PHYSIOLOGY

Heart Is Reliable Pump

A muscle as big as the fist has efficiency to be envied by machine makers. Its strength is due largely to the criss-cross layer structure of the muscle fibers.

By JANE STAFFORD

➤ HEARTS mean romance and soft music to many, especially in February, but actually the beating heart is a hard-working pump with an efficiency that any pump or motor manufacturer would be proud to achieve.

To equal the heart's efficiency as a motor, a gasoline engine, such as the one in your car, would have to be capable of running one million miles without attention.

Work Force Is Huge

In one minute the human heart puts out a work force capable of raising a weight of 78 pounds to the height of one foot. Every day it pumps from nine to ten tons of blood, driving this through miles of veins and arteries. In the biblical lifespan of three score years and ten, which many persons now outlive, the heart, pumping at the rate of 72 times a minute, delivers nearly three billion thrusts to pump more than 40 million gallons of blood.

All this power is housed in an organ that measures, on the average, 5 by 3½ by 2½ inches in a grown person. To get an idea of the size of your heart, look at your lightly closed fist. It matches pretty well the heart in your chest, whether you are a tall, big-fisted man or a slender little woman. Your heart is closer to that fist shape, too, than to the shape of the heart on your valentine. Medical books describe the heart as pear-shaped.

Heart Is Near Center

When you put your hand on your heart to swear allegiance to the flag, or to your love in a sentimental moment, you probably miss the exact location of your heart. It is not so far to the left as many persons seem to think. The base, or broad part, of the heart is directed upward and to the right, with the apex, or narrow end, directed downward and to the left.

Division of Heart

The heart is a hollow muscle, enclosed in a tough fibrous bag called the pericardium. Between the heart and this bag is a little lubricating fluid for reducing friction. A wall down the middle of the heart divides it into what you may have heard your doctor call the right and left heart.

The reason for this division, which in a way makes the heart into two pumps, is that there are two separate circulations of blood. One of these is through the lungs and the other through all the rest of the body.

Blood Returns

After the blood has been through the body, it comes back to the right heart through two big veins, one from the trunk and legs, the other from the head and arms. It goes into the top chamber of the right heart, called the auricle and then through a flap of membrane, or valve, into the right ventricle. From here it is pumped through an artery to the lungs, where it discharges a waste gas, carbon dioxide, and picks up a fresh supply of oxygen.

Two veins, one from each lung, deliver the blood back to the left heart, which also has a receiving chamber, or auricle, and a pumping chamber, or ventricle. From this left heart's ventricle the blood is pumped through the body's biggest artery, the aorta, out to the rest of the body.

Double Pumping Job

This double pumping job is done simultaneously by the two sides of the heart. The powerful muscles of the two ventricles contract at the same time, to pump blood into the lungs and into the rest of the body.

The impulse for the heart's contraction comes from a small bundle of muscle and nerve cells in the wall of the right auricle. This impulse from this pace-maker travels in waves, first along the walls of the auricles and then along the walls of the ventricles. The auricles therefore start contracting first, followed by the ventricles. The force of the heart's contraction is strong enough to shoot a column of blood six feet into the air.

Heart Relaxes

After the contracting heart has forced the last drop of blood out of the ventricles, it relaxes. The contraction lasts for three-tenths of a second, the relaxation, or rest period, five-tenths of a second in a heart that beats 72 times a minute. The period of contraction is called the systole, that of relaxation the diastole. You may have heard your doctor speak of systolic blood pressure and diastolic blood pressure. The systolic pressure is the pressure in the arteries when the heart is in systole, or contracted. The diastolic pressure is that in the arteries when the heart is relaxed.

The heart's great strength comes primarily from the kind of muscle of which it is made. The muscle fibers criss-cross in many layers, running in different directions. This gives them strength in the same way that laminated material gets strength, though it may be made of many thin layers. No other muscle in a man's body has as much power as his heart muscle. Only one human muscle has more power. That is the contracting uterus in a woman's body as she is giving birth to a child.

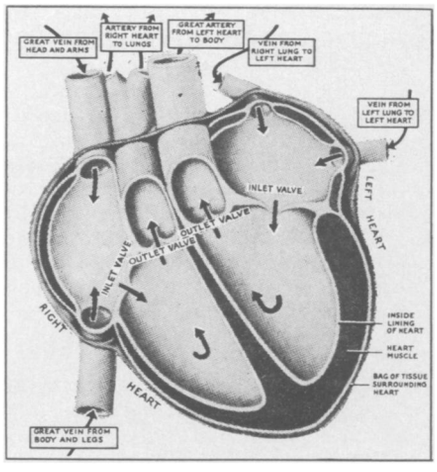
The heart muscle, of course, must have a supply of blood to nourish it for its work of pumping blood out to the rest of the body and through the lungs.

Arteries Supply Its Blood

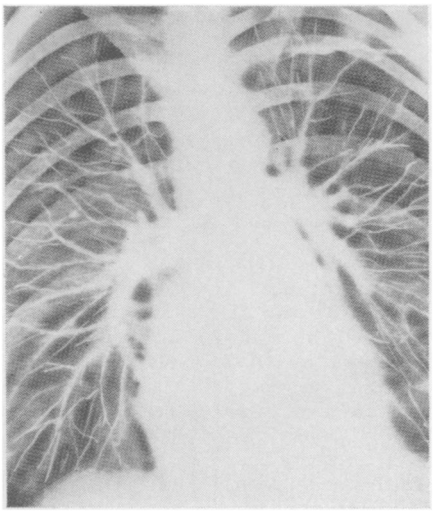
The heart muscle does not get its blood directly from that inside the chambers but from arteries, called the coronary arteries, which branch off from the big aorta at the top of the heart. And the heart has veins for carrying blood back into its chambers.

You may have heard of coronary artery disease, or coronary disease as doctors sometimes call it. This refers to disease of these arteries that nourish the heart muscle. Coronary thrombosis is a condition in which one of the coronary arteries is plugged by a clot. A plugged artery obviously cannot carry blood, and the part of the heart it was supplying therefore is no longer able to function.

This is only one of several kinds of diseases that can interfere with the heart's efficiency as a pump or put it out of commission altogether.



HEART DIAGRAM—The diagram showing the architecture of the heart was made for the Metropolitan Life Insurance Company and the American Heart Association which this month is conducting a campaign to raise funds for research on heart disease.



X-RAY HEART—The very clear view of the heart, the arteries and the veins is obtained by injecting into the arm vein an opaque substance which is carried in the circulating blood.

The fact that the heart acts as a muscular force-pump propelling the blood through the arteries and that the blood returns to the heart through the veins was discovered by the English physician, William Harvey, in 1628. Atomic age medical scientists are now following the course of the blood through the body with radioactive chemicals to label blood cells and Geiger counters to trace them.

Science News Letter, February 11, 1950

NUCLEAR PHYSICS

Neutron Not Fundamental Particle, But Splits

➤ THE neutron, trigger of the fission atomic bomb, has lost its distinction of being a fundamental particle of nature, thanks to experiments reported to the American Physical Society by an Oak Ridge National Laboratory team, consisting of Dr. Arthur H. Snell, Frances Pleasonton and R. V. McCord.

Instead of being something that cannot itself be split, this electrically neutral particle, present in the hearts of atoms, decays radioactively after 10 to 30 minutes of freedom into an electron (unit of negative electricity) and a proton (the positive particle that is the center of the hydrogen atom).

Along with the proton, the neutron has long been considered a fundamental building block of atomic nuclei and therefore of all matter. In 1933 two Englishmen found that the neutron was slightly heavier than the proton. They suggested that it could turn into a proton by loss of an electron, what is called radioactive beta decay, since the electron is called the beta particle.

Now the Oak Ridge scientists have proved this to be the case. The lack of electrical charge on the neutron causes it to pass through all matter with extraordinary ease. It also readily interacts with matter. Neutrons can not be studied like other radioactive material.

A stream of neutrons from the Oak Ridge uranium-graphite reactor or "pile" was used. The electrons and protons into which the neutrons decayed were detected near the powerful neutron beam.

Science News Letter, February 11, 1950

PHYSICS

Device Records Flying, Resting Time of Birds

➤ A SMALL radioactive device fastened to the wing of homing pigeons that records how much of the bird's time is spent in flying and how much in resting has been made by Dr. D. H. Wilkinson of Cambridge University's Cavendish Laboratory, Cambridge, England.

When the bird is in flight a stream of alpha particles strikes a photographic plate. When the bird is at rest a steel ball falls into place, sealing off the radiation so that it can not reach the film. When the film is examined under the microscope, the number of tracks counted gives the bird's flying time.

Dr. Wilkinson has some improvements in mind, including a built-in compass to record direction, and an absorption device to indicate time spent on water. He announced his new flight recorder in a letter to the British journal NATURE (Feb. 4).

Science News Letter, February 11, 1950

On This Week's Cover

➤ THE possibilities of producing superbombs by the D-D reaction, the lithium-hydrogen reaction and the beryllium-deuterium reaction have forced uranium, a little used and little known element before atomic energy development, to assume a secondary role in the production of bombs. However, the atomic bomb may serve to trigger or set off the hydrogen bomb. The surface of a piece of uranium is shown being prepared for microscopic examination at the Battelle Memorial Institute; the many sparks are typical of uranium. Even after the war, knowledge of its metallurgy was no better than that concerning iron and steel in 1870. And today, when the limelight has shifted from it, the qualities of the high-purity metal are still not well understood.

Science News Letter, February 11, 1950