

Changes in the Body With Aging

By **Richard W. Besdine, MD, The Warren Alpert Medical School of Brown University**

[NOTE: This is the Consumer Version.](#)

The body changes with aging because changes occur in individual cells and in whole organs. These changes result in changes in function and in appearance.

Aging cells

As cells age, they function less well. Eventually, old cells must die, as a normal part of the body's functioning.

Old cells sometimes die because they are programmed to do so. The genes of cells program a process that, when triggered, results in death of the cell. This programmed death, called apoptosis, is a kind of cell suicide. The aging of a cell is one trigger. Old cells must die to make room for new cells. Other triggers include an excess number of cells and possibly damage to a cell.

Old cells also die because they can divide only a limited number of times. This limit is programmed by genes. When a cell can no longer divide, it grows larger, exists for a while, then dies. The mechanism that limits cell division involves a structure called a telomere. Telomeres are used to move the cell's genetic material in preparation for cell division. Every time a cell divides, the telomeres shorten a bit. Eventually, the telomeres become so short that the cell can no longer divide.

Sometimes damage to a cell directly causes its death. Cells may be damaged by harmful substances, such as radiation, sunlight, and chemotherapy drugs. Cells may also be damaged by certain by-products of their own normal activities. These by-products, called free radicals, are given off when cells produce energy.

Did You Know...

- Disorders, not aging, usually account for most loss of function.

Aging organs

How well organs function depends on how well the cells within them function. Older cells function less well. Also, in some organs, cells die and are not replaced, so the number of cells decreases. The number of cells in the testes, ovaries, liver, and kidneys

decreases markedly as the body ages. When the number of cells becomes too low, an organ cannot function normally. Thus, most organs function less well as people age. However, not all organs lose a large number of cells. The brain is one example. Healthy older people do not lose many brain cells. Substantial losses occur mainly in people who have had a stroke or who have a disorder that causes the progressive loss of nerve cells (neurodegenerative disorders), such as Alzheimer disease or Parkinson disease.

A decline in one organ's function, whether due to a disorder or to aging itself, can affect the function of another. For example, if atherosclerosis narrows blood vessels to the kidneys, the kidneys function less well because blood flow to them is decreased.

Often, the first signs of aging involve the musculoskeletal system. The eyes, followed by the ears, begin to change early in mid-life. Most internal functions also decline with aging. Most bodily functions peak shortly before age 30 and then begin a gradual but continuous decline. However, even with this decline, most functions remain adequate because most organs start with considerably more functional capacity than the body needs (functional reserve). For example, if half the liver is destroyed, the remaining tissue is more than enough to maintain normal function. Thus, disorders, rather than normal aging, usually account for most of the loss of function in old age.

Even though most functions remain adequate, the decline in function means that older people are less able to handle various stresses, including strenuous physical activity, extreme temperature changes in the environment, and disorders. This decline also means that older people are more likely to experience side effects from drugs. Some organs are more likely to malfunction under stress than others. These organs include the heart and blood vessels, the urinary organs (such as the kidneys), and the brain.

Bones and Joints

Bones tend to become less dense. Thus, bones become weaker and more likely to break. In women, loss of bone density speeds up after menopause because less estrogen is produced. Estrogen helps prevent too much bone from being broken down during the body's normal process of forming, breaking down, and re-forming bone.

Bones become less dense partly because they contain less calcium (which gives bones strength). The amount of calcium decreases because the body absorbs less calcium from foods. Also, levels of vitamin D, which helps the body use calcium, decrease slightly. Certain bones are weakened more than others. Those most affected include the end of the thighbone (femur) at the hip, the ends of the arm bones (radius and ulna) at the wrist, and the bones of the spine (vertebrae).

Changes in vertebrae at the top of the spine cause the head to tip forward, compressing the throat. As a result, swallowing is more difficult, and choking is more likely. The vertebrae become less dense and the cushions of tissue (disks) between them lose fluid and become thinner, making the spine shorter. Thus, older people become shorter.

The cartilage that lines the joints tends to thin, partly because of the wear and tear of years of movement. The surfaces of a joint may not slide over each other as well as they

used to, and the joint may be slightly more susceptible to injury. Damage to the cartilage due to lifelong use of joints or repeated injury often leads to osteoarthritis, which is one of the most common disorders of later life.

Ligaments, which bind joints together, and tendons, which bind muscle to bone, tend to become less elastic, making joints feel tight or stiff. These tissues also weaken. Thus, most people become less flexible. Ligaments tend to tear more easily, and when they tear, they heal more slowly. These changes occur because the cells that maintain ligaments and tendons become less active.

Muscles and Body Fat

The amount of muscle tissue (muscle mass) and muscle strength tend to decrease beginning around age 30 and continuing throughout life. Some of the decrease is caused by decreasing levels of growth hormone and testosterone, which stimulate muscle development. Also, muscles cannot contract as quickly because more fast-contracting (fast-twitch) muscle fibers are lost than slow-contracting (slow-twitch) muscle fibers. However, aging's effects reduce muscle mass and strength by no more than about 10 to 15% during an adult's lifetime. More severe muscle loss (called sarcopenia, which literally means loss of flesh) results from disease or extreme inactivity, not from aging alone.

Most older people retain enough muscle mass and strength for all necessary tasks. Many older people remain strong athletes. They compete in sports and enjoy vigorous physical activity. However, even the fittest notice some decline as they age.

Did You Know...

- To make up for the muscle mass lost during each day of strict bed rest, older people may need to exercise for up to 2 weeks.

Regular exercise to strengthen muscles (resistance training) can partially overcome or significantly delay loss of muscle mass and strength. In muscle-strengthening exercise, muscles contract against resistance provided by gravity (as in sit-ups or push-ups), weights, or rubber bands. If this type of exercise is done regularly, even people who have never exercised can increase muscle mass and strength. Conversely, physical inactivity, especially bed rest during an illness, can greatly accelerate the loss. During periods of inactivity, older people lose muscle mass and strength much more quickly than younger people do. For example, to make up for the muscle mass lost during each day of strict bed rest, people may need to exercise for up to 2 weeks.

By age 75, the percentage of body fat typically doubles compared with what it was during young adulthood. Too much body fat can increase the risk of health problems, such as diabetes. The distribution of fat also changes, changing the shape of the torso. A healthy diet and regular exercise can help older people minimize increases in body fat.

Eyes

As people age, the following occur:

- The lens stiffens, making focusing on close objects harder.
- The lens becomes denser, making seeing in dim light harder.
- The pupil reacts more slowly to changes in light.
- The lens yellows, changing the way colors are perceived.
- The number of nerve cells decrease, impairing depth perception.
- The eyes produce less fluid, making them feel dry.

A change in vision is often the first undeniable sign of aging.

Changes in the lenses of the eye can cause or contribute to the following:

- **Loss of near vision:** During their 40s, most people notice that seeing objects closer than 2 feet becomes difficult. This change in vision, called presbyopia, occurs because the lens in the eye stiffens. Normally, the lens changes its shape to help the eye focus. A stiffer lens makes focusing on close objects harder. Ultimately, almost everyone gets presbyopia and needs magnifying reading glasses. People who need glasses to see distant objects may need to wear bifocals or glasses with variable-focus lenses.
- **Need for brighter light:** As people continue to age, seeing in dim light becomes more difficult because the lens tends to become less transparent. A denser lens means that less light passes through to the retina at the back of the eye. Also, the retina, which contains the cells that sense light, becomes less sensitive. So for reading, brighter light is needed. On average, 60-year-olds need 3 times more light to read than 20-year-olds.
- **Changes in color perception:** Colors are perceived differently, partly because the lens tends to yellow with aging. Colors may look less bright and contrasts between different colors may be more difficult to see. Blues may look more gray, and blue print or background may look washed out. These changes are insignificant for most people. However, older people may have trouble reading black letters printed on a blue background or reading blue letters.

The pupil of the eye reacts more slowly to changes in light. The pupil widens and narrows to let more or less light in, depending on the brightness of the surroundings. A slow-reacting pupil means that older people may be unable to see when they first enter a dark room. Or they may be temporarily blinded when they enter a brightly lit area. Older people may also become more sensitive to glare. However, increased sensitivity to glare is often due to darkened areas in the lens or to cataracts.

Did You Know...

- Most 60-year-olds need 3 times more light to read than 20-year-olds.

Fine details, including differences in shades and tones, become more difficult to discern. The reason is probably a decrease in the number of nerve cells that transmit visual signals from the eyes to the brain. This change affects the way depth is perceived, and judging distances becomes more difficult.

Older people may see more tiny black specks moving across their field of vision. These specks, called floaters, are bits of normal fluid in the eye that have solidified (see [Eye Floaters](#)). Floaters do not significantly interfere with vision. Unless they suddenly increase in number, they are not a cause for concern.

The eyes tend to become dry. This change occurs because the number of cells that produce fluids to lubricate the eyes decreases. Tear production may decrease.

The appearance of the eyes changes in several ways:

- The whites (sclera) of the eyes may turn slightly yellow or brown. This change results from many years of exposure to ultraviolet light, wind, and dust.
- Random splotches of color may appear in the whites of the eyes, particularly in people with a dark complexion.
- A gray-white ring (arcus senilis) may appear on the surface of the eye. The ring is made of calcium and cholesterol salts. It does not affect vision.
- The lower eyelid may hang away from the eyeball because the muscles around the eye weaken and the tendons stretch. This condition (called ectropion) may interfere with lubricating the eyeball and contribute to dry eyes.
- The eye may appear to sink into the head because the amount of fat around the eye decreases.

Ears

Most changes in hearing are probably due as much to noise exposure as to aging. Exposure to loud noise over time damages the ear's ability to hear. Nonetheless, some changes in hearing occur as people age, regardless of their exposure to loud noise.

As people age, hearing high-pitched sounds becomes more difficult. This change is considered age-associated hearing loss (presbycusis). For example, violin music may sound less bright.

Did You Know...

- Articulating consonants clearly may be more helpful than speaking more loudly to older people who have trouble understanding speech.
- High-pitched sounds are particularly hard for older people to hear.

The most frustrating consequence of presbycusis is that words become harder to understand. As a result, older people may think that other people are mumbling. Even when other people speak more loudly, older people still have difficulty understanding the

words. The reason is that most consonants (such as k, t, s, p, and ch) are high-pitched, and consonants are the sounds that help people identify words. Because vowels are lower-pitched sounds, they are easier to hear. So older people may hear “Ell me exaly wha you wan oo ee,” rather than “Tell me exactly what you want to keep.” To help, other people need to articulate consonants more clearly, rather than simply speak louder. Understanding what women and children say may be more difficult than understanding what men say because most women and children have higher-pitched voices. Gradually, hearing lower pitches also becomes more difficult.

Many older people have more trouble hearing in loud places or in groups because of the background noise. Also, earwax, which interferes with hearing, tends to accumulate more.

Thick hairs may grow out of the ears.

Mouth and Nose

Generally, when people are in their 50s, the ability to taste and smell starts to gradually diminish. Both senses are needed to enjoy the full range of flavors in food. The tongue can identify only five basic tastes: sweet, sour, bitter, salt, and a relatively newly identified taste called umami (commonly described as meaty or savory). The sense of smell is needed to distinguish more subtle and complex flavors (such as raspberry).

As people age, taste buds on the tongue decrease in sensitivity. This change affects tasting sweet and salt more than bitter and sour. The ability to smell diminishes because the lining of the nose becomes thinner and drier and the nerve endings in the nose deteriorate. However, the change is slight, usually affecting only subtle smells. Because of these changes, many foods tend to taste bitter, and foods with subtle smells may taste bland.

The mouth tends to feel dry more often, partly because less saliva is produced. Dry mouth further reduces the ability to taste food.

As people age, the gums recede slightly. Consequently, the lower parts of the teeth are exposed to food particles and bacteria. Also, tooth enamel tends to wear away. These changes, as well as a dry mouth, make the teeth more susceptible to decay and cavities (caries) and thus make tooth loss more likely.

With aging, the nose tends to lengthen and enlarge, and the tip tends to droop.

Thick hairs may grow in the nose and on the upper lip and chin.

Skin

The skin tends to become thinner, less elastic, drier, and finely wrinkled. However, exposure to sunlight over the years greatly contributes to wrinkling and to making the skin rough and blotchy. People who have avoided exposure to sunlight often look much younger than their age.

The skin changes partly because the aging body produces less collagen (a tough, fibrous tissue that makes skin strong) and elastin (which makes skin flexible). As a result, the skin tears more easily.

The fat layer under the skin thins. This layer acts as a cushion for the skin, helping protect and support it. The fat layer also helps conserve body heat. When the layer thins, wrinkles are more likely to develop, and tolerance for cold decreases.

The number of nerve endings in the skin decreases. As a result, people become less sensitive to pain, temperature, and pressure, and injuries may be more likely.

The number of sweat glands and blood vessels decreases, and blood flow in the deep layers of the skin decreases. As a result, the body is less able to move heat from inside the body through blood vessels to the surface of the body. Less heat leaves the body, and the body cannot cool itself as well. Thus, the risk of heat-related disorders, such as heatstroke, is increased. Also, when blood flow is decreased, the skin tends to heal more slowly.

The number of pigment-producing cells (melanocytes) decreases. As a result, the skin has less protection against ultraviolet (UV) radiation, such as that from sunlight. Large, brown spots (age spots) develop on skin that has been exposed to sunlight, perhaps because the skin is less able to remove waste products.

The skin is less able to form vitamin D when it is exposed to sunlight. Thus, the risk of vitamin D deficiency increases.

Brain and Nervous System

The number of nerve cells in the brain typically decreases. However, the brain can partly compensate for this loss in several ways:

- As cells are lost, new connections are made between the remaining nerve cells.
- New nerve cells may form in some areas of the brain, even during old age.
- The brain has more cells than it needs to do most activities—a characteristic called redundancy.

Levels of the chemical substances involved in sending messages in the brain change. Most decrease, but some increase. Nerve cells may lose some of their receptors for messages. Blood flow to the brain decreases. Because of these age-related changes, the brain may function slightly less well. Older people may react and do tasks somewhat more slowly, but given time, they do these things accurately. Some mental functions—such as vocabulary, short-term memory, the ability to learn new material, and the ability to recall words—may be subtly reduced after age 70.

After about age 60, the number of cells in the spinal cord begins to decrease. Usually, this change does not affect strength or sensation.

Did You Know...

- The brain has ways to compensate for the loss of nerve cells that occurs with aging.

As people age, nerves may conduct signals more slowly. Usually, this change is so minimal that people do not notice it. Also, nerves may repair themselves more slowly and incompletely. Therefore, in older people with damaged nerves, sensation and strength may be decreased.

Heart and Blood Vessels

The heart and blood vessels become stiffer. The heart fills with blood more slowly. The stiffer arteries are less able to expand when more blood is pumped through them. Thus, blood pressure tends to increase.

Despite these changes, a normal older heart functions well. Differences between young and old hearts become apparent only when the heart has to work hard and pump more blood—for example, during exercise or an illness. An older heart cannot speed up as quickly or pump as fast or as much blood as a younger heart. Thus, older athletes are not able to perform as well as younger athletes. However, regular aerobic exercise can improve athletic performance in older people.

Muscles of Breathing and the Lungs

The muscles used in breathing, such as the diaphragm, tend to weaken. The number of air sacs (alveoli) and capillaries in the lungs decreases. Thus, slightly less oxygen is absorbed from air that is breathed in. The lungs become less elastic. In people who do not smoke or have a lung disorder, these changes do not affect ordinary daily activities, but these changes may make exercising more difficult. Breathing at high altitudes (where there is less oxygen) may also be harder.

The lungs become less able to fight infection, partly because the cells that sweep debris containing microorganisms out of the airways are less able to do so. Cough, which also helps clear the lungs, tends to be weaker.

Digestive System

Overall, the digestive system is less affected by aging than most other parts of the body. The muscles of the esophagus contract less forcefully, but movement of food through the esophagus is not affected. Food is emptied from the stomach slightly more slowly, and the stomach cannot hold as much food because it is less elastic. But in most people, these changes are too slight to be noticed.

Certain changes cause problems in some people. The digestive tract may produce less lactase, an enzyme the body needs to digest milk. As a result, older people are more likely to develop intolerance of dairy products (lactose intolerance). People with lactose intolerance may feel bloated or have gas or diarrhea after they consume milk products.

In the large intestine, materials move through a little more slowly. In some people, this slowing contributes to constipation.

The liver tends to become smaller because the number of cells decreases. Less blood flows through it, and liver enzymes that help the body process drugs and other substances work less efficiently. As a result, the liver may be slightly less able to help remove drugs and other substances from the body. And the effects of drugs—intended and unintended—last longer.

Kidneys and Urinary Tract

The kidneys tend to become smaller because the number of cells decreases. Less blood flows through the kidneys, and at about age 30, they begin to filter blood less well. As years pass, they may remove waste products from the blood less well. They may excrete too much water and too little salt, making dehydration more likely. Nonetheless, they almost always function well enough to meet the body's needs.

Certain changes in the urinary tract may make controlling urination more difficult:

- The maximum volume of urine that the bladder can hold decreases. Thus, older people may need to urinate more often.
- The bladder muscles may contract unpredictably (become overactive), regardless of whether people need to urinate.
- The bladder muscles weaken. As a result, they cannot empty the bladder as well, and more urine is left in the bladder after urination.
- The muscle that controls the passage of urine out of the body (urinary sphincter) is less able to close tightly and prevent leakage. Thus, older people have more difficulty postponing urination.

These changes are one reason that urinary incontinence (uncontrollable loss of urine) becomes more common as people age.

In women, the urethra (the tube through which urine leaves the body) shortens, and its lining becomes thinner. The decrease in the estrogen level that occurs with menopause may contribute to this and other changes in the urinary tract.

In men, the prostate gland tends to enlarge. In many men, it enlarges enough to interfere with the passage of urine and to prevent the bladder from emptying completely. As a result, older men tend to urinate with less force, to take longer to start the stream of urine, to dribble urine at the end of the stream, and to urinate more often. Older men are also more likely to be unable to urinate despite having a full bladder (called urinary retention). This disorder requires immediate medical care.

Reproductive Organs

Women

The effects of aging on sex hormone levels are more obvious in women than in men. In women, most of these effects are related to menopause, when the levels of female

hormones (particularly estrogen) decrease dramatically, menstrual periods end permanently, and pregnancy is no longer possible. The decrease in female hormone levels causes the ovaries and uterus to shrink. The tissues of the vagina become thinner, drier, and less elastic (a condition called atrophic vaginitis). In severe cases, these changes can lead to itching, bleeding, pain during intercourse, and a need to urinate immediately (urinary urgency).

The breasts become less firm and more fibrous, and they tend to sag. This change makes finding lumps in the breasts more difficult.

Did You Know...

- Because the breasts change with aging, finding lumps that could be cancer may be harder.

Some of the changes that begin at menopause (such as lower hormone levels and vaginal dryness) may interfere with sexual activity. However, for most women, aging does not greatly detract from enjoyment of sexual activity. Not having to worry about becoming pregnant may enhance sexual activity and enjoyment.

Men

In men, changes in sex hormone levels are less sudden. Levels of the male hormone testosterone decrease, resulting in fewer sperm and a decreased sex drive (libido), but the decrease is gradual. Although blood flow to the penis tends to decrease, most men can have erections and orgasms throughout life. However, erections may not last as long, may be slightly less rigid, or may require more stimulation to maintain. A second erection may require more time. Erectile dysfunction (impotence) becomes more common as men age and is often due to a disorder, usually a disorder that affects blood vessels (such as a vascular disease) or diabetes.

Endocrine System

The levels and activity of some hormones, produced by endocrine glands, decrease.

- Growth hormone levels decrease, leading to decreased muscle mass.
- Aldosterone levels decrease, making dehydration more likely. This hormone signals the body to retain salt and therefore water.
- Insulin, which helps control the sugar level in blood, is less effective, and less insulin may be produced. Insulin enables sugar to move from the blood into cells, where it can be converted to energy. The changes in insulin mean that the sugar level increases more after a large meal and takes longer to return to normal.

For most people, the changes in the endocrine system have no noticeable effect on overall health. But in some, the changes may increase the risk of health problems. For example, the changes in insulin increase the risk of type 2 diabetes. Thus, exercise and diet, which can enhance insulin's action, become more important as people age.

Blood Production

The amount of active bone marrow, where blood cells are produced, decreases. Therefore, fewer blood cells are produced. Nonetheless, the bone marrow can usually produce enough blood cells throughout life. Problems may occur when the need for blood cells is greatly increased—for example, when anemia or an infection develops or bleeding occurs. In such cases, bone marrow is less able to increase its production of blood cells in response to the body's needs.

Immune System

The cells of the immune system act more slowly. These cells identify and destroy foreign substances such as bacteria, other infecting microbes, and probably cancer cells. This immune slowdown may partly explain several findings associated with aging:

- Cancer is more common among older people.
- Vaccines tend to be less protective in older people.
- Some infections, such as pneumonia and influenza, are more common among older people and result in death more often.
- Allergy symptoms may become less severe.

As the immune system slows down, autoimmune disorders become less common.