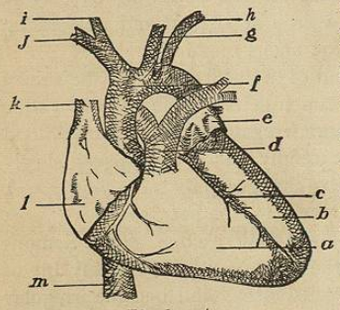
The heart 162-172- June

CHAPTER XIX

THE HEART

282. The heart. — The blood is kept flowing through all parts of the body by the *heart*. The heart is essentially a hollow shell of muscles, which has the power of squeezing its sides tightly together, so as to force out the blood. It is conical in shape. Its side lies upon the diaphragm, with its tip pointing downward, forward, and to the left. Its small end touches the chest wall about two and a half inches to the left of the lower end of the sternum or breastbone, and its large end extends along the right side of the breastbone, from its lower end upward as high as the third rib. It is almost covered by the lung, and is inclosed in a bag of serous membrane called the *pericardium*. The pericardium is very smooth, so as to permit free movements of the heart within it. (See cut, p. 66.)

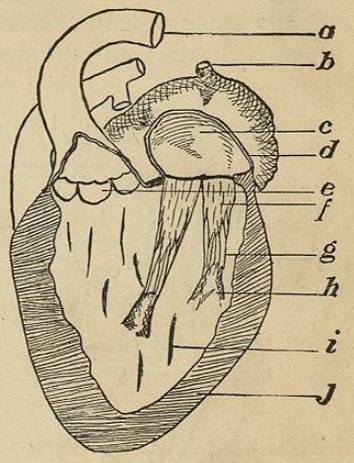


The heart.

a right ventricle.
b left ventricle.
c artery between the two ventricles, nourishing the heart's muscles.
d pulmonary artery.
e left auricle.
f aorta.
g artery to left side of head.
h artery to left arm.
i artery to right side of head.
j artery to right arm.
k descending vena cava.
l right auricle.
m ascending vena cava.

283. Cavities of the heart. — The heart is designed to pump two separate streams of blood at once. Its left side pumps blood through the whole body, while its right side pumps it only through the lungs. The cavity on each side is partly divided into an upper chamber called an *auricle*, and a lower one called a *ventricle*. Each auricle has thin, flabby walls, and does little of the work of pumping blood.

The ventricles have thick and strong walls, which form nearly all the bulk of the heart. The left ventricle has walls three times as thick as the right ventricle, for it must pump blood through a much greater part of the body. From each ventricle a tube, called an *artery*, conducts the blood away.

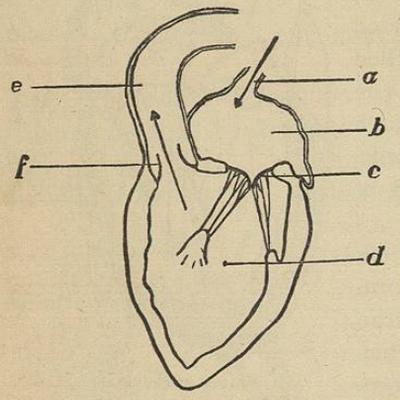


Valves of the heart.

a artery with its lower end split open.
b vein leading into the heart.
c auricle with the front cut away.
d cut edge of the auricle, showing its thinness.
e semilunar valves; their upper edges are free and movable.
f mitral valve spread open.
g strings from the edge of the curtain of the valve to steady it.
h muscular projection upon the inside of the ventricle to which the strings are attached.
i indentations upon the inner surface of the ventricle.
j wall of the ventricle, showing its thickness as compared with that of the auricle, *d*.

284. Valves of the heart. — Blood enters each auricle through tubes called *veins*, and streams through the opening into the ventricle, but is prevented from flowing back by thin, strong curtains which are attached to the edge of the opening and hang suspended in the ventricle. From the edges of each

curtain fine threads extend to projections upon the muscular walls of the ventricle, to keep the curtains smooth and straight. Blood flowing from the auricle into the ventricle readily separates the curtains, but blood pressing upon them from the ventricle forces them tightly together, so that not a drop can pass through. Thus they form a *valve* in each opening. The valve upon the left side is composed of two curtains, and is called the *mitral* valve. The one on the right side is composed of three curtains and is called the *tricuspid* valve. From their situation, these valves are often called the *auriculo-ventricular* valves.



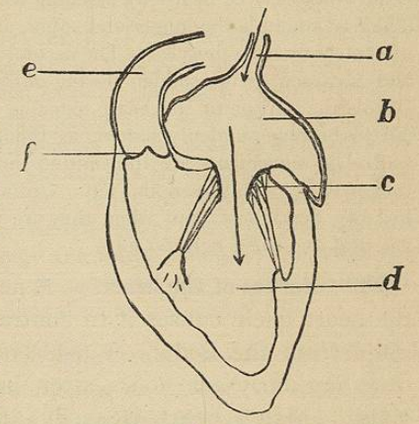
Systole of the heart.

a vein entering the auricle.
b auricle.
c closed valve to keep blood from flowing back into the auricle.
d ventricle.
e artery.
f valve to keep blood from returning to the ventricle.

285. Semilunar valve. — At the beginning of each artery leading from the ventricles are three thin, silklike flaps, shaped like half-moons. They are arranged so that blood flowing from the ventricle pushes each flap against the side of the artery; but between the beats of the heart, the blood in the artery presses backward, forcing the flaps away from the side of the artery, so that they all meet tightly in the middle. They form a valve called the *semilunar* valve, from the shape of each flap.

286. Action of the heart. — The heart is a pump with valves permitting blood to flow through an auricle into a ventricle and out into an artery, while preventing any flow in the opposite direction.

As blood enters the heart it passes through the auricles into the ventricles. Just before the ventricles are full the auricles suddenly contract and drive the blood into the ventricles, which are thus filled full and immediately begin to contract, while the auricles relax. The pressure closes the mitral and tricuspid valves and opens the semilunar valves. The blood is thus prevented from flowing back to the auricles, but flows through the open entrance to the arteries. During the contraction of the ventricles, the auricles remain relaxed and receive the blood returning to the heart.



Diastole of the heart.

a blood entering auricle.
b auricle.
c open valve to permit blood to flow into the ventricle.
d ventricle.
e artery.
f closed semilunar valve.

When all the blood is expelled from the ventricle it relaxes, and the blood falls back upon the semilunar valves, closing them so that none returns. At the same time the blood in the auricles presses open the mitral and tricuspid valves, and again fills the ventricles.

287. Rate and time of the heart's action. — The contraction of the heart is called its *systole*, and its relaxation its *diastole*. At each systole from two to four ounces of

blood are expelled. It occurs about seventy-two times each minute. While the heart beats occur regularly without apparent pause, yet it rests in diastole about one half the time.

288. Sounds of the heart. — Two sounds are produced by each beat, which may be heard by listening with the ear close to the heart. The first sound is the longer and softer, and is caused by the vibration of the contracting muscles. The second sound is shorter and sharper, and is caused by the sudden closing of the semilunar valves. At each systole the portion of the heart touching the wall of the chest may be felt to become suddenly harder, as though it beat against the chest wall. Its movements are transmitted through the chest walls so that they may be plainly seen and felt. Ordinarily a person is not aware of his own heart beats, but when they are very forcible they are plainly felt, and are called *palpitation*.

289. Nerves of the heart. — A nervous mechanism within the heart itself causes it to contract even after it is separated from the body. A fish's or turtle's heart will contract regularly for hours after being removed from the body. Man's heart is easily affected by outside influences, but, because of its own nervous mechanism, it is not so sensitive as has been supposed. Wounds completely penetrating the ventricle have been sewed up, and recovery has taken place. The action of the heart is regulated and adapted to the varying needs of the body through two sets of nerves, one set from the brain and the other set from the spinal cord. In physical exertion the spinal nerves cause it to beat faster and more forcibly. This adaptation is so delicate that rising from a sitting to a standing position perceptibly increases the number of heart beats. Joy, or anger, or excitement of any kind hastens its action, while grief usually retards and weakens it.

290. Effect of violent exercise. — In prolonged and violent physical exercise the heart performs more work than

is natural, and grows larger to accommodate itself to the strain. Repeated calls to extra exertion may cause it to respond more quickly and with more vigor than occasion demands, so that a slight excitement or exertion causes palpitation. Those who engage in races are especially liable to overwork their hearts.

291. Palpitation of the heart. — The response of the heart to influences from the outside may be excessive, so that it beats too quickly and more forcibly than occasion demands. Sudden noises, and excitement of any kind, cause the heart to beat violently or *palpitate* in some persons. But palpitation of the heart is an annoyance rather than a disease. While the will has no control over the heart, yet it can control the emotions which cause the palpitations. Persons of calm temperament, who exercise self-control over their emotions, are rarely troubled with palpitation. Our words ending in "hearted," as "warm-hearted," are records of the old belief that the heart governed the feelings instead of the feelings affecting the heart.

292. Fatty heart. — The heart may become diseased, but heart disease is by no means so dangerous as is commonly supposed. In fact, those having diseased hearts are usually unaware of it for years, while, on the other hand, those who think their hearts are diseased are almost always mistaken.

There is a common change of the heart's muscle, in which little particles of the muscle cells are changed to *fat*. The cells are thus weakened, and made unable to respond to a sudden extra demand. A person with excessive development of fat elsewhere, is liable to have a fatty heart. Avoidance of things which tend to cause excitement and overwork will enable such a heart to work on without noticeable change in its actions.

293. Disease of the valves of the heart. — The other common form of heart trouble is a thickening and puckering of the valves, causing a leakage so that some blood flows backward. But the heart grows larger and stronger,

so that it can pump enough blood to supply the body in spite of the constant leakage backward. The heart may thus become twice its natural size, but there is a limit to its enlargement, and finally it grows weak. If exertion is avoided, such a heart may work perfectly for years.

The nervous system contained in the heart's muscle makes it the most resistant of all the organs of the body, and the one whose disease is least to be feared. It is the first organ formed in the child, and is the last to die. When it begins to fail, the blood accumulates in the lowest parts of the body, and produces swelling of the feet, which is one of the first signs of heart disease.

294. Fainting. — When the heart is suddenly checked and made weak in its action to such an extent that little blood is driven to the brain, unconsciousness and complete loss of muscular power result, so that the person falls to the ground. The face appears pale, because there is but little blood in it. This paleness and loss of consciousness is called *fainting*. When a person faints he should be laid upon his back with his head as low as his body, so that the blood may flow to the brain more easily. Cold water should be thrown upon the face so that the sudden shock may stimulate the spinal nerves which hasten the heart's action. In a few seconds the heart beats become stronger, and consciousness is regained. Remember *not* to raise the head of a fainting person.

295. Effects of alcohol upon the heart. — The first effect of alcohol is to increase the force and frequency of the heart beats. This sends more blood through all the body, and there is a feeling of greater strength, which is called *stimulation*. Men take strong drink for this effect. This feeling comes on within a few minutes after drinking and passes off in the course of an hour. Then the

drinker feels a desire for more alcohol and so forms a habit of its use. While a little alcohol may make a man feel better, yet the strength and endurance of his heart is really diminished. Alcohol is like a whip which makes the heart beat harder for a time but leaves it less able to do its work in the future. Its blow is pleasant at the time it is given, but it is all the more harmful because it is enjoyed.

296. Effects of continuous drinking. — The derangement of digestion and assimilation resulting from long-continued drinking impairs the nutrition of the whole body, including the heart. Drinkers confound the absence of fatigue with strength itself.

297. Effects of tobacco upon the heart. — Tobacco used in any form is a direct poison to the heart's muscle and causes it to beat with less strength. When a large amount is used, it poisons the nerves of the heart and hinders their harmonious action. Then the heart will beat irregularly, and there will be palpitation on slight exertion, so that hard physical exercise becomes an impossibility. The trouble may be only an inconvenience, so that the person cannot engage in violent exercise; but in its severe forms it may be the cause of death.

SUMMARY

1. The blood is kept in constant motion by a double muscular pump, called the *heart*.
2. The heart contains two pairs of *cavities*, each consisting of an *auricle* and *ventricle*.
3. Between each auricle and ventricle there is a *valve* which permits blood to flow into the ventricle, but keeps it from flowing back.

4. Each ventricle contracts upon the blood about *seventy-two* times a minute, forcing it out through a tube called an *artery*.
5. Blood is kept from running back into the heart by a valve at the beginning of the artery.
6. The heart contains a nervous mechanism which makes it partially independent of the rest of the body.
7. The heart has great power of resistance against disease, and of accommodating itself to increased work, so that heart disease is less to be feared than disease of almost any other part of the body.
8. Alcohol at first causes the heart to beat faster and more strongly than the body needs, thus causing it to tire itself out.
9. Alcohol soon weakens the heart by impairing its nutrition.
10. Tobacco makes the heart beat irregularly and with less power.

DEMONSTRATIONS

70. The left side of a chicken's heart closely resembles a man's left auricle and ventricle, and can be used to show the cavities and valves. In removing it, be careful to preserve its covering of pericardium. A pig's, or sheep's, or bullock's heart is more like a human heart. The butcher should be instructed not to cut off the auricles. (See demonstration 35.)

71. The heart of a frog or fish which has just been killed should be removed to show its persistence in beating. (See demonstration 35.)

72. Have the students listen to each other's hearts so as to get a clear idea of the two sounds. Feel the heart beats upon the chest, and notice how they increase in force and frequency when a person rises after lying down, and more yet when he walks and runs.

REVIEW TOPICS

1. Describe the heart: its situation, pericardium, cavities, and valves.
2. Describe the action of the heart and the flow of blood through it.
3. Describe what may be heard, seen, and felt by examining the body over the heart.
4. Describe the nervous mechanism of the heart.
5. Give the effect of violent exercise upon the heart.
6. Discuss palpitation of the heart.
7. Describe a fatty heart.
8. Describe how the valves of the heart may be diseased.
9. Describe fainting and its treatment.
10. Give the effects of alcohol upon the heart.
11. Give the effects of tobacco upon the heart.