Muscular System: 
Facts, Functions & Diseases

While most people associate muscles with strength, they do more than assist in lifting heavy objects. The 650 muscles in the body not only support movement — controlling walking, talking, sitting, standing, eating and other daily functions that people consciously perform — but also help to maintain posture and circulate blood and other substances throughout the body, among other functions.

Muscles are often associated with activities of the legs, arms and other appendages, but muscles also produce more subtle movements, such as facial expressions, eye movements and respiration, according to the National Institutes of Health (NIH).

Three Types of Muscles

The muscular system can be broken down into three types of muscles: skeletal, smooth and cardiac, according to the NIH.

Skeletal muscles are the only voluntary muscle tissue in the human body and control every action that a person consciously performs. Most skeletal muscles are attached to two bones across a joint, so the muscle serves to move parts of those bones closer to each other, according to The Merck Manual.

Visceral, or smooth, muscle is found inside organs such as the stomach and intestines, as well as in blood vessels. It is called a smooth muscle because, unlike skeletal muscle, it does not have the banded appearance of skeletal or cardiac muscle. The weakest of all muscle tissues, visceral muscles contract to move substances through the organ, according to The Merck Manual. Because visceral muscle is controlled by the unconscious part of the brain, it is known as involuntary muscle, as it cannot be controlled by the conscious mind.

Found only in the heart, cardiac muscle is an involuntary muscle responsible for pumping blood throughout the body, according to The Merck Manual. The heart's natural pacemaker is made of cardiac muscle that signals other cardiac muscles to contract. Like visceral muscles, cardiac muscle tissue is controlled involuntarily. While hormones and signals from the brain adjust the rate of contraction, cardiac muscle stimulates itself to contract.
Muscle Shapes

Muscles are further classified by their shape, size and direction, according to the NIH. The deltoids, or shoulder muscles, have a triangular shape. The serratus muscle, which originates on the surface of the second to ninth ribs at the side of the chest, and runs along the entire anterior length of the scapula (shoulder blades), has a distinctive sawlike shape. The rhomboid major, which attaches the scapula to the spinal column, is a diamond shape.

Size can be used to differentiate similar muscles in the same region. The gluteal region (the buttocks) contains three muscles differentiated by size: the gluteus maximus (large), gluteus medius (medium) and gluteus minimus (smallest), the NIH noted.

The direction in which the muscle fibers run can be used to identify a muscle. In the abdominal region, there are several sets of wide, flat muscles, according to the NIH. The muscles whose fibers run straight up and down are the rectus abdominis, the ones running transversely (left to right) are the transverse abdominis and the ones running at an angle are the obliques. As any exercise enthusiast knows, obliques are among the hardest muscles to develop to achieve "six-pack" abs.

Muscles also can be identified by their function. The flexor group of the forearm flexes the wrist and the fingers. The supinator is a muscle that allows you to roll your wrist over to face palm up. Adductor muscles in the legs adduct, or pull together, the limbs, according to the NIH.

Diseases of the Muscular System

There is no single type of doctor that treats muscular diseases and disorders. Rheumatologists, orthopedists and neurologists may all treat conditions that affect the muscles, according to the American Medical Association. There are a number of common neuromuscular disorders, according to Dr. Robert Schabbing, chief of neurology at Kaiser Permanente in Denver.

Common primary muscle disorders include inflammatory myopathies, including polymyositis, which is characterized by inflammation and progressive weakening of the skeletal muscles; dermatomyositis, which is polymyositis accompanied by a skin rash; and inclusion body myositis, which is characterized by progressive muscle weakness and wasting. Other common disorders are muscular dystrophies and metabolic muscle disorders, he said. Muscular dystrophy affects muscle fibers. Metabolic muscle
disorders interfere with chemical reactions involved in drawing energy from food. Neuromuscular junction disorders impair the transmission of nerve signals to muscles, Schabbing noted.

The most common neuromuscular junction disorder is myasthenia gravis, which is characterized by varying degrees of weakness of the skeletal muscles, Schabbing said. "There are many types of peripheral neuropathies that can be secondary to other medical conditions, such as diabetes, or due to a variety of other causes, including toxins, inflammation and hereditary causes," he said.

Motor neuron disorders affect the nerve cells that supply muscles, Schabbing said. The most recognizable motor neuron disease is amyotrophic lateral sclerosis, or ALS, commonly known as Lou Gehrig’s disease.

**Symptoms, Diagnosis and Treatment**

The most common symptom or sign of a muscle disorder is weakness, although muscle disorders can cause a number of symptoms, according to Schabbing. In addition to weakness, symptoms include abnormal fatigue with activity, as well as muscle spasms, cramping or twitching. Neuromuscular disorders affecting the eyes or mouth can cause drooping eyelids or double vision, slurred speech, difficulty swallowing or, sometimes, difficulty breathing.

Electromyography — commonly referred to as an EMG — is often used to diagnose muscular disorders. An EMG helps characterize causes of nerve and muscle disorders by stimulating nerves and recording responses, Schabbing noted. Rarely, nerve or muscle biopsies are needed.

Steroids and other medications can help to reduce spasms and cramping. Milder forms of chemotherapy can help treat many muscular disorders, according to Dr. Ricardo Roda, an assistant professor of neurology, neuroscience and physiology at NYU Langone Medical Center.
Muscular System

The muscular system can be broken down into three types of muscles: skeletal, smooth and cardiac. The muscles in the body support movement, help maintain posture, and circulate blood and other substances throughout the body.

Classification
The 650 muscles are given Latin names according to location, relative size, shape, action, origin/insertion and/or number of origins.

Muscles of the Eye
In an hour of reading a book, the eyes make nearly 10,000 coordinated movements.

Heart
The heart is the hardest-working muscle. It pumps out 7 ounces (57 grams) of blood with every heartbeat. Daily, the heart pumps at least 2,500 gallons (9,464 liters) of blood. The heart has the ability to beat more than 3 billion times in a person's life.

Skeletal Muscle
Skeletal muscle fibers can be divided into two types based on how they produce and use energy:
- Slow Twitch
  The slow-twitch muscles are efficient at using oxygen and can function over a long time before they fatigue.
- Fast Twitch
  Fast-twitch muscles are much better at generating short bursts of strength or speed than slow-twitch muscles.

The Three Types of Muscles
- **Skeletal muscles** control every action that a person consciously performs.
- **Visceral or smooth muscle** is found inside of organs and is controlled by the unconscious part of the brain.
- **Cardiac muscle** is found only in the heart and is responsible for pumping blood throughout the body.

Sources: About.com, Library of Congress
Your Muscles

Did you know you have more than 600 muscles in your body? They do everything from pumping blood throughout your body to helping you lift your heavy backpack. You control some of your muscles, while others — like your heart — do their jobs without you thinking about them at all.

Muscles are all made of the same material, a type of elastic tissue (sort of like the material in a rubber band). Thousands, or even tens of thousands, of small fibers make up each muscle.

You have three different types of muscles in your body: smooth muscle, cardiac (say: KAR-dee-ak) muscle, and skeletal (say: SKEL-uh-tul) muscle.

Smooth Muscles

Smooth muscles — sometimes also called involuntary muscles — are usually in sheets, or layers, with one layer of muscle behind the other. You can't control this type of muscle. Your brain and body tell these muscles what to do without you even thinking about it. You can't use your smooth muscles to make a muscle in your arm or jump into the air.

But smooth muscles are at work all over your body. In your stomach and digestive system, they contract (tighten up) and relax to allow food to make its journey through the body. Your smooth muscles come in handy if you're sick and you need to throw up. The muscles push the food back out of the stomach so it comes up through the esophagus (say: ih-SAH-fuh-gus) and out of the mouth.

Smooth muscles are also found in your bladder. When they're relaxed, they allow you to hold in urine (pee) until you can get to the bathroom. Then they contract so that you can push the urine out. These muscles are also in a woman's uterus, which is where a baby develops. There they help to push the baby out of the mother's body when it's time to be born.

You'll find smooth muscles at work behind the scenes in your eyes, too. These muscles keep the eyes focused.

A Hearty Muscle

The muscle that makes up the heart is called cardiac muscle. It is also known as the myocardium (say: my-uh-KAR-dee-um). The thick muscles of the heart contract to pump blood out and then relax to let blood back in after it has circulated through the body.

Just like smooth muscle, cardiac muscle works all by itself with no help from you. A special group of cells within the heart are known as the pacemaker of the heart because it controls the heartbeat.
Skeletal Muscle

Now, let's talk about the kind of muscle you think of when we say "muscle" — the ones that show how strong you are and let you boot a soccer ball into the goal. These are your skeletal muscles — sometimes called striated (say: STRY-ay-tud) muscle because the light and dark parts of the muscle fibers make them look striped (striated is a fancy word meaning striped).

Skeletal muscles are voluntary muscles, which means you can control what they do. Your leg won't bend to kick the soccer ball unless you want it to. These muscles help to make up the musculoskeletal (say: mus-kyuh-low-SKEL-uh-tul) system — the combination of your muscles and your skeleton, or bones.

Together, the skeletal muscles work with your bones to give your body power and strength. In most cases, a skeletal muscle is attached to one end of a bone. It stretches all the way across a joint (the place where two bones meet) and then attaches again to another bone.

Skeletal muscles are held to the bones with the help of tendons (say: TEN-dunz). Tendons are cords made of tough tissue, and they work as special connector pieces between bone and muscle. The tendons are attached so well that when you contract one of your muscles, the tendon and bone move along with it.

Skeletal muscles come in many different sizes and shapes to allow them to do many types of jobs. Some of your biggest and most powerful muscles are in your back, near your spine. These muscles help keep you upright and standing tall.

They also give your body the power it needs to lift and push things. Muscles in your neck and the top part of your back aren't as large, but they are capable of some pretty amazing things: Try rotating your head around, back and forth, and up and down to feel the power of the muscles in your neck. These muscles also hold your head high.

Face Muscles

You may not think of it as a muscular body part, but your face has plenty of muscles. You can check them out next time you look in the mirror. Facial muscles don't all attach directly to bone like they do in the rest of the body. Instead, many of them attach under the skin. This allows you to contract your facial muscles just a tiny bit and make dozens of different kinds of faces. Even the smallest movement can turn a smile into a frown. You can raise your eyebrow to look surprised or wiggle your nose.

And while you're looking at your face, don't pass over your tongue — a muscle that's attached only at one end! Your tongue is actually made of a group of muscles that work together to allow you to talk and help you chew food. Stick out your tongue and wiggle it around to see those muscles at work.
Major Muscles

Because there are so many skeletal muscles in your body, we can't list them all here. But here are a few of the major ones:

- In each of your shoulders is a **deltoid** (say: DEL-toyd) **muscle**. Your deltoid muscles help you move your shoulders every which way — from swinging a softball bat to shrugging your shoulders when you're not sure of an answer.
- The **pectoralis** (say: pek-tuh-RAH-lus) **muscles** are found on each side of your upper chest. These are usually called **pectorals** (say: PEK-tuh-rulz), or pecs, for short. When many boys hit puberty, their pectoral muscles become larger. Many athletes and bodybuilders have large pecs, too.
- Below these pectorals, down under your ribcage, are your **rectus abdominus** (say: REK-tus ab-DAHM-uh-nus) **muscles**, or **abdominals** (say: ab-DAHM-uh-nulz). They're often called abs for short.
- When you make a muscle in your arm, you tense your **biceps** (say: BYE-seps) muscle. When you contract your biceps muscle, you can actually see it push up under your skin.
- Your **quadriceps** (say: KWAD-ruh-seps), or quads, are the muscles on the front of your thighs. Many people who run, bike, or play sports develop large, strong quads.
- And when it's time for you to take a seat? You'll be sitting on your **gluteus maximus** (say: GLOOT-ee-us MAK-suh-mus), the muscle that's under the skin and fat in your behind!
The Tongue: Facts, Function & Diseases

Though the tongue may seem like a simple organ, it has a wide range of purposes, such as licking, breathing, tasting, swallowing and articulating speech. Its many talents are due to the construction of the tongue.

Size

Typically a human tongue is around 3.3 inches (8.5 centimeters) for men and 3.1 inches (7.9 cm) for women, according to the University of Edinburgh. The world’s longest tongue is 3.97 inches (10.1 cm) long, from the tip to the middle of the closed top lip, and belongs to Nick Stoeberl of Salinas, California, according to Guinness Book of World Records. The longest tongue for a woman is 3.8 inches (9.75 cm), belonging to Chanel Tapper of Los Angeles.

Function

The tongue consists of eight interwoven, striated muscles that can move in any direction, making it quite flexible. Throughout the muscles are glands and fat, while the outside is covered by a mucus membrane. The top of the tongue, also called the dorsum, is covered with papillae, tiny nodes that contain the taste buds and the serous glands.

The serous glands secrete some of the fluid found in saliva, while the taste buds taste food through receptors that send information to the brain. Receptors are nerve endings that have a chemical reaction to the food that is being eaten. There are different reactors for different types of flavors, and there are around 50 to 150 taste receptor cells inside each taste bud, according to Encyclopedia Britannica.

It is a myth that different parts of the tongue taste different things. While it is true that different receptors taste different flavors, these various receptors are bunched in four places on the tongue. Most of the taste receptors are found on the tip of the tongue, according to the University of Texas Medical Branch.

The bottom of the tongue is smooth. Its purple color comes from the many blood vessels that run along the bottom of the tongue.

The root of the tongue is the bottom part of the tongue that can't be seen. It has arteries, bundles of nerves and muscles that branch out to the rest of the tongue.
Sticking it out

Sticking out your tongue is considered unacceptable behavior in many cultures, but it is a sign of respect in others, according to Bright Hub Education. In Tibet, sticking out the tongue is a greeting. When two people meet, they stick out their tongues at each other. Among the Maori people of New Zealand, sticking out the tongue is part of a war chant and is meant to intimidate the enemy. If a Maori woman sticks out her tongue, it is a sign of defiance.

The unusual condition known as "geographic tongue" causes red and white patches that give the appearance of continents on a map.

Diseases & conditions

Though the tongue is small, it can develop many different conditions. "The most common condition that I see as a dentist is [oral] erythema migrans, aka 'geographic tongue," said Dr. Corbin Brady of Brady Dental Care in Des Moines, Iowa. This condition is characterized by red patches on the tongue with a yellow or white serpentine border that disappears and reappears on different parts of the tongue. "Its etiology is unknown and no known conditions seem to cause it. The good news is that no pain or symptoms are typically associated with it," said Brady. (Erythema migrans is also the name of a skin rash that is a symptom of Lyme disease. The two are not related.)

Like with geographic tongue, most shape changes or discoloration of the tongue, such as furry tongue or black or yellow coloring, are harmless.

Oral thrush, or oral candidiasis, is caused by an accumulation of a fungus on the lining of the mouth. It causes creamy white lesions on the tongue and inner cheeks, according to the Mayo Clinic. It is more likely to affect babies, the elderly and people with suppressed immune systems, such as people with HIV/AIDS.

Smoking can cause a wide variety of tongue problems. People who smoke often find that their sense of taste is deadened or changed. "Nicotine is a known vasoconstrictor, something that limits blood flow — it limits your bodies cells from functioning or
healing. For the tongue, continued smoking has shown to alter the morphology of the fungiform papillae, which hold your taste buds. Smoker's papillae have been shown to typically be less dense in number, have less blood flow (less capillaries), and have thicker 'skin' (more keratin)," Brady said.

Smoking and other tobacco products can also cause tongue cancer. According to Cancer Treatment Centers of America, some of the symptoms may include:

- Difficulty swallowing or chewing
- Persistent tongue and/or jaw pain
- White or red patch on the gums, tongue, tonsil, or lining of the mouth
- A lump or thickening in the inside of the mouth
- Sore throat or feeling that something is caught in the throat that does not go away
- Difficulty moving the jaw or tongue
How the Human Eye Works

The human eye belongs to a general group of eyes found in nature called "camera-type eyes." Just as a camera lens focuses light onto film, a structure in the eye called the cornea focuses light onto a light-sensitive membrane called the retina.

Structure of the Eye

The cornea is a transparent structure found in the very front of the eye that helps to focus incoming light. Situated behind the pupil is a colorless, transparent structure called the crystalline lens. A clear fluid called the aqueous humor fills the space between the cornea and the iris.

"The cornea focuses most of the light, then it passes through the lens, which continues to focus the light," explained Dr. Mark Fromer, an ophthalmologist and retina specialist at Lenox Hill Hospital in New York City.

Behind the cornea is a colored, ring-shaped membrane called the iris. The iris has an adjustable circular opening called the pupil, which can expand or contract to control the amount of light entering the eye, Fromer said.

Ciliary muscles surround the lens. The muscles hold the lens in place but they also play an important role in vision. When the muscles relax, they pull on and flatten the lens, allowing the eye to see objects that are far away. To see closer objects clearly, the ciliary muscle must contract in order to thicken the lens.

The interior chamber of the eyeball is filled with a jelly-like tissue called the vitreous humor. After passing through the lens, light must travel through this humor before striking the sensitive layer of cells called the retina.
The Retina

Fromer explained that the retina is the innermost of three tissue layers that make up the eye. The outermost layer, called the sclera, is what gives most of the eyeball its white color. The cornea is also a part of the outer layer.

The middle layer between the retina and sclera is called the choroid. The choroid contains blood vessels that supply the retina with nutrients and oxygen and remove its waste products.

Embedded in the retina are millions of light sensitive cells, which come in two main varieties: rods and cones.

Rods are used for monochrome vision in poor light, while cones are used for color and for the detection of fine detail. Cones are packed into a part of the retina directly behind the retina called the fovea, which is responsible for sharp central vision.

When light strikes either the rods or the cones of the retina, it's converted into an electric signal that is relayed to the brain via the optic nerve. The brain then translates the electrical signals into the images a person sees, Fromer said.
Vision Problems/Diseases

The most common problems with vision are nearsightedness (myopia), farsightedness, (hyperopia), a defect in the eye caused by nonspherical curvature (astigmatism) and age-related farsightedness (presbyopia), according to the National Eye Institute.

Most people will develop presbyopia in their 40s or 50s, and start needing reading glasses, Fromer said. With age, the lens gets denser, making it harder for the ciliary muscles to bend the lens, he said.

The leading causes of blindness in the United States include cataracts (clouding of the lens), age-related macular degeneration (deterioration of the central retina), glaucoma (damage to the optic nerve), and diabetic retinopathy (damage to retinal blood vessels), according to the Centers for Disease Control and Prevention (CDC). Other common disorders include amblyopia ("lazy eye") and strabismus (crossed eyes), the CDC says.
How Many Muscles Does It Take To Smile?

You've likely been told (or read in a forwarded e-mail) that it takes fewer muscles to smile than it does to frown, and that, in light of this fact, you should smile more often. There are quite a few numbers that get tossed around when this line is used. Some claim it takes 43 muscles to frown and 17 to smile, but open Aunt Milda's chain letter and you might be surprised to learn it takes 26 to smile and 62 to frown. And some naysayers claim it's quite the opposite, that in fact it takes more muscles to smile than to frown.

When we make facial expressions, we're essentially transmitting a packet of information that can be received, read and interpreted by others. By contracting or expanding our facial muscles in different degrees and combinations, we can produce thousands of different messages that provide cues to our overall emotional state, our short-term feelings about our immediate environment, our mental well-being, our personality and mood, our physical health, our creditability and whether or not we view others as being creditable.

The smile -- transmitted either consciously or subconsciously -- is viewed across cultures as a sign of friendliness, especially when greeting someone. Frowns, too, are generally recognized as indicating sadness or disapproval.

There are 43 muscles in the face, most of which are controlled by the seventh cranial nerve (also known as the facial nerve). This nerve exits the cerebral cortex and emerges from your skull just in front of your ears. It then splits into five primary branches: temporal, zygomatic, buccal, mandibular and cervical. These branches reach different areas of the face and enervate muscles that allow the face to twist and contort into a variety of expressions.

However, nobody has really come up with a definitive number for how many muscles it takes to smile or frown -- one person's smile is another person's smirk. Also, not everyone has the same number of facial muscles; some have more, enabling a wider range of expression, while some people actually have 40 percent fewer.

The truth is that people smile -- and frown -- differently, even when presented with similar stimuli. There is an even wider range of variety when one begins using different expressive muscles for the eyes, mouth, nose and forehead.

So will this divisive matter ever be resolved?
**Smile vs. Frown**

While nobody could possibly tell you with accuracy exactly how many muscles you use when you smile (43? 17? 26?), it's possible to tell you the minimum number of muscles that are used in the most insincere, subtle, restrained, mouth-only smile or frown.

If we analyze a smile that only raises the corners of the lips and the upper lip (the smile you give when you bump into your former boss in the grocery store, perhaps), then there are five muscle pairs (or 10 total muscles) that accomplish this. Two muscle pairs primarily raise the upper lip, while three other muscle pairs are tasked mainly with raising the corners of the mouth.

If we reduce a frown only to the lowering of the corners of the mouth along with a slight downward pouting of the lower lip, we're dealing with only three muscle pairs (one pair to drop the lower lip, and two pairs to lower the corners).

Counted individually (as you might count your biceps to be two different muscles, instead of one muscle pair), we reach a tally that very well may turn our understanding of the universe completely on end: 10 muscles to smile, and six muscles to frown.

But before you abandon your smile for a look of mild disappointment in order to conserve energy, consider that we can reduce both a smile and a frown even further, so that each is produced merely by raising or lowering the corners of the mouth into a robotic expression. In this case, we have a tie: two muscle pairs (for a total of four) to "smile," and the same number to "frown."

While such expressions would hardly be recognized as a proper smile or frown, the fact that the same amount of effort is used to produce one or the other means that the scientific minds of this generation and the next will have to continue searching for a good reason for humans to put a smile on their faces -- and not a frown of equal but opposing effort.

**Turning That Frown**

Humans don't have a monopoly on facial expressions. Many primates, especially apes, have many of the same expressive muscles that we do and use them to express similar emotional information. Chimpanzees can hunt in groups using only nonverbal cues to transmit pertinent information and remain organized.