

# What happens to our cardiovascular system as we age?

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Credit: AI-generated image ([disclaimer](#))

With every pump of our heart, blood courses through our arteries and veins, carrying oxygen and nutrients through our body. But as we age, blood vessels can stiffen, blockages can build up, and the system may become prone to inflammation, resulting in increased risk of heart attacks, heart failure, and other cardiac dysfunction.

Genetics, our environment, and lifestyle choices we make can all play a role in our cardiovascular health. Research has shown that men have a higher risk of cardiovascular disease than women when they're young, but once women go through menopause, their risk levels rise sharply. Researchers at Tufts University School of Medicine are trying to determine why these differences exist and how best to help us manage our [cardiovascular health](#) as we age.

## Stiffening arteries

Our [blood vessels](#) are much more than just passive tubes funneling blood cells to the right locations. They can expand and contract to draw additional blood to places it is needed, like to our legs when we're running or to our stomach during digestion. They also flex with each pump of the heart, smoothing out that pressure into a gentler, more even wave.

But over time, our blood vessels become less flexible. That loss of flexibility can make it harder for blood to get where it's needed, cause an increase in [blood pressure](#), and create faster pressure waves, placing extra stress on the heart and increasing the likelihood of [heart failure](#) or other cardiac diseases.

Estrogen seems to have a protective effect on the cardiovascular system, says Jennifer DuPont, a principal investigator at the Molecular Cardiology Research Institute (MCRI) at Tufts Medical Center and an assistant professor at Tufts University School of Medicine.

"Women have lower arterial stiffness when they're young," DuPont says. "And then they hit menopause and all of a sudden they have a large increase in arterial dysfunction. Not only do they catch up to the rates of dysfunction in men, they actually exceed it in some instances."

DuPont has been studying the role of estrogen and estrogen receptors in blood vessels, in an effort to understand how their function might change as we age. She has found that genetic deletion of estrogen receptors in older female mice protects them from the usual increase in arterial stiffness.

Like humans, the animals experience a drop in circulating estrogen as they go through menopause, so most estrogen receptors are left unbound—with no estrogen attached to them. DuPont is trying to figure out what these unbound receptors are doing that has detrimental effects on heart health.

"Our goal is to figure out some downstream targets of the unbound receptors, which could lead to the development of novel sex-specific therapeutic options," DuPont says.

## **Plaques and inflammation**

Over the course of our life, deposits of cholesterol known as plaques can collect on the inside of our arteries. Our body responds by sending white blood cells to the site and eventually growing a cap of muscle cells over the plaque. Plaques can narrow parts of our arteries and may limit blood flow to the heart with exertion, but in most cases they don't cause serious problems unless the cap ruptures. A ruptured plaque forms a blood clot, which can abruptly block an artery entirely and cause a heart attack or a stroke.

"It turns out that plaques that are more inflamed—have more white blood cells in them—are more likely to rupture," says Iris Jaffe, the Elisa Kent Mendelsohn Professor of Molecular Cardiology at the School of Medicine and the executive director of MCRI. "We've shown that plaques in young female mice are less inflamed than plaques from male mice. That might explain why younger females are protected from heart

attacks and strokes."

Inflammation is our body's response to damage—[white blood cells](#) are sent to the site of an injury to start the healing process and fight off potential infections. But as we get older, our cardiac system becomes more prone to generalized inflammation, where white [blood cells](#) are on high alert all the time.

Jaffe has been able to link the age-related increase in blood vessel inflammation, as well as blood vessel stiffening and constricting, to an increase in the mineralocorticoid receptor in our blood vessels. She has shown that blocking this receptor in mice stops these signs of blood vessel aging, and her experiments with human blood vessel cells in the lab have had similar results.

She has also shown that estrogen interacts with this receptor. Jaffe suspects that the combination of a high number of mineralocorticoid receptors and a low amount of estrogen—which women experience after menopause—leads to the uptick in both inflammation and the corresponding risk of heart attacks.

"We think that the mineralocorticoid receptor becomes important in post-menopausal women because it's no longer blocked by estrogen," Jaffe says. "That's something we still have to investigate further."

## **Keeping the heart healthy**

Although some effects of aging are inevitable, there are plenty of things that we can do to keep our cardiovascular system healthy. Alice H. Lichtenstein, director of the Cardiovascular Nutrition Team at the Jean Mayer USDA Human Nutrition Research Center on Aging and the Stanley N.

Gershoff Professor of Nutrition Science and Policy at Tufts, recommends that people find a dietary pattern they enjoy that emphasizes whole grains, fruits and vegetables, fat-free and low-fat dairy products, and proteins from fish, lean poultry, or plant-based sources like beans, nuts, and seeds, and is limited in salt and added sugar.

"It's easier than ever to consume a heart-healthy diet," says Lichtenstein, pointing to the variety of reduced-sodium, reduced added sugar, and whole-grain options commonly available at grocery stores. "And there's plenty of flexibility to find a healthy pattern that fits one's personal preferences and ethnic and cultural background. You shouldn't feel penalized because you want to develop a healthy dietary pattern."

Other lifestyle choices are likewise important. Avoiding smoking, staying active, controlling stress, and getting adequate sleep are also key to maintaining healthy heart and blood vessels as we age. And keeping them in good shape is much easier if it starts when you're young, rather than trying to reverse damage once you're older, the researchers agree.

"It's not as if you turn 65 or 70 and everything falls apart," Lichtenstein says. "If your aim is to keep your vasculature healthy, you have to start early and be a good role model for your offspring."

Provided by Tufts University

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