## Heart

The heart is a muscular organ whose interior is divided into two pairs of chambers, one on the right, the other on the left; the chambers of each pair are connected with each other by a valve. Lying in the mid-left section of the chest, close to the breastbone, the human heart weighs about 12 ounces, beats 70 to 80 times a minute, and is enclosed by a sturdy membrane called *pericardium*. Its chambers are lined by a delicate membrane, the *endocardium*, and its vigorous muscular and connective tissues are nourished by the heart’s own blood vessels, the coronary vessels.

### How the Heart Works

This remarkable muscle serves as a pump controlling the blood stream in two circuits, the *pulmonary* and the *systemic*. The right side of the heart receives the blood from the large veins that drain the systemic circuit and propels it into the lungs where carbon dioxide is removed and oxygen is picked up. The oxygenated blood, collecting in the pulmonary veins, than enters the left side of the heart, from which it is pumped out again into the systemic circulation by way of the body’s largest blood vessel, the aorta. The rhythmic pumping is in the form of a repeated contraction ( *systole* ) and relaxation (*diastole*). Every 60 seconds, this precisely adjusted human pump drives about five quarts of blood through the body.

# Auricles and Ventricles

The four chambers of the heart have special roles in the pumping process. The upper chambers are called the *auricles*; the lower chambers, the *ventricles.* The auricle and ventricle on each side together form an independent part of the heart, somewhat like a duplex apartment; in effect, they make up a “right heart” and a “left heart”. There is no connection for the blood into the pulmonary circuit, the left into the general body circuit.

# Valves of the heart

Between the right auricle and right ventricle is a valve, called the *tricuspid* valve. Similarly, the left auricle and left ventricle are connected by the *mitral* valve, so named because of its apparent resemblance to a bishop’s miter or tall cap. The sounds of the valves opening and closing are heard by the doctor when he listens with his stethoscope. In addition to the valves between auricle and ventricle on each side of the heart, there are valves at the blood’s exit points: the *pulmonary valve* opening from the right ventricle into the pulmonary artery, and the *aortic valve* opening from the left ventricle into the aorta. All these valves, both within the heart and leading out of it, open shut in such a way is to keep the blood flowing only in one direction through the heart’s two separate pairs of chambers: from auricle to ventricle and out through its appropriate artery.

# A Single Pumping Action

Although the right and left sides of the heart serve two separate branches of the circulation, each with its distinct function, they are co-ordinated so that the heart efficiently serves both sides with a single pumping action. The valve action on both sides is also co-ordinated with the two phases of the pumping action. Thus, during the diastole, or relaxation phase, the oxygen-poor blood which was accumulated in the right auricle returning from the systemic or body circulation pours into the right ventricle. At the same time, the oxygen-rich blood which was accumulated in the left auriclereturning from the pulmonary circulation pours into the left ventricle. The weak walls of both auricles contract to press the blood into the relaxed ventricles. In the next or contraction phase, the systole, the valve between auricle and ventricle on each side closes, and the muscular walls contract the ventricles and sweep the blood through each passage into the pulmonary artery and the aorta. At the end of the contraction the pulmonary and aortic valves snap shut, preventing any backward surge of the blood to the ventricles. The diastole follows, the ventricles again fill with the flow from their separate auricles and the cycle is repeated. This co-ordinated rhythmic action goes on tirelessly day and night throughout every individual’s lifetime.

### The Valve Cusps

The valves, which must withstand considerable pressure, are composed of a special type of tough tissue. The mitral valve, between the left auricle and ventricle, has two cusps or leaflets. The tricuspid valve, between the right auricle and ventricle, has three cusps. Both valves function in the same manner. When blood pressure in auricle is higher than in the ventricle, the valve leaflets are swept open; as the blood flows downward, the auricular contraction at the start of the heart beat helps to push the blood along. As the blood fills the ventricle, the leaflets close, and with the contraction of the ventricle, pressure tightly shuts the valve. The valve leaflets are bolstered from below by a set of tough tendons with muscular attachments, enabling the leaflets to withstand the pressure and keep the valves from opening inward into the auricle.

The two valves which control the exit passages from the heart, the aortic valve and the pulmonary valve, have three leaflets each, and they also only for one-way flow. Other valves at special stations along the line in the circulatory system keep the blood from pooling in the lower extremities of the body.

**Heart Disease.**

Heart disease, the leading cause of death, is a term covering a variety of more than 20 different diseases of the heart and blood vessels. The most common of these are rheumatic heart disease, hypertension or high blood pressure, and coronary artery disease. Other forms of heart disease can be caused by congenital malformations of the heart and major vessels, syphilis, diphtheria, abnormal functioning of the thyroid gland, or diseases resulting from vitamin deficiencies.

Although approximately ten million Americans have some form of heart disease, the tremendous advances made by medical science have made it possible to treat and control these illnesses with increasing success. The majority of individuals who suffer a heart attack recover, and recurrent attacks of rheumatic fever which injure the heart can now frequently be prevented. By means of modern surgical techniques, heart defects and heart damage may often be repaired by HEART SURGERY.

To clarify various descriptions of heart ailments, it should be understood that a “heart attack” is not strictly the same as “heart disease”. A heart attack usually signifies the sudden obstruction of a coronary artery, one of the blood vessels feeding blood to the heart muscle; the clogging of the artery by a blood clot cuts off the blood supply to an area of the heart muscle. There is also a distinction between a heart attack, heart disease, and “heart failure”. Heart failure does not mean that the heart has stopped beating but that the heart is not pumping efficiently and the body’s blood circulation is being affected by the change.

One of the most prevalent of the diseases involving the heart is arteriosclerosis, commonly known as hardening of the arteries. Diseases of other organs of the body can also produce heart disease; one of these is nephritis, a disease of the kidneys which affects the tiny blood vessels or capillaries. Another such disease is diabetes which in some individuals may injure the blood vessels in much the same fashion as does high blood pressure.

### Symptoms

Symptoms of heart disease may include certain types of palpitation, shortness of breath, a particular type of chest pain in the region of the left breast (angina pectoris), swelling of the ankles and feet, dizziness, fainting spells, extreme weariness, bluish lips, coughing up of blood, or a persistent cough. A person suffering from such symptoms should consult a doctor to determine whether heart disease is present. After taking the patient’s medical history and making a thorough examination, which may include an electrocardiogram, the doctor will diagnose the condition and prescribe any treatment that may be required.

Palpitations

An unusually rapid, strong, or irregular heartbeat of which a person is aware is called *palpitation.* In the majority of cases, palpitation is completely normal; almost everyone, for example, feels his heart pounding more rapidly and strongly after exertion or when he is excited or nervous. Many people are also apt to be especially conscious of heartbeat when they are lying in bed, especially when lying on the left side. There are also palpitations that are abnormal but that do not of themselves indicate heart disorder, though they may cause annoyance or discomfort. Commonest is the “skipped beat”, or *extrasystole*; in some cases this may occur because of excessive smoking o coffee drinking or as a reaction to some kinds of medicine.

The various types of palpitation that may indicate heart disorder in some instances include *paroxysmal tachycardia* and “flutter”, abnormal rhythms in which the heart executes runs of rapid beats. Another is *auricular fibrillation*, in which the beats are rapid but irregular, seeming to occur at random.

These palpitations may be caused by organic heart disease, but they also can result from other factors. Similarly, emotional pressures rather than organic changes may cause the so-called “nervous heart”, or functional heart disease. Although these symptoms do not prove definitely that the heart is in a trouble, they should prompt a person to consult his doctor. If the doctor’s examination shows no heart disease, the individual can be reassured. If not, the doctor will be able to begin immediate treatment.

#### Shortness of Breath

This may occur after only moderate exercise, such as climbing one flight of steps. A person who finds himself continually in a breathless state after activities which he once did without efforts should consult a physician. Awakening at night short of breath may also be warning of heart difficulties. This type of night breathlessness often takes the form of feeling of suffocation or a choking sensation. Shortness of breath may also indicate other disorders; some of these are described more fully in the article on BREATHLESSNESS.

Chest Pain (Angina Pectoris)

This type of pain, usually over the heart or in the mid-chest, may follow some excitement, a heavy meal, or exertion. It may not last more than a minute or two, and may fade when the person rests or stands still. Such pain may frequently be confused with similar symptoms arising from gas pains or indigestion, but only a physician should diagnose the complaint. Self-diagnosis can be dangerous.

#### Swelling of the Ankles and Feet

Deterioration of the heart’s pumping efficiency, or heart failure, can throw the blood circulation odd balance and cause fluid to collect in the tissues (edema). Swelling may be caused by varicose veins or by standing for long periods of time, but puffiness of a different type which may interfere with putting on shoes, or which can be deeply indented by pressure with a finger, should be checked with a doctor.

## Kinds of Heart Disease

The diseases affecting the heart and blood vessels range from defects present at birth to damage of the organs caused by other diseases or injuries. They include congenital, syphilitic, and rheumatic heart disease; bacterial endocarditis, coronary insufficiency, coronary thrombosis, heart failure, and related disorders.

#### Congenital Heart Defects

Between 30000 and 40000 children with one or more heart defects are born annually in the USA. A quite common defect is the *tetralogy of Fallot*, sometimes inaccurately called Blue Baby. Another defect consists of passage between the aorta and pulmonary artery which normally closes right after birth. There may be an opening between the ventricles, the two pumping chambers of the heart (*ventricular septal defect).* Defective valves affecting the flow of blood to and from the heart may also be present.

A rarer congenital condition is transposition of the great vessels. In this defect, the position of the chief blood vessels of the heart is reversed. The aorta, the chief artery in the body, rises from the right ventricle instead of the left, while the pulmonary artery, which carries blood to the lungs, emerges from the left ventricle rather than from the right. The result of this circulatory confusion is that dark oxygen-poor blood returning from the body to the right side of the heart is pumped back into the general circulation instead of being transported to the lungs. Meanwhile, red, oxygen-rich blood flows aimlessly to and from the lungs. Both the tetralogy of Fallot and the transposition of the great vessels can be corrected in some instances by special surgery.

The condition in which the passage from the aorta to the pulmonary artery fails to close after birth may occur by itself, without associated defects. This defect forces the left ventricle to overwork. Another congenital defect results when the foramen ovale, a window between the auricles (upper chambers of the heart) fails to close completely after birth. When an opening remains between the auricles, some of the oxygen-rich blood from the left auricle passes into the right auricle and travels back through the lungs without being first transported through the body. Another heart defect, coarctation of the aorta, results when the portion of the aorta is unusually narrow. In many cases – depending on the severity of the defect and the physical condition of the patient- these congenital conditions can be treated by surgery.

#### Syphilitic Heart Disease

Years after syphilis is contracted, the disease can damage the aorta, as well as injure the aortic valve. The walls of the aorta are invaded by the syphilis germs, and eventually become weakened. The aorta gradually dilates forming an ANEURYSM which may rupture.

#### Rheumatic Heart Disease

This disease most commonly starts between the age of 5 and 19 but can occur at any age. It is the result of rheumatic fever, a combination of a streptococcal infection and an allergic sensitivity to streptococcal germs. It is responsible for most heart disease in individuals under the age of 20.

Early indications of rheumatic fever may be a state of fatigue, poor appetite, failure to gain weight, paleness, and anemia.

It is estimated that 50 percent of those who are diagnosed in adulthood as having chronic rheumatic heart disease never realized they had experienced attacks of rheumatic fever as children. The disease causes an inflammation of the heart muscles and heart valves, and scars the valves so that they do not perform normally. The damage may prevent the valves from opening or closing properly. Rheumatic fever is controlled by regular doses of penicillin and sulfa drugs, particularly in adolescents and young adults.

#### Bacterial Endocarditis

This is a bacterial infection of the lining of the heart (*endocardium*) and the valves which may follow rheumatic fever and also may occur in persons with congenital defects of the heart. Bacteria, usually of the streptococcus family, can enter the blood stream after operations on the mouth, throat, nose, or intestines. If the microbes reach defective heart valves, they can grow on them and cause a dangerous illness. That is why persons with a history of rheumatic fever or those with congenital heart abnormalities may be given penicillin or sulfa drugs before undergoing certain operations or tooth extractions.

There are two forms of the disease, *acute* and *subacute*, with the subacute form or more common. The acute type strikes the person suddenly and can be fatal within a few days if immediate treatment is not given. Treatment includes bed rest and antibiotics.

Coronary Insufficiency.

Coronary insufficiency is a term applied to heart difficulties in which the blood flow in the coronary arteries which nourish the heart muscle itself may be decreaced.Atherosclerosis *,*a common form of hardening of the arteries, may produce this condition by thickening or narrowing the walls of the coronary arteries.When the arteries are narrowed, less blood and less oxygen are carried to the heart musclemen.One form of such insufficiency is ANGINA PECTORIS, in which the coronary arteries temporarily do not provide the necessary blood to the heart muscle. The amount of blood to the heart muscle may be adequate for periods of rest or mild activity. Under conditions of emotional stress or increased physical exertion, the supply may be insufficient for the added work of the heart, and pain will result. The characteristic pain has been described as crushing or viselike and located near the left breast. The pain may fan out to the left arm and left fingers. Treatment consists of rest, *nitroglycerin* tablets under the tongue, or inhalation of *amylnitrite.*

##### **Heart Failure**

Heart failure does not mean that the heart has stopped, but that its pumping efficiency has lessened. Two types of failure can interfere with normal circulation. In one, *circulatory*, or *forward*, failure, the heart is unable to pump enough oxygenated blood to the tissues because a severe hemorrhage may cause the blood volume to fall, or because the heart is not capable of supplying the tissues with sufficient blood.

In the second type of failure, known as *cardiac insufficiency* ( *backward,* or *congestive*, failure), the heart muscle loses its normal vigorous beat and fails to propel the blood out of the heart chambers as swiftly as it enters them. As a consequence of the slowing of circulation, body fluids collect in the tissues. The ankles may swell, and the individual may be short of breath because of fluid in the lungs. There may be various types of indigestion from congestion of the liver and other abdominal organs. This type of heart failure may develop after a severe heart attack or rheumatic fever, after a long period of untreated high blood pressure, or in connection with a congenital heart defect.

In circulatory failure, the victim is pale and listless, and visible veins sag. In cardiac insufficiency, the victim’s skin has a bluish tinge, the jugular vein is swollen, and he breathes noisily. The blueness stems from the fact that not enough oxygen is being supplied to the arterial blood , and the tissues also lack sufficient oxygen, while carbon dioxide mounts in the cells.

Treatment for heart failure includes rest, a special diet with lowered salt intake, medication(*digitalis)* to strengthen heart action, and diuretic medicines to control the excess of fluid.

## Related Disorders

Hardening of the arteries and high blood pressure (*hypertension*) are two of the most common forms of diseases affecting the heart, and are found most frequently in the middle-aged or elderly person. The conditions may be present separately, although they are frequently associated. In the first, atherosclerosis, the walls of the arteries, and particularly the internal lining called the *intima,* may become roughened. Fatty deposits begin to collect. Fibrotic materials, and sometimes calcium, coat these deposits, and help to form what are known as *atherosclerotic plaques*. The damage spreads into the *media,* the muscular-elastic part of the artery, and causes loss of resiliency. These plaques fill the passageway, and gradually obstruct the flow of the blood. As the arterial walls are narrowed, it becomes more difficult for the blood to flow through the vessel.

Rise in blood pressure may be caused by a variety of factors, including emotional stress. In 90 percent of the cases, the specific cause remains undiscovered. It is believed that high blood pressure helps to speed the processes of hardening of the arteries and other blood vessel diseases.

Hardening of the arteries and high blood pressure are chiefly responsible for STROKES (Known as *celebrovascular accidents*), which are caused by clogging or hemorrhaging of an artery in the brain or in an artery in the neck leading to the brain. The walls of an artery may have lost their smoothness and elasticity and collected the deposits typical of hardening of the arteries, or the artery may have been clogged by a blood clot from the heart. An area of the brain to which the blood supply has been interrupted is injured, as a result of which some muscular function controlled by the brain cells may be temporarily or permanently lost.

Another disease related to diseases of the heart and blood vessels is NEPHRITIS (Bright’s disease), or inflammation of the kidneys, which can cause high blood pressure. The heart works under the high pressure handicap, as in other types of hypertension. An acute attack of nephritis may so injure the capillaries, the tiniest blood vessels, that fluid settles in the tissues, causing swelling in various parts of the body.

## Prevention and Care

Guarding against heart ailments involves a reasonable consideration for the amount of work the heart is accustomed to doing. For example, a man over 40 should remember that a burst of unusual physical work or strenuous sport creates a strain on a heart that is accustomed only to a sedentary life. Extra weight places an extra burden on the heart. Fears of heart trouble can also be harmful. It is wise to have regular medical check-ups, and take intelligent care of one’s health, and to maintain a sensible approach to life between examinations. This includes avoiding excessive use of tobacco, following a well-balanced diet, taking regular exercise, and maintaining a good balance between work, social life and rest.

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