, excluding the foot; the lower leg runs from the knee to the ankle
medial: on the side toward the midline of the body; toward the big toe when in reference to the leg
proximal: closer to the base or attached end
tarsus: the ankle
thigh: the upper segment of the leg, from the hip joint to the knee
tibia: the larger of the two bones in the lower leg on the medial side

STRUCTURE AND FUNCTIONS

The lower extremities consist of the thighs, lower legs, and feet. Each extremity attaches to the pelvis (innominate bone) at the hip joint. The lower extremity is made mostly of bones and muscles. Still, it also contains blood vessels, lymphatics, nerves, skin, toenails, and other structures. Important directional terms for the lower extremity include proximal (closer to the base or attached end), distal (further from the base or attached end), medial (on the same side as the tibia and big toe), and lateral (on the same side as the fibula and little toe). The lower extremity is clothed in the skin (or integument). Along the foot, the lower surface is called "plantar"; the upper surface is called "dorsal." the sole or plantar surface of the foot is unusual, along with the palm, in being completely hairless; it also contains the thickest outer skin layer (the stratum corneum) of any part of the body. Each toe has a hardened toenail on its dorsal surface.

The pelvic girdle that supports the lower extremity develops as three separate bones: the ilium, ischium, and pubis. All three help form the acetabulum, a socket the femur fits into. Below the acetabulum, the ischium and pubis surround a large opening called the "obturator foramen." The right and left pubis meet to form a pubic symphysis. The lower extremity bones include the femur, tibia, fibula, tarsals, metatarsals, and phalanges. The femur (thigh bone) is the largest bone in the body. Its rounded upper end, or head, fits into the acetabulum and is attached by a short neck. A rough-surfaced greater trochanter lies just beyond this neck and serves for the attachment of many muscles. The lesser trochanter, also for muscle attachments, lies below the neck. The knee joint is covered and protected by the kneecap, or patella, the largest sesamoid bone formed within tendons at stress points. The lower leg, from the knee to the



Bones of the leg. Image via Wikimedia Commons. [Public domain.]

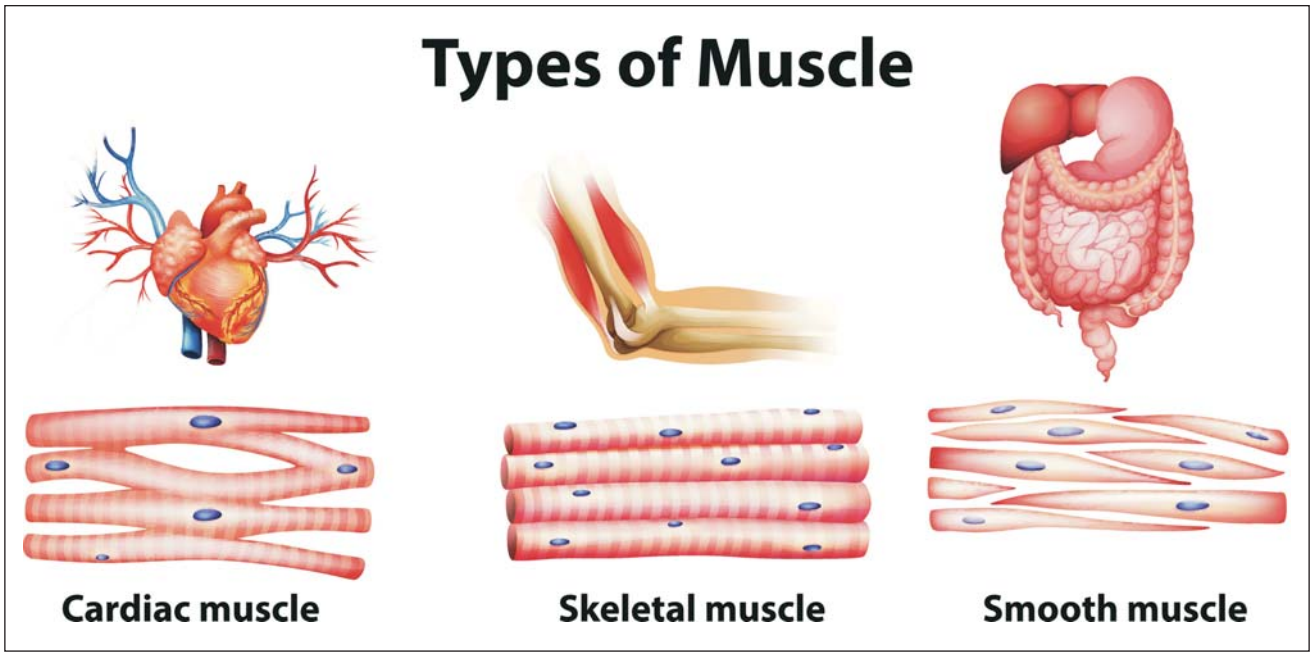


Image via iStock/blueringmedia. [Used under license.]

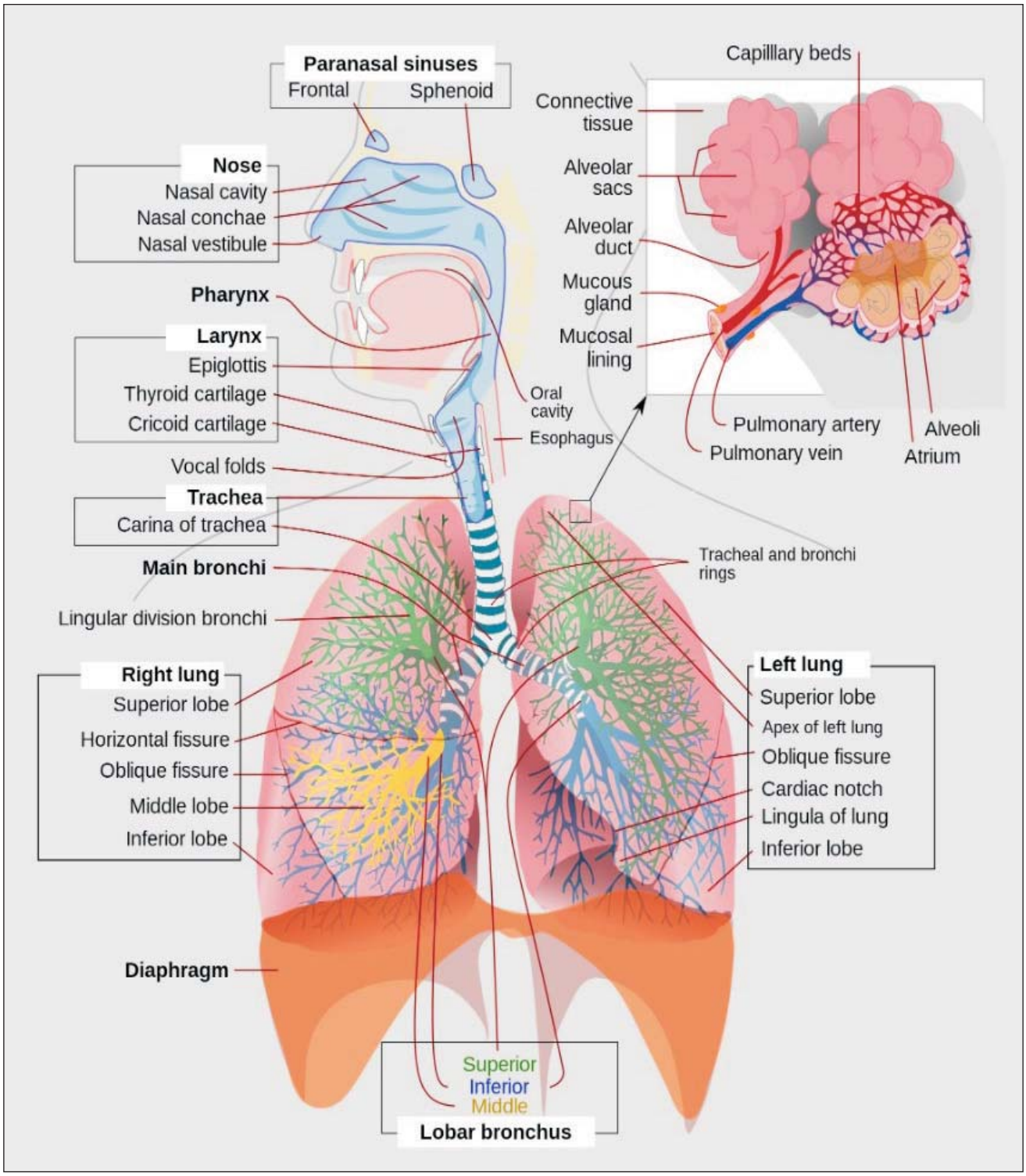
that they are short and spindle-shaped. They also differ from skeletal muscle cells in that they are not striated. Furthermore, smooth muscle cells usually are not surrounded by tough connective tissue to form a muscle; instead, they are arranged in layers.

Cardiac muscle is found only in the heart. Like smooth muscle, cardiac muscle cannot contract through conscious effort. Like skeletal muscle, however, cardiac muscle is striated. Cardiac muscle contraction causes the heart to beat. Each heartbeat results from cardiac muscle contraction, which pumps blood throughout the body.

Although many differences exist among skeletal, smooth, and cardiac muscles, all have one thing in common—their ability to contract. However, the contraction mechanism utilized by skeletal muscle differs from that of smooth muscle and cardiac muscle.

For skeletal muscles to contract, they must first be electrically stimulated. This electrical stimulation is brought about by nerves closely associated with the muscle fibers. Each muscle fiber has a branch of a nerve, an axon terminal, close to it. This axon terminal does not touch the muscle fiber but is separated from it by a tiny space known as the "synaptic cleft" (or gap). An electrical impulse from the nerve causes the release of a chemical called a "neurotransmitter" into the synaptic cleft. The specific type of neurotransmitter for skeletal muscle is known as acetylcholine. Acetylcholine passes through the synaptic cleft to the muscle fiber membrane, binding to a particular site on a membrane protein known as a "nicotinic receptor." When the neurotransmitter binds to the receptor, it causes an electrical impulse, or depolarization, to travel down the muscle fiber. Depolarization brings calcium into the muscle cell, which induces muscle fiber contraction. When most or all of the muscle fibers contract, the result is the contraction of the entire muscle.

The muscle fibers and muscle will remain contracted if the neurotransmitter is bound to the receptor on the muscle fiber membrane. The nicotinic receptor must release its bound acetylcholine for the muscle fiber to relax. The enzyme cholinesterase de-



Respiratory System. Image via Wikimedia Commons. [Public domain.]

Overall, OT can effectively address balance problems, improve safety and independence in daily activities, and enhance the overall quality of life. It is important to consult a healthcare provider to determine the most appropriate treatment plan for an individual's needs and goals.

—Albert C. Jensen

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BLINDNESS

Specialties and related fields: Geriatrics and gerontology; Ophthalmology

Definition: the absence of vision, or its extreme impairment to the extent that activity is limited; about 95 percent of all blindness is caused by eye diseases, the rest by injuries

KEY TERMS

glaucoma: excessive pressure inside the eye that can damage the optic nerve

laser: an intense light beam used in eye surgery

macular degeneration: a deterioration of vision in the most sensitive, central region of the retina

retina: a paper-thin membrane lining the inside surface of the eyeball, where light is transformed into nerve impulses

trachoma: a contagious eye infection primarily found in the developing world

CAUSES AND SYMPTOMS

The major cause of blindness among older adults in the Western world is glaucoma. The aqueous fluid produced inside the eye fails to drain properly and causes pressure to build up. In extreme cases, the eyeball becomes hard. Without prompt treatment, the outer layer of the optic nerve starts to deteriorate. The patient can still see straight ahead but not off to the side. When the cone of forward vision has narrowed to less than 20 degrees (called tunnel vision), the patient is considered legally blind.

Cataracts are another common defect of vision among older adults. The lens of the eye develops dark spots that interfere with light transmission. An infection or a tumor does not cause cataracts but is a normal part of aging, like gray hair. There is no known treatment to retard or reverse the growth of cataracts, though they may be surgically removed.

Macular degeneration and diabetes mellitus can cause blindness due to hemorrhages from tiny blood vessels in the retina. The macula is a small region in the middle of the retina where receptor cells are tightly packed to obtain sharp vision for reading or close work. With aging, blood circulation in the

INFORMATION ON BLINDNESS

Causes: Eye injury, disease (especially glaucoma), the aging process

Symptoms: Tunnel vision, black spots, pain, eventual loss of sight

Duration: Temporary to chronic

Treatments: Laser therapy, medication, surgery

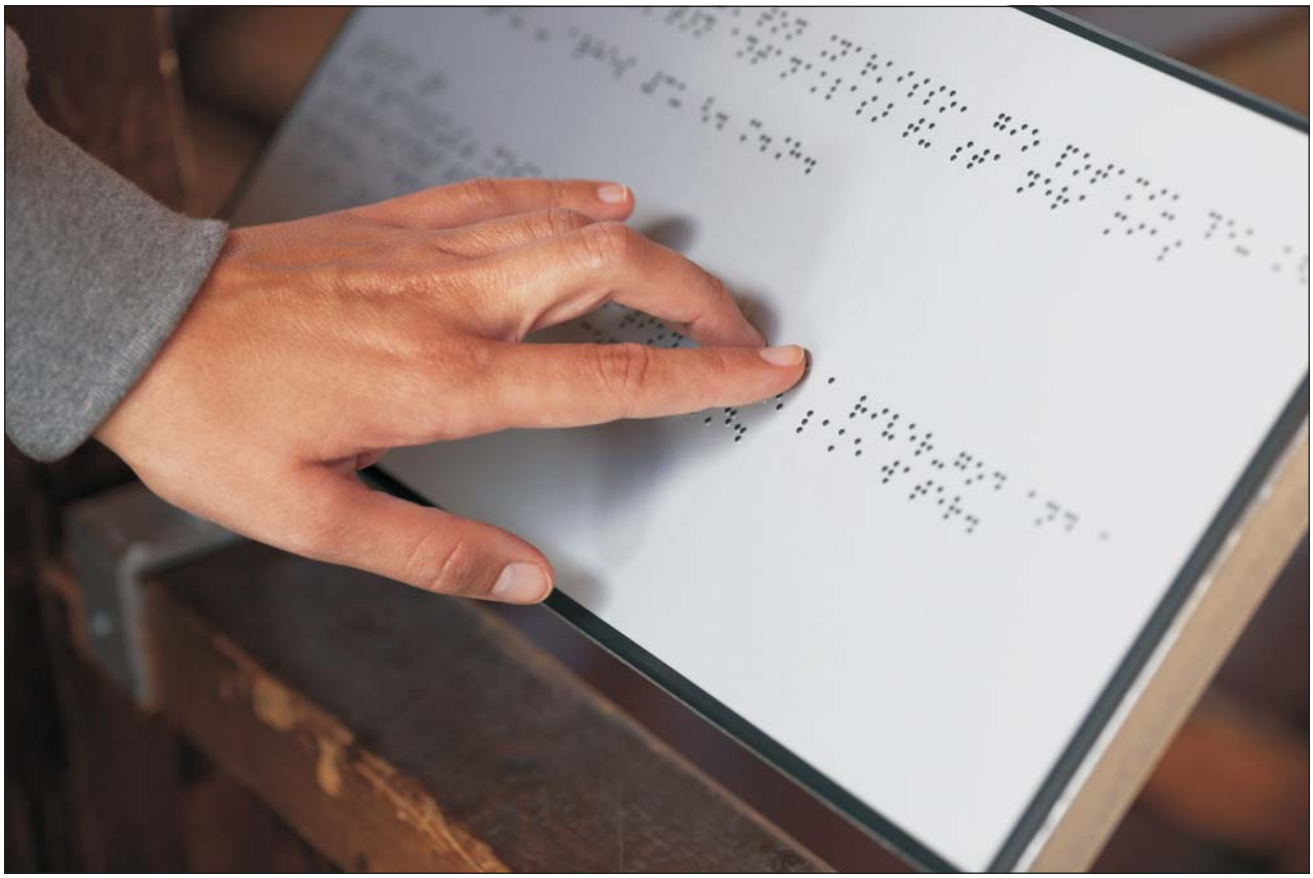
macula gradually deteriorates until the patient develops a black spot in the center of the field of view. Advanced diabetes also causes blood vessel damage in the eye. In serious cases, fluid can leak behind the retina, causing it to become detached. The resulting visual effect resembles a dark curtain that blacks out part of the scene.

Globally, trachoma is the leading infectious cause of blindness. This potentially blinding eye disease is a chronic keratoconjunctivitis (an inflammatory process that involves both the conjunctiva and the superficial cornea) caused by recurrent infection with a small, gram-negative obligate intracellular bacterium called *Chlamydia trachomatis*. Humans are the only host for this bacterium. Unfortunately, trachoma afflicts millions of people in poor parts of the world. If untreated, it scars the eye's cornea, clouding it and causing blindness.

Trachoma is transmitted between individuals via the spread of ocular and nasal secretions on fingers and contaminated objects. *Chlamydia trachomatis* can live on extraocular surfaces for several hours. Eye-seeking flies like *Musca sorbens* can pass this microorganism from one person's eye to another's.

Many kinds of injuries may cause blindness. Car accidents, sports injuries, chemical explosions, battle wounds, and small particles that enter the eye can all result in serious vision loss.

The infectious eye disease called trachoma has been known for over two thousand years. Trachoma is effectively treated with a single dose (20 mg/kg, orally) of azithromycin. This antibiotic is safe for



An example of the Braile system of reading, first invented in 1829 and still widley used. Photo via iStock/Ekaterina79. [Used under license.]

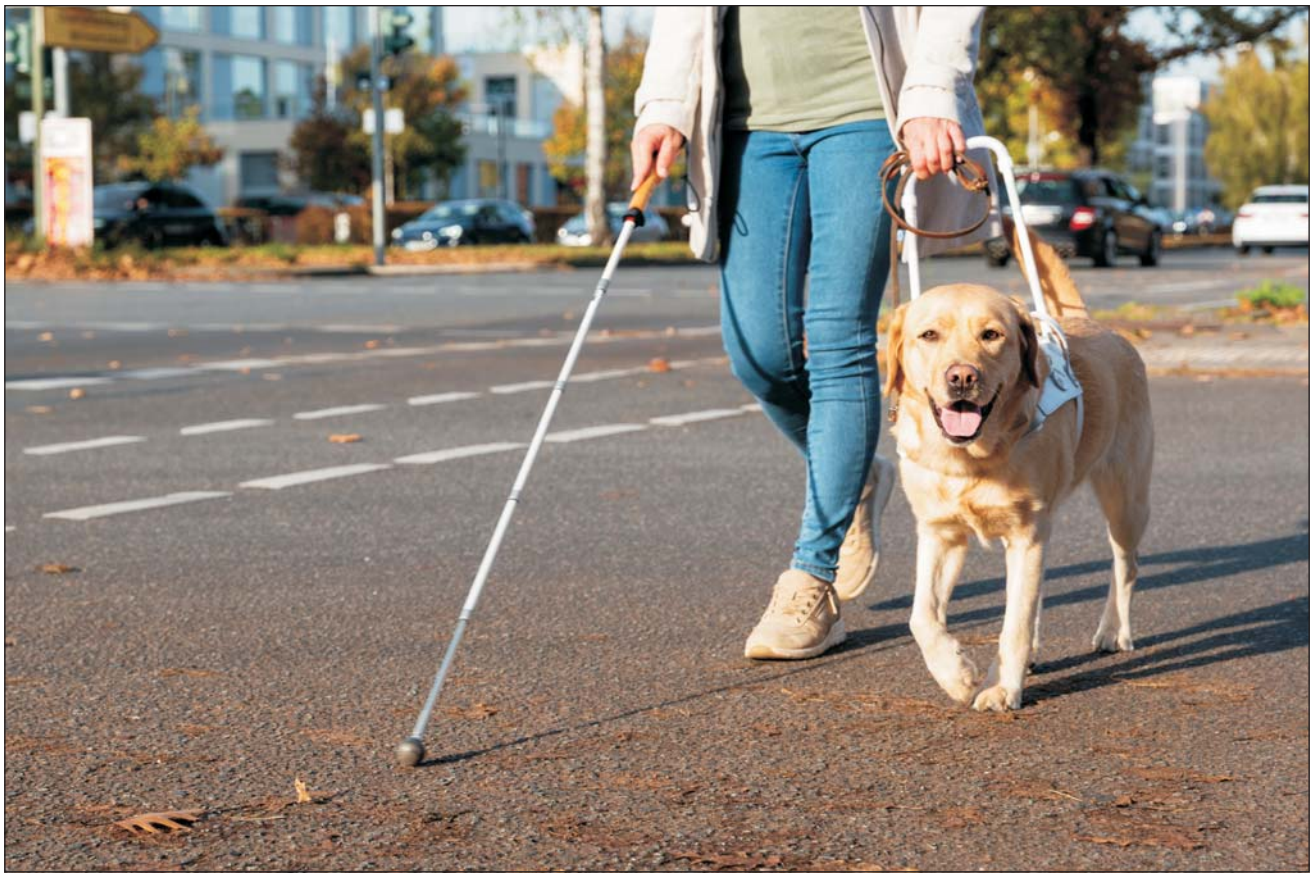


Photo via iStock/fotografixx. [Used under license.]

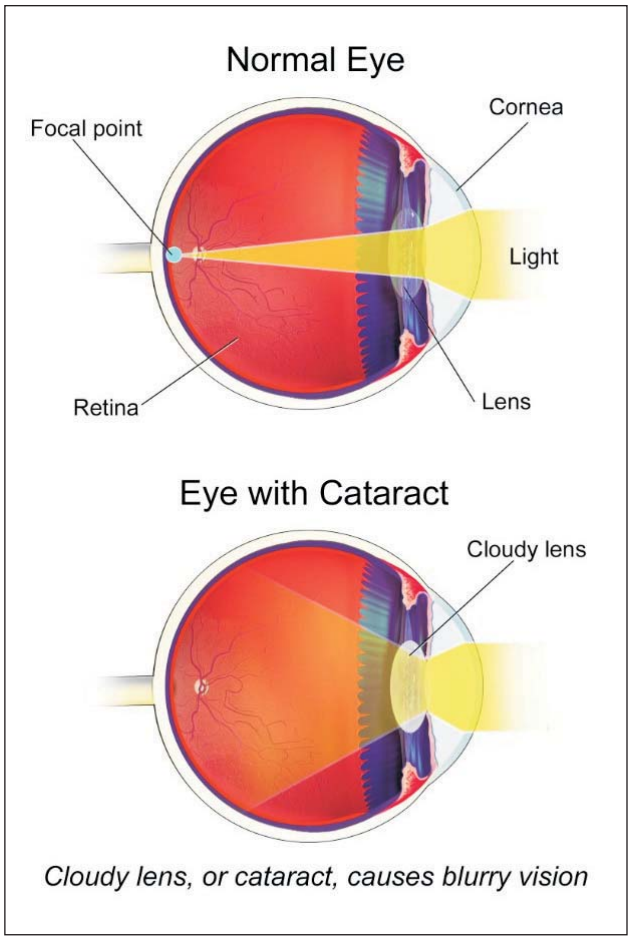
children and pregnant women. Topical tetracycline (1 percent eye ointment twice daily for six weeks) is a viable alternative treatment. Unfortunately, reinfection is common in rural villages where most people have the disease, and sanitation is poor. The World Health Organization has initiated a public health program to teach parents the importance of cleanliness and frequent eye washing with sterilized water for their children.

TREATMENT AND THERAPY

An indispensable tool in the treatment of serious eye problems is the laser. Its intense light focused into a tiny spot, the laser's heat can burn away a ruptured blood vessel or weld a detached retina back into place.

Medications to reduce fluid pressure in the eye (prostaglandin analogs, beta-blockers, carbonic anhydrase inhibitors, alpha receptor agonists, muscarinic receptor agonists and rho kinase inhibitors) may be effective for glaucoma patients, but they must continually take these medicines to prevent increases in intraocular pressure. However, laser treatments can burn a small hole through the iris to improve fluid drainage. The laser can be used only to prevent blindness, however, and not to restore sight.

Cataracts formerly were a major cause of blindness among older people. Once the eye lens becomes cloudy, nothing can be done to clear it. Cataract surgery has become common to remove the defective lens and insert a permanent plastic re-



A medical illustration depicting cataracts. Image by Bruce Blaus, via Wikimedia Commons.

placement. In the United States, more than a million cataract surgeries are performed annually, with a success rate greater than 95 percent.

PERSPECTIVE AND PROSPECTS

Various techniques have been developed to help sightless people to live a self-reliant lifestyle. Using a white cane or walking with a trained dog allows a blind person to get around. Biomedical engineers have designed a miniature sonar device built into a pair of glasses that uses reflected sound waves to warn the wearer about obstacles.

The Braille system of reading, using patterns of raised dots for the alphabet, was invented in 1829 and is still widely used. For blind students, voice recordings of textbooks, magazines, and even whole encyclopedias are available on tape. A recent development is an optical scanner connected to a computer with a voice simulator to read printed material aloud.

The National Federation of the Blind was founded in 1940. Its goals are to assist blind people to participate fully in society and to overcome the still-prevalent stereotype that people who are blind are helpless. Blind men and women work as engineers, teachers, musical performers, ministers, insurance agents, computer programmers, and school counselors. As society becomes more sensitive to all forms of disability, opportunities for blind people continue to expand.

SIGNIFICANCE

Occupational therapy (OT) is an integral part of the overall medical care of the visually impaired. Occupational therapists (OTs) help individuals with vision loss develop the skills and strategies necessary to engage in daily activities, promote independence, and enhance their overall quality of life.

First, OTs train the visually impaired to independently carry out the activities of daily living (ADLs): OTs help individuals develop and maintain independence in activities such as grooming, dressing, bathing, and eating. They may provide training on adaptive techniques, assistive devices, and environmental modifications to optimize participation in these tasks.

Second, OTs help the visually impaired with orientation and mobility: They train blind individuals to develop skills related to orientation and mobility, including safely navigating their surroundings, using mobility aids (such as canes or guide dogs), and understanding environmental cues. They may also provide training in orientation strategies, spatial awareness, sensory compensation, and public transportation skills.

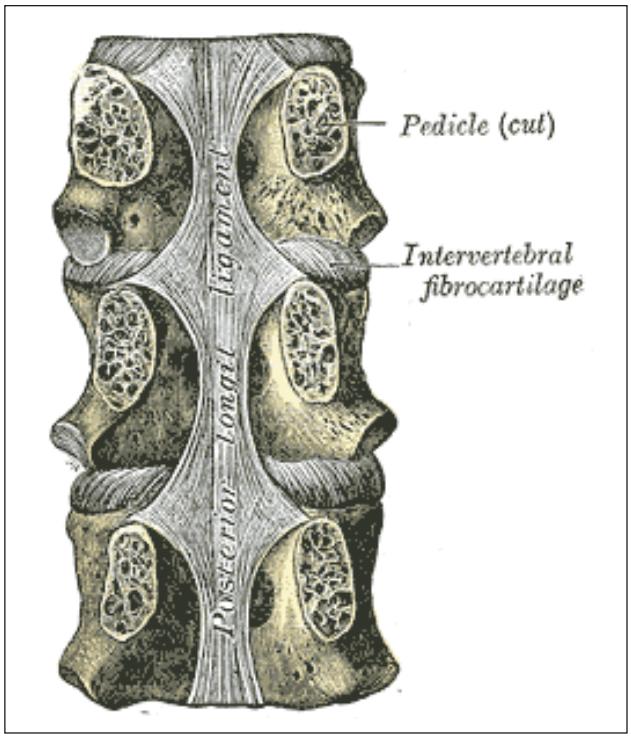


Figure 2. The posterior longitudinal ligament in the thoracic region. Image via Wikimedia Commons. [Public domain.]

The damaged disc affects the nerve root corresponding to the inferior level of the herniated disc since the spinal nerves in the lumbar region exit the enter vertebral foramen superior to the level of the herniated disc. For example, a herniated disc at the L4-L5 level does not pinch spinal nerve L4 because it exits the intervertebral foramen above the intervertebral disc between L4 and L5. However, it will impinge on the L5 nerve root because it will cross this disc while exiting the intervertebral foramen between L5 and S1 (Figure 3).

Nerve impingement causes clinical symptoms such as lower back pain, paresthesia, and weakness in the areas innervated by the impinged nerve. Nerve impingement can also cause referred pain down the back of the leg.

If a herniated lumbar disc compresses any portion of the sciatic nerve (L4-S3), the patient will display "sciatica." Sciatica causes lower back pain and pain radiating to the hips, back of the thigh, and lower legs. Patients also show weakness in hip extension, knee flexion, and ankle plantarflexion, and an absent ankle tendon reflex. Sciatica most commonly results from herniations at the level of L5 or S1. The "straight leg test" readily elicits sciatica symptoms. When the individual lies on their back, the healthcare worker lifts the leg straight to flex the thigh and stretch the sciatic nerve. Sciatica is present if pain occurs when the leg is flexed at less than 60 degrees. Note, however, that the results of this test can vary between patients.

Intervertebral disc herniation can also occur in the cervical region of the spinal column almost as often as in the lumbar region. Chronic or forced hyperflexion of the cervical region causes cervical disc herniation. Head-on collisions in soccer or football or automobile accidents can cause cervical disc herniations.

In the cervical region, spinal nerves exit the intervertebral foramen and cross the intervertebral

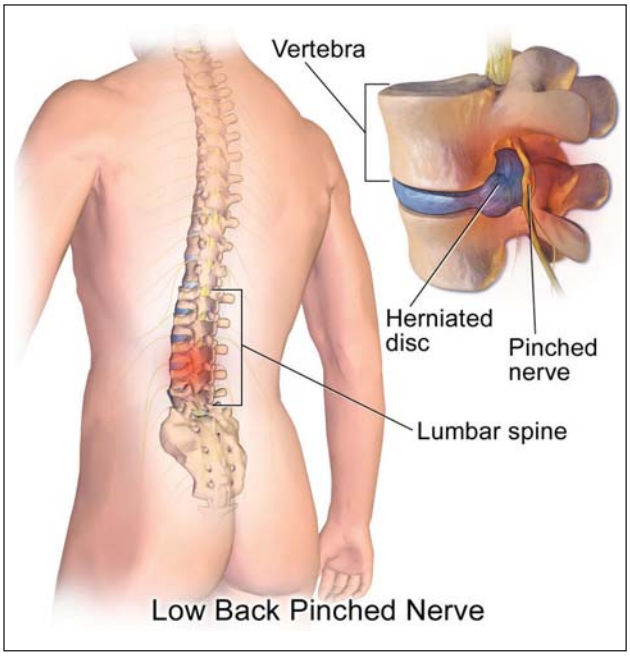


Figure 3. Herniated lumbar disc. Image by Bruce Blaus, via Wikimedia Commons.

Technology

Assistive Devices and Technologies

Specialties and related fields: Occupational therapy
Definition: any device or system that allows an individual to perform a task that they would otherwise be unable to do or increases the ease and safety with which the task can be performed

KEY TERMS

adaptive equipment: any piece of equipment adapted to make life easier

aging in place supports: the ability to live in one's own home and community safely, independently, and comfortably, regardless of age, income, or ability level

home modifications: a range of changes, alterations, and repairs that make a home more livable for individuals with different physical abilities

occupational therapist: a healthcare professional specializing in occupational science and therapy who uses a scientific basis to promote a patient's ability to fulfill their daily routines and roles

occupational therapy assessments: an examination of a patient's functional capabilities and needs; assessments include tests of fine motor skills, gross motor skills, visual perception skills, sensory integration, executive functioning, and self-care skills

rehabilitative devices: tools, equipment, or products that can help people with disabilities successfully complete activities at school, home, work, and in the community

smart home technology: or domotics, involves automation for a home that monitors and controls home attributes such as lighting, climate, entertainment systems, and appliances, and may also include home security appurtenances such as access control and alarm systems

INTRODUCTION

Assistive technologies are a central feature of occupational therapy. They help patients with short-term or long-term disabilities overcome functional barriers and live well and independently.

Assistive equipment and technologies include devices, tools, or equipment designed to assist individuals in performing tasks, improving their independence, and enhancing their quality of life. These devices can be used in various settings, including homes, workplaces, and educational institutions. They help people live in the comfort of their homes, include students in educational programs, and make life easier and safer for those with disabilities.

People living with disabilities have trouble performing daily living activities. Moving around their domicile is painful for those with rheumatoid arthritis or impossible for amputees. Communication is uncomfortably difficult for stroke patients. Self-feeding, dressing, bathing, and grooming present substantial challenges for people with damaged hands or nervous systems. Assistive technologies help the disabled move around their home environment, communicate with others, and access information. These technologies also have broader societal bene-

fits, including reducing healthcare costs, increasing productivity, promoting inclusivity, and reducing the stigmas associated with disabilities.

Globally, over 1 billion people need one or more assistive devices, and 2 billion will need at least one assistive product by 2030.

TYPES OF ASSISTIVE TECHNOLOGY

Some assistive equipment is "low-tech" and does not require electricity or advanced technologies. These low-tech assistive devices are made with commonly available materials or easily found at pharmacies or healthcare facilities. Such items might include canes, reachers, bump dots, weighted pens, and faucet extenders.

Canes are low-tech motility aids that stabilize people with poor balance or low-extremity strength. Reachers are long rods with mechanical jaws at their ends that people use to acquire out-of-reach objects. However, not only disabled people use reachers since others use them on long car trips to grab things in the back seat without unfastening their seat belts.

Bump dots are tactile markers on items to alert those with diminished vision where certain buttons are or that something is nearby. For example, a large, flat bump dot on a microwave tells the patient where the "stop" button is, but a smaller, round bump dot marks the "start" button. Marking furniture with large bump dots might alert someone's feet to the couch or dining room table.

Weighted pens help patients with tremors or Parkinson's disease write without pushing down. Adapted weighted writing pens improve handwriting legibility by reducing tremors and fatigue and increasing muscle strength.

Facet extenders help those who cannot reach across the sink access flowing water. These devices work well for children or adults with a disability.

Low-tech assistive devices are inexpensive, easy to operate, and beneficial to those who require minimal assistance. These items also do not require any modifications or customizations for patients to use them successfully.

High-tech assistive technologies include computer software, specialized communication devices, advanced prosthetics, and robotics. These assistive devices often contain computer-based systems customized to each patient's needs.

Various assistive technologies address specific patient needs. To that end, assistive devices and tech-

Image via iStock/Golden Sikorka. [Used under license.]

Glossary

abdomen: the rib-free part of the trunk, below the diaphragm

abdominal binders: a compression belt that facilitates recovery after abdominal surgeries

absence seizure: a mild type of epileptic seizure characterized by a very short lapse of consciousness, usually without convulsions; the person with epilepsy does not fall down

accreditation: the process of review and certification for athletic training programs

acetabulum: the portion of the pelvic bone joining the femoral head to create the hip joint

acetylcholine: a chemical released by motor neuron terminals; it causes muscle contraction

acetylcholinesterase: an enzyme that degrades acetylcholine

Achievement Goal Theory: a theory of motivation that considers the individual's concept of ability as well as personal and situational factors that influences the meaning that is attached to successful or unsuccessful experiences

Achilles tendon: the tendon connecting calf muscles to the heel

acromion: the outward end of the spine of the scapula or shoulder blade

action: the type of movement made by a muscle contraction

action potential: an electrochemical event that nerve cells use to send signals along their cellular extensions in the nervous system

acute: refers to the sudden onset of a disease process

acute pain: sudden, extreme pain that is short-term; serves as a warning of damage or disease

adaptation: change or adjustment made to create a balance between existing thought structures and the environment

adaptive equipment: any piece of equipment adapted to make life easier

adaptive task practice: a training method in which a motor or behavioral objective is approached in small steps by successive approximations or by making the task more difficult per the patient's motoric capabilities

addiction: defining pervasive and intense urge to engage in maladaptive behaviors providing immediate sensory rewards, despite their harmful consequences

additive manufacturing (AM): a process of creating physical objects by adding materials layer by layer based on a digital design

adenosine triphosphate (ATP): a high-energy compound found in the cell that provides energy for all bodily functions

adipocyte: a cell whose specific function is to store fats and associated nutrients, hormones, etc.

adjuvant therapy: the use of multiple treatments for cancer, such as chemotherapy or radiation, or both, following surgery to prevent metastasis

adolescent scoliosis: abnormal curvature of the spine that is diagnosed in the early stages of puberty

adverse effects: an undesired effect of a drug or other type of treatment

aerobic exercise: physical activity that is vigorous, continuous, and rhythmical

aerobic: metabolism involving the breakdown of energy substrates using oxygen