



Zoom into the **Human Bloodstream**

Heart

(9 centimeters)

About the size of a clenched fist, the heart is a powerful muscle which pumps blood through the body's *circulatory system*, a complex network of arteries, veins, and tiny capillaries. Laid end-to-end, these vessels could stretch 60,000 miles or more—long enough to wrap around the earth twice.

Arteriole

(50 micrometers,
or millionths of a meter)

An arteriole is a tiny blood vessel (about 2000 times smaller than the heart itself) that carries blood from the heart to the body's tissues. Arterioles have strong, flexible walls that allow them to adjust blood flow to different parts of the body. When arterioles constrict, blood pressure increases, because more force is needed to push blood through narrower spaces.

Red Blood Cell

(7 micrometers)

Red blood cells circulate in the blood and carry oxygen throughout the body. Human red blood cells are flexible and shaped a bit like doughnuts (without the holes). They're squishy enough to squeeze through capillaries where oxygen is exchanged for carbon dioxide. One teaspoon of healthy blood contains about 25 million red blood cells.

Platelet

(2 micrometers)

Platelets, the smallest cells in blood, are a key part of the healing process. When tissues are cut or torn, chemical signals cause these normally-smooth cells to become spiky. Their tiny protrusions help platelets at the wound site stick to each other, form clots, and stem the flow of blood from the injury.

Cholesterol Particle

(22 nanometers,
or billionths of a meter)

Cholesterol, a type of fat, plays a role in forming cell membranes. Cholesterol is carried through the bloodstream in particles containing hundreds of cholesterol molecules. These particles can form a sticky substance called *plaque* that thickens artery walls and causes blood clots and heart attacks. Researchers are developing nanoparticles that might be injected into the bloodstream to collect at plaque deposits and signal their location.

Hemoglobin Protein

(5.5 nanometers)

Red blood cells transport oxygen from lungs to body tissues using a protein called *hemoglobin*. One hemoglobin protein holds four *heme group* subunits, each containing an iron atom. These iron atoms give blood its red color. Working at the nanoscale, researchers have engineered synthetic hemoglobin that may one day be used to make artificial blood.

Heme Group

(1 nanometer)

These ring-shaped structures form the links between hemoglobin and the oxygen it carries. When the iron atom in a heme group connects to an oxygen molecule, the entire hemoglobin protein changes shape to allow oxygen to bind to the other groups. Each hemoglobin protein can thus transport four oxygen molecules to the body.

Oxygen Atom

(.14 nanometers)

Atoms are the building blocks of all matter. Two oxygen atoms link to form a molecule of oxygen gas, which makes up about 20% of the earth's atmosphere and is key to almost all biological processes on the planet. Able to magnify a sample 50 million times, today's *scanning probe microscopes* allow researchers to see and manipulate individual atoms.