A HEALTH READER FOR INDIAN HIGH SCHOOLS

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TORONTO

A HEALTH READER

FOR

INDIAN HIGH SCHOOLS

BY

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"KNOW THYSELF"

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DIRT AND DARKNESS

MARRIED

AND HAD ISSUE

DISEASE AND DEATH

IGNORANCE AND SUPERSTITION

ATTENDED THE WEDDING

AND ARE GOOD FRIENDS OF THE CHILDREN

PREFACE

THE object of this book is the statement of simple truths in simple language, and the provision of a suitable "reader" for the upper classes of Indian High Schools.

If there be anything a boy ought to know, it is the elements of the truth about his body and the laws which govern it.

This Second Edition has been revised in accordance with the suggestions of a distinguished officer of the Indian Medical Service.

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PART I.

THE HUMAN BODY.

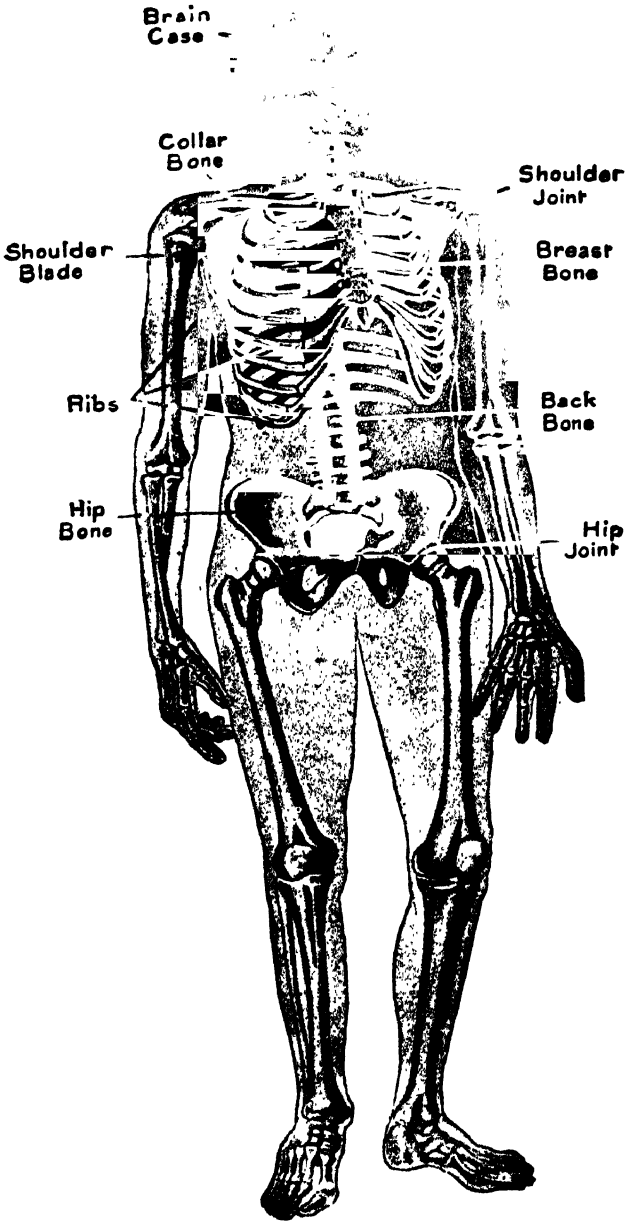
CHAPTER I.

THE SKELETON.

BEFORE any kind of building can be erected a framework of some kind is necessary for its support. There must be foundations, pillars, walls, girders and other stone and iron supports. The framework which supports the human body is called the skeleton, and consists of a number of bones—more than 200 in all. These bones not only form a supporting framework for the body as a whole, but also protect and support various important organs. The great supporting bones are those of the legs and back-bone, the carrying and protecting bones are those of the skull, pelvis, ribs and back-bone.

Let us consider first the head, then the trunk, and lastly the limbs.

The bones of the head forming the *box* called the skull are 22 in number, 14 of which are in the face. Why should we have such a large


Brain Case
Collar Bone
Shoulder Joint
Shoulder Blade
Breast Bone
Ribs
Back Bone
Hip Bone
Hip Joint

number of bones, and why should they form such a very strong box? They form a strong box because they have to contain the greatest treasure of the body—the brain, which is the seat or home of the mind, soul, intelligence, will, feelings, and the *self* of the person. And the

brain is as delicate as it is important—the slightest injury to it may cause death or lunacy.

The bones are numerous, because the skull is thus stronger. If a big Bombay shop had one great plate-glass window, and this window was struck by a stone, it might be smashed, and a whole new window would have to be put in. But if it had many small pieces of glass in frames, making one window, the stone could

only smash *one* of them and far less damage would be done. Similarly with the bones of the skull. If the skull were all in one piece, like a hollow glass ball, a single blow might shatter it and cause death. When it consists of many pieces the same blow will break only one of the bones, and if it does not break it so badly that the brain is touched, the wound will heal.

The trunk, or body, contains the back-bone (or spine or spinal column), the ribs, and the breast-bone.

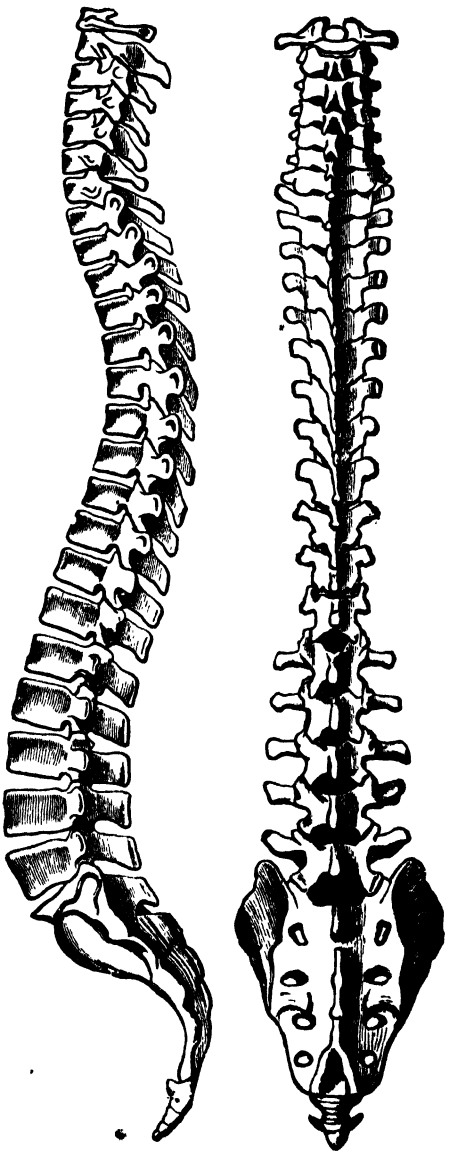
The back-bone is not one bone at all. It is a column of bones, 33 in number, all fastened together, one on top of another, like a number of cotton-reels on a string. Why is this? Because otherwise we should be unable to bend our backs. Not only does the back-bone support the trunk, but it protects the spinal cord, which runs down the centre of it from the brain (just as the string runs through the holes in the cotton-reels). It is like a very strong and flexible pipe protecting a delicate and important cord. For, like the brain, the spinal cord is as delicate as it is important. If it were cut at any point the whole of the body below that point would become as though dead. It would have neither feeling nor the power to move, and would be said to be "paralysed." If you were to put red-hot coals on the feet of a man whose spinal cord had been cut

he would not know it, unless he saw you do it.

The ribs form a kind of *cage* for the protection of the next most important organs of the body, the heart and lungs. There are 12 on each side, running round the body from the back-bone behind, to the breast-bone in front.

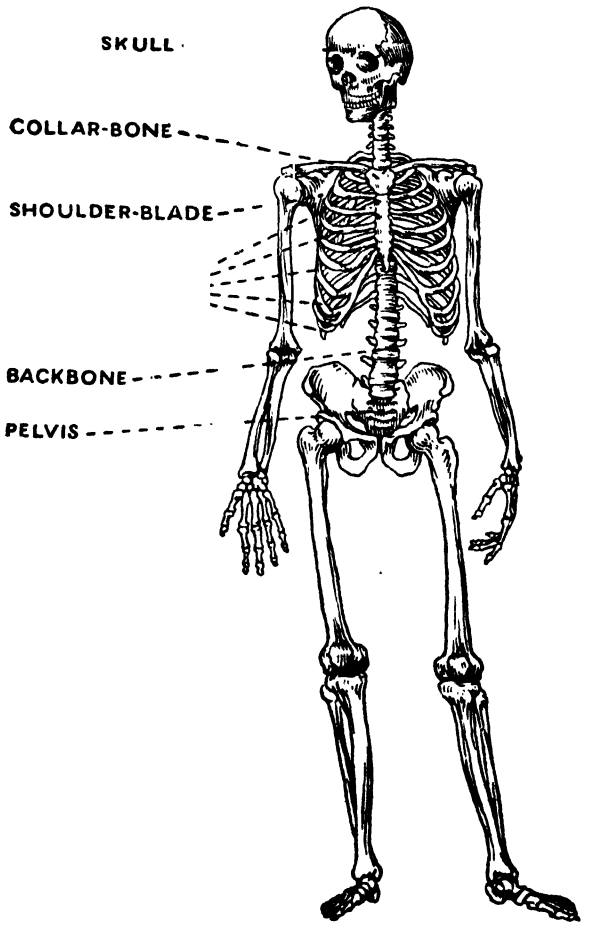
The pelvis is like a *basin* of bone, and contains and supports the organs of digestion. You can feel the sides of it by the hips.

The limbs are the arms and legs, with the hands and fingers, and feet and toes. The arm includes the shoulder-blade, collar-bone, upper-



THE BACK-BONE.
Side and back views.

arm, fore-arm, wrist and hand. There are two bones in the fore-arm, eight in the wrist, five in



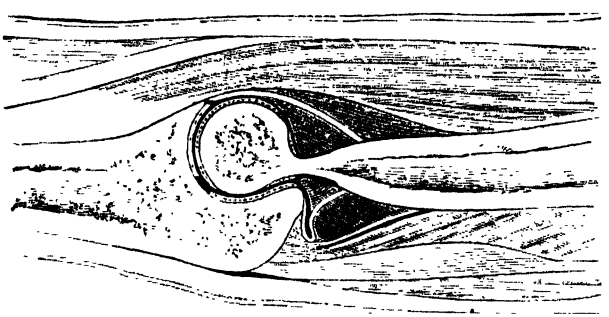
the hand, and fourteen in the fingers of each hand.

You can feel your shoulder-blades if you put your hand behind you—flat triangular bones, and you can see and feel your collar-bones, on each

side of the throat. Why should there be so many bones in the arms and hands? To enable them to turn and twist and bend in every direction, so that things can be grasped and actions performed.

In each leg are the thigh-bone, knee-cap, two leg-bones, twelve bones in the foot, and fourteen in the toes. Why are there so many bones in the legs? To enable them to move in all directions.

Wherever two bones meet there is a joint. There are three kinds of joints—those which allow of no movement, those which move like a hinge, and those which move like a ball in a cup. The bones of the top of the skull have joints of the first kind, and simply fit into each other.



LONGITUDINAL AND VERTICAL SECTION THROUGH THE ELBOW-JOINT.

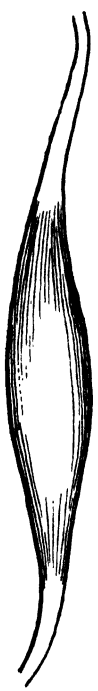
At the knee and elbow are "hinge" joints, allowing the bones to move only backward and forward, but not sideways. At the thigh and shoulder are "ball and socket joints," allowing of movement in every direction.

Thus you see that the human body has a framework or skeleton which is not only strong and able to support and protect, but which will also bend, twist, turn, and move in every direction.

CHAPTER II.

THE MUSCLES.

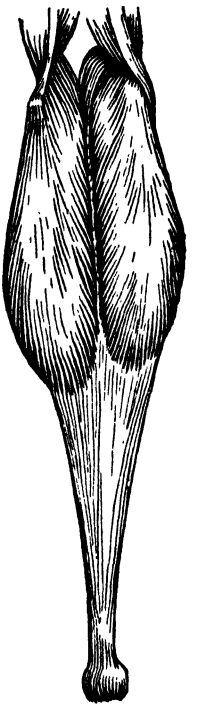
THE muscles enable us to perform all the motions and actions which we desire to perform. It is only by means of the muscles that we can move our bones so that we can stand up, sit down, walk, run, jump, throw, eat, swim, play games, and perform actions. Muscles make up the *flesh* part of our bodies and are really bundles or strips of flesh (or "fibre").



A MUSCLE SHOWING A TENDON AT EACH END.

There are two kinds of muscles, those that go on with their work without any orders from the brain, and those that continually have to receive orders, and never work without them. The heart, for example, is a great muscle and keeps on working day and night, whether we think about it or not. The breathing

muscles do the same thing, and so we breathe while we are asleep, without having to wake up and think about it. Such muscles are called "involuntary" muscles, while those which we ourselves can set to work, and stop from working, are called "voluntary" muscles. Our legs never make us get up and walk unless we wish to do so, and our hands never reach out and seize something until the muscles have received orders from the brain. Muscles which are used regularly and with care, increase in size, while those that are not used decrease. Anyone can increase the size of any, or all, of his muscles if he wishes to, and, what is still better, he can increase their health and strength, and improve their quality. But it must be remembered that it is nearly as bad to *overwork* a muscle as it is to neglect it altogether.

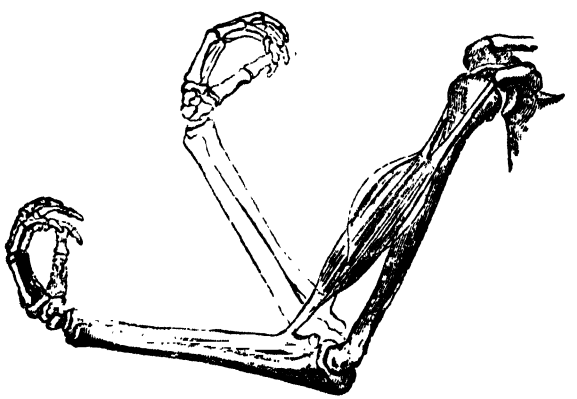


MUSCLES OF THE LEG (CALF).

The ends of muscles are fastened to bones by means of short *tendons*, which are very strong *strings* of a kind of hard, tough, flexible substance called gristle, or cartilage. Muscles move bones by contracting and thickening themselves. If you put your arm out straight and look at the

biceps muscle in front of the upper arm you will find it long and thin. But if you bend your arm at the elbow, and bring your hand up to your shoulder, you will find the muscle short and thick. By contracting itself and making itself shorter and thicker, it brought the lower arm up to the upper arm.

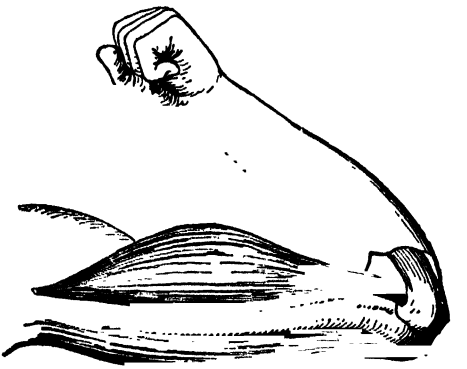
No action can be performed without the use of one or more muscles, and the entire body is covered with them. Some are used much more than others, and so grow much larger than those which are less used. The largest and most important of the external muscles are those of the front of the upper arm, of the back of the upper



THE BONES OF THE UPPER EXTREMITY WITH THE BICEPS MUSCLE.

arm; of the side, front, and back of the shoulders; of the chest, of the abdomen (or belly), of the back; of the front of the thigh, of the back of the thigh; and of the calf of the leg.

If these muscles are well-exercised and large, the body has a look of strength and activity, and is said to be muscular. It is a fine thing to be muscular, because it shows health and strength, and these mean happiness. A man who is strong and muscular can do his work well, protect himself, resist disease, and usually enjoy manly games; all of which still further adds to his contentment and happiness. The healthy mind is in the healthy body and also the quiet, calm, and peaceful mind. We shall read more about these muscles later on, and how to make them strong and quick.



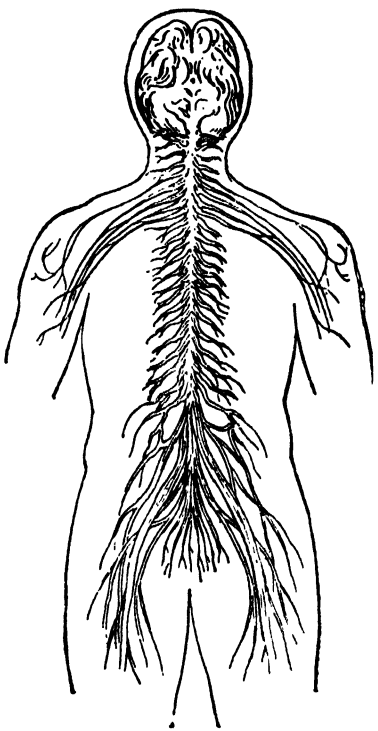
BICEPS MUSCLE.

CHAPTER III.

THE NERVES.

BUT how do the voluntary muscles know when the brain wishes them to move? By means of the nerves. Nerves are like telegraph wires, and the brain is like the great central telegraph office. Thoughts about actions are the telegrams.

From the brain runs the spinal cord down the centre of the bones of the neck and spine (or back-bone) and this is the main telegraph wire or nerve. From it run nerves to every part of the muscles and flesh of the body. If you can find any part of the body that is unable to feel pain, that part of the body has no nerves. But we can feel pain in every part of the body except the hair, nails, and outer skin. Prick yourself anywhere with a pin, or cut yourself with a knife, and you at once feel pain. But you feel no pain when your hair and nails are cut, or if a pin is run sideways through your skin without piercing the flesh; and this shows that in these parts there are no nerves. Therefore the brain can neither send messages to the outer skin, nails, or hair, nor receive messages from them. They are like those villages to which no telegraph wire runs.



NERVOUS SYSTEM.

If someone cut a piece of your hair while you

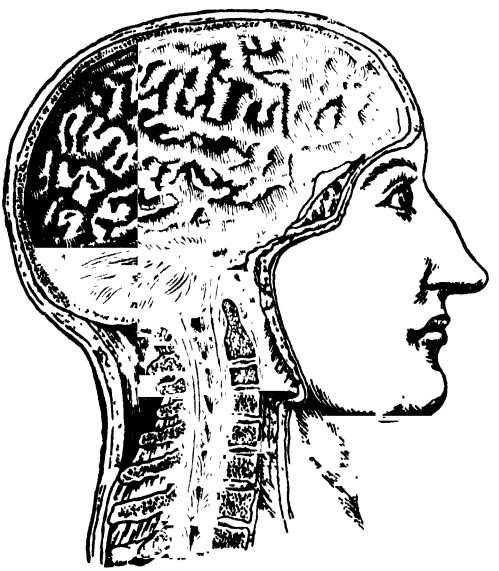
were asleep, or when you were not looking, you would not be aware of the fact, because there are no nerves in the hair to telegraph the news to the brain. But if anyone stuck a pin into any part of your body you would know it at once, because the very first nerve that the point of the pin touched would at once send the news to the brain.

A boy is walking along with you and says, "Stop a moment, I have a nail in my shoe." What has happened? The point of a nail has come through the leather of the sole of his boot. He did not know it. It began to press into the thick outer skin of the sole of his foot. Still he did not know it. It passed right through the skin and touched the flesh underneath. He at once knew all about it then, as the first nerve that the nail touched telegraphed the information to his brain.

Is it a good thing that such news should be sent at once? Certainly it is. If he had no feeling in that foot because there were no nerves there, he would go on walking and at each step the nail would enter further and make the hole larger. Dirt and dye would find their way in, and by the time he came to take off his boot there would be a sore under his foot which would be dangerous by reason of the chance of blood-poisoning.

Pain is one of the finest things in the world, and if there were no nerves there would be no pain.

When a man's tooth aches, the nerves tell the brain that they are being hurt because they are no longer covered and protected by the hard shell of the tooth. If the man is wise he goes at once to the dentist, has the hole stopped, and saves his tooth. Pain is always a warning, and usually a punishment.



Thus the messages pass to and fro, and when the nerve is cut no message can pass, any more than it can along a broken telegraph wire. The brain cannot tell the muscle what to do. An injured place cannot say that it is injured.

It is by means of the nerves which go from the eyes to the brain that the brain knows what the eye sees, and by means of those which go from the ear, nose, and tongue, that the brain knows what the ear hears, the nose smells, and the

tongue tastes. If the nerves were cut between these organs and the brain there would be no sense of sight, hearing, smelling, or tasting, although eyes, ears, nose and tongue were still uninjured and the brain still uninjured. They would be like far-off telegraph offices between which and the great head office the wires had been cut. Neither they nor the central office are damaged, but there is no means of sending information and exchanging messages.

Nerves are like very tiny, thin, white cotton threads. The spinal cord is a white cord half-an-inch broad and eighteen inches long, and the brain is a mass of soft grey matter. It lies in many folds and wrinkles, and usually the more numerous these are the more intelligent is the man (or animal).

Man has a very big brain indeed, in proportion to his size.

CHAPTER IV.

BREATHING.

We begin breathing as soon as we are born, and we go on breathing, night and day, awake or asleep, until we die. If a person's breathing is stopped for a few minutes death follows. We breathe sixteen or seventeen times a minute, and

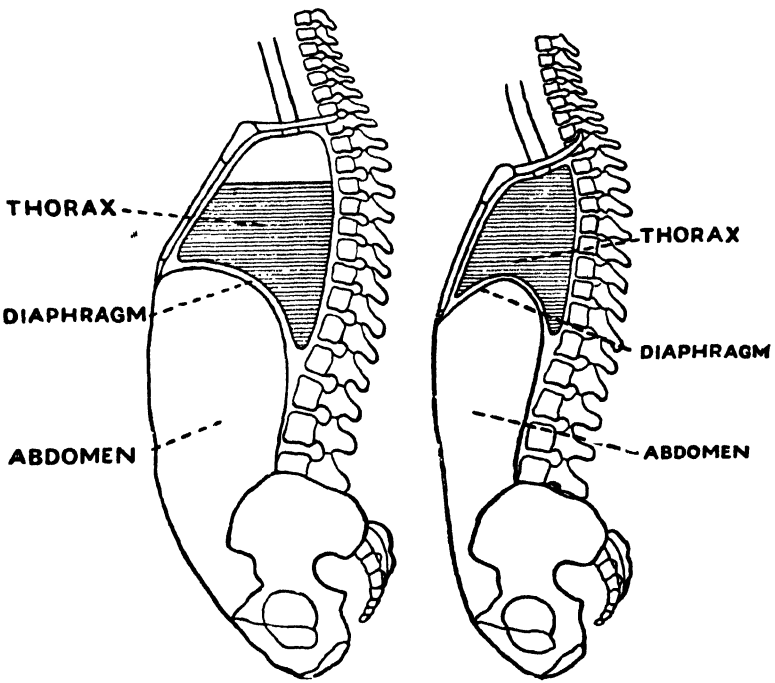
take in, and breathe out about twenty to thirty cubic inches of air each time. There is a great difference, however, between the twenty or thirty cubic inches of pure air that go into the lungs and the twenty or thirty cubic inches of gas that come out.

Pure air consists of two gases mixed together, Oxygen and Nitrogen. Nitrogen only "dilutes" and weakens the Oxygen, which is the gas we require, but which is too strong for use by itself. We shall read more about it later on.

The "air" which is breathed out of the lungs is really air no longer, but a mixture (of gases) which is poisonous. The Oxygen has gone and its place is taken by Carbonic Acid Gas. What has happened? The body is like a long box divided into two parts or compartments. The upper box is the thorax or chest, and the lower box is the abdomen or belly. In the chest are the heart and lungs.

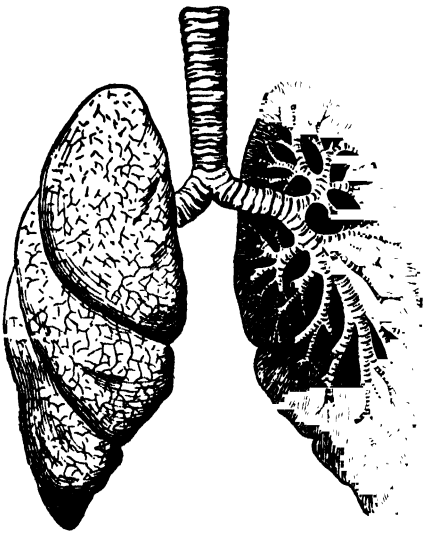
When we breathe in (or inspire) the lungs fill out as a bladder does when you blow into it, and when we breathe out (or expire) the lungs empty again very nearly. As this happens the whole chest expands and contracts, and the front of the chest can be seen to rise and fall. We can take in a number of deep breaths if we wish to, but as a rule breathing goes on without our thinking about it. This is because the bottom of the box,

called the thorax, consists of a great arch-shaped muscle called the diaphragm, which, during the whole of one's life, continually expands and contracts sixteen or seventeen times a minute. It is



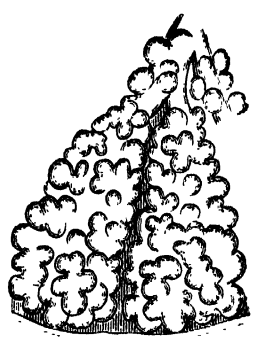
an "involuntary" muscle and goes on doing its work without any orders from the brain. During the act of breathing it contracts and pulls itself flat; this pushes the ribs out and enlarges the chest. As the chest is enlarged air is bound to rush in or there would be a vacuum somewhere. When the handle of a pair of bellows is raised and the inside space is enlarged, air is bound to rush in

through the pipe to fill the space. So with the lungs, and the air rushes in through the mouth and nostrils (if the mouth is open—which it should not be) and fills the lungs. When the lungs have taken in as much air as they can hold, there is a short pause while the Oxygen does its work, and then the diaphragm expands and goes back to its former shape as an arch, the ribs close in and the chest becomes smaller again. This causes most of the air to rush out again, just as happens when the handle of a pair of bellows is pressed down, or when a hollow ball is squeezed flat. The actions of inspiring and expiring are called "respiration." There are two lungs, one on each side of the heart. The lungs are not hollow bags like leather bottles. They are rather more like sponges, and consist of a vast number of tiny cells, called air-cells, arranged together somewhat like grapes in a bunch. It would take forty of them in a row to cover an inch, and if they were all spread out they would cover an



THE LUNGS, INFLATED.

area of about 14,000 square feet. Now each of these tiny air-cells has a great number of tiny blood-vessels in its walls or sides, and these blood-vessels are constantly and hungrily taking Oxygen from the air and using part of it to burn up the waste matter in the blood. Have you ever wondered why your body is warm and your breath hot? There is *burning* always going on in your lungs, although there is neither flame nor smoke. As the Oxygen burns up the waste matter in the blood and makes the blood pure, it is turned to Carbonic Acid Gas and this gas is breathed out of the lungs along with the Nitrogen which came in with the Oxygen and which has remained quite unchanged. (Perhaps your teacher will show you some experiments with Oxygen.) The pure air going into the body and the foul air coming out are something like the coal that goes into the factory and the burnt up ashes that come out. The coal can give heat, burn, do work and keep the engine going. The ashes are useless, waste, can do no good, and if thrown on to the fire will put it out. We shall read more about this later.



LUNG TISSUE.

CHAPTER V.

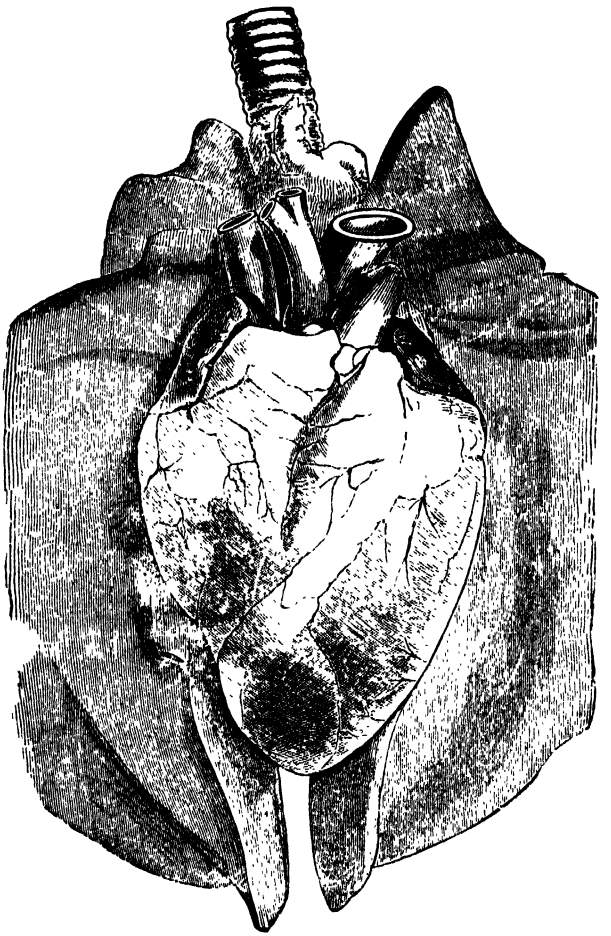
THE BLOOD AND ITS CIRCULATION.

EVERY part of the body contains blood except those parts, the hair, nails, and outer skin, in which there are no nerves and no feeling. Blood is the "stream of life," and if the stream flows out through a cut we die. If the blood is in a bad state and impure, we are unhealthy. For us to be in a state of complete health and strength, our blood must be perfectly pure.

The blood is constantly flowing along in the blood-vessels throughout the body in a never-ceasing stream, on a journey that begins in the heart and ends in the lungs before starting afresh in the heart, feeding, cleaning and warming the body. The heart is a pump which never ceases, from birth to death, to pump blood through the blood-vessels. It works from seventy to ninety times a minute. It is one of the involuntary muscles and, like the diaphragm, continues its work night and day without any orders from the brain. If it stops, we die. Like all other muscles, it does its work by contracting and expanding.

When the heart, which contains four chambers and is full of blood, contracts all the blood is driven out, just as air is driven out of a hollow

ball when it is squeezed, or water is driven out of a *mussack* or bhisti's water-bag. Impure

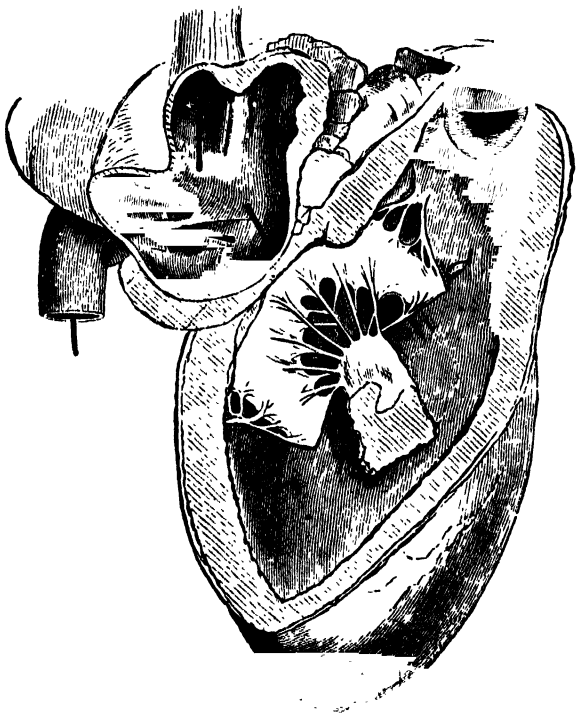


HEART OF A SHEEP.

blood is driven from one side of the heart to the lungs, and pure blood from the other side all over the body.

The pure blood, thus driven out, runs along

great blood-vessels (called arteries) and then along smaller ones, and then along still smaller ones until it comes to some too small for the eye

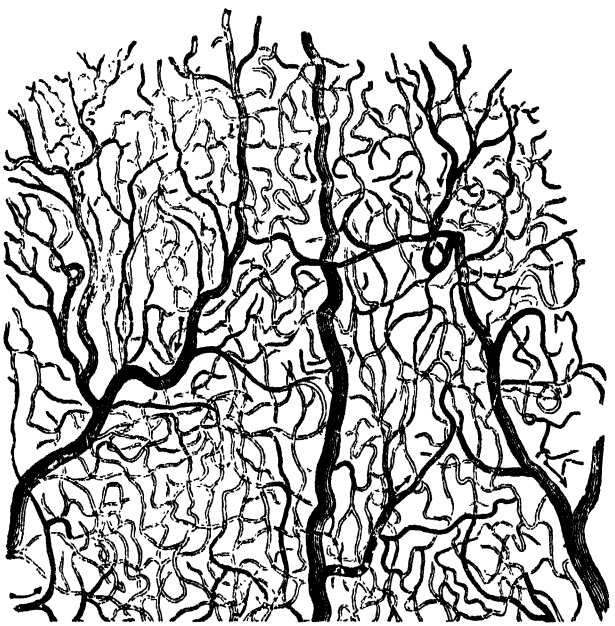


RIGHT SIDE OF THE HEART OF A SHEEP.

to see. These tiny hair-like blood-vessels are called capillaries, and the walls or sides of them are so thin that the "food" in the blood, which is to feed the muscles and build them up, can pass right through them. The capillaries are so numerous that we cannot prick any part of the body with a pin without breaking them and causing blood to ooze out.

In these capillaries the blood does its work of fetching and carrying—fetching oxygen and new material to build up the "tissue" or flesh of the muscles, and taking away the used-up, waste matter. Every time we use a muscle, part of it is destroyed, wasted, and used up; and that tiny used-up portion has to be removed by the blood, and its place supplied with new tissue or flesh.

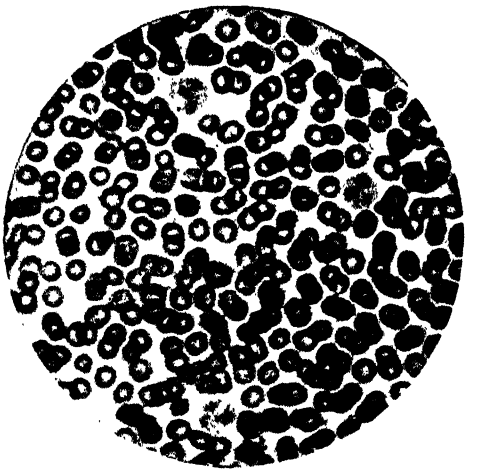
As the blood passes through these millions of capillaries in all parts of the body it loses more



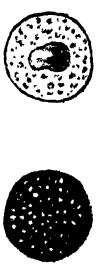
WEB OF A FROG'S FOOT MAGNIFIED.

and more of its oxygen and pure flesh-forming matter, and gains more and more waste, poisonous matter. It changes colour as this goes on, from

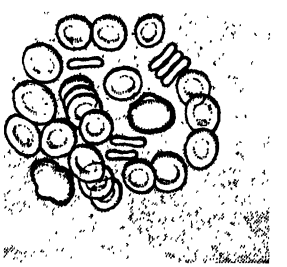
a bright red to a dark purple colour. As it goes further on it enters larger blood-vessels (called veins) and then larger and larger ones, until at last it flows by a very big vein, as big as your finger, into one of the chambers of the heart, and from there as the heart contracts it is driven into the other chamber on the same side, and from there, as the heart contracts again, it is driven along a big artery into the lungs.



BLOOD SEEN UNDER THE MICROSCOPE.



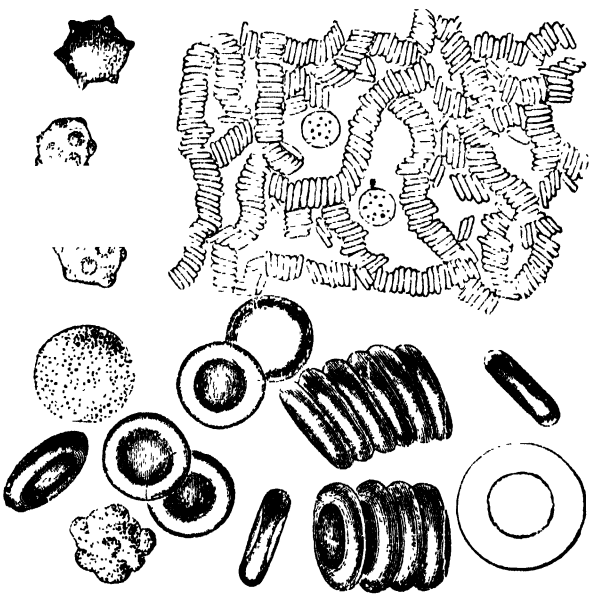
TWO WHITE CORPUSCLES.



BLOOD CORPUSCLES MAGNIFIED 400 TIMES. Two white corpuscles are shown.

In the lungs the impure blood flows into the millions of capillaries in the air-cells, and

while in these capillaries, the Oxygen of the air purifies it by burning up all the impure, useless, waste matter it has brought from the various parts of the body. The blood then flows on, and again enters the heart as pure blood containing Oxygen, and is again pumped through the arteries



RED AND WHITE CORPUSCLES OF THE BLOOD.

into the capillaries to do its work of fetching the new pure matter to the muscles, and carrying away the used-up, worn-out matter. And this goes on night and day from birth to death.

Blood looks, as you know, like a red liquid, but it is really a colourless liquid full of millions and millions of tiny red bodies, shaped like

rupees. They are so tiny that 12,000 of them in a pile, like a *pile* of rupees, would only be an inch high. If they were laid flat in a row like a *row* of rupees it would take 3,200 of them to extend the distance of one inch. They are called red corpuscles. These little corpuscles take up Oxygen in the lungs and carry it to all parts of the body, and this is their work. They are little oxygen-carts. There are also white corpuscles in the blood, about one to every five or six hundred red corpuscles. They are larger than the red corpuscles and are always changing their shape. They are scavengers or sweepers, and if they come across any disease-germs (or "seeds") in the blood they eat them up and destroy them, if there are not too many. They are a kind of policemen or soldiers as well as sweepers, and they arrest disease-germs and fight against their armies.

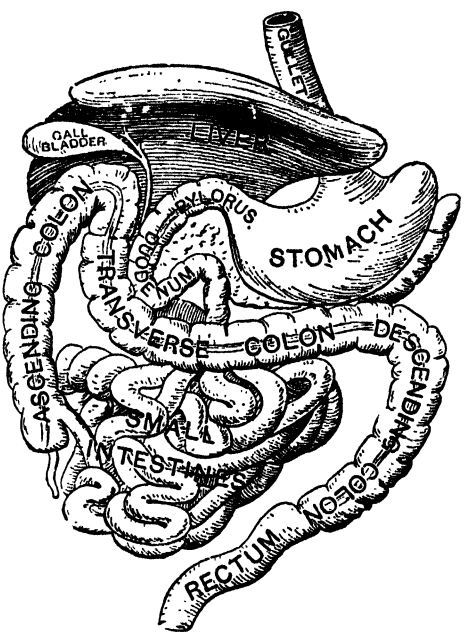
CHAPTER VI.

DIGESTION.

And how is the blood, that feeds the body, itself fed? It gets its food straight from the stomach and intestines, which turn the rice, ghee, vegetables, bread, milk, sugar, fruit, and whatever else we eat into food for the blood. This work

is helped by the teeth, saliva (or spittle), the tongue, and the liver.

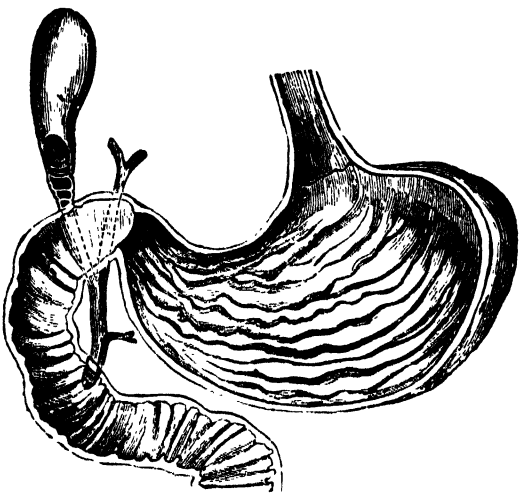
If a man makes his stomach do what his teeth ought to do it will soon get indigestion, and fall ill. The work of the teeth is to grind food up and turn it from a solid into a kind of paste or thick liquid, by mixing it with the saliva or spittle, which flows into the mouth from tiny pipes while the food is there. Every day over twenty ounces of saliva are used to dissolve and soften food.



The tongue helps by rolling the food about in the mouth, pushing it between the upper and lower teeth, and moving it backwards to the throat in the act of swallowing.

From the mouth the chewed-up food passes down the food-pipe or gullet to the stomach, which is about ten inches below the throat. If you want to live long and be healthy, see that no food passes along this pipe until it has been chewed almost into a liquid.

The stomach is a bag, and it is one of the most important organs of the body. If it is out of order through bad treatment, the whole body is soon out of order, and illness follows. The chief kinds of bad treatment that the stomach gets are the giving it half-chewed food, too much food,



THE STOMACH LAID OPEN.

too little food, or bad food; and allowing it to get a "chill" or cold.

The walls of the stomach are full of tiny pipes which pour juice into it when it contains food, just as tiny pipes pour saliva into the mouth. About 15 lbs. of this juice are used daily. It is known as gastric juice, and it carries on the work (of dissolving the food) begun by the saliva. There are no teeth in the stomach, of course, but

the food is rolled about in it just as it was in the mouth. The stomach does this by continually contracting and expanding from end to end. It is another of the involuntary muscles, and keeps on working without any special messages from the brain. If it stopped working we should die of starvation, however much we ate.

After the food has been in the stomach for some time, and has been thoroughly mixed with the gastric juice, much of it becomes fit for blood-food, and passes into the capillaries in the walls of the stomach and becomes blood.

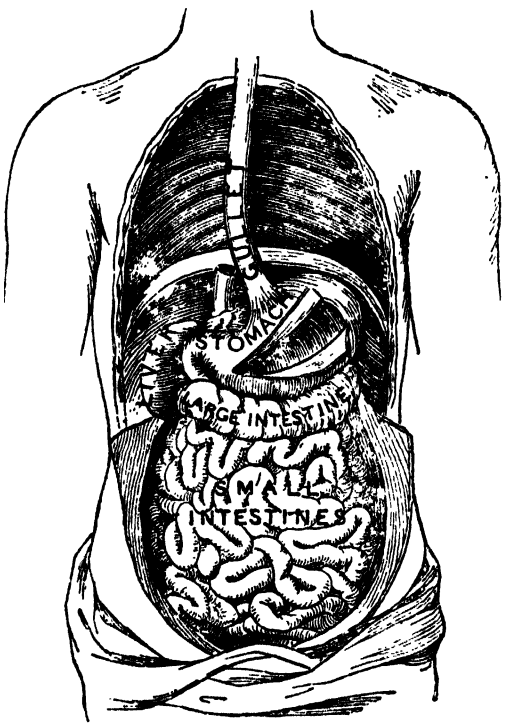
Much of the food is not yet fit to become blood, and goes on out of the stomach into the intestines. These are long pipes, of which the small intestine is twenty feet in length, and the large intestine five feet.

In these intestines the food is still further changed by juice which flows into them from tiny pipes in their walls. From the liver also another kind of juice, called *bile*, flows into the small intestine near the stomach, and again still further helps to change the mixture into blood-food.

The liver is a very important organ, weighing from 2½ to 4 lbs., and at any moment containing nearly half the blood in the body. If it gets out of order through a chill, want of exercise, or bad food, we at once feel very ill.

The juice which it pours into the intestines dissolves fat, prevents the food from decaying, and helps it to pass along.

As the food continues its way through the intestines, more and more of it is taken into the capillaries in the walls of the intestines, and becomes blood. What is useless passes on until it leaves the body as excreta.



The water that we drink goes into the blood in the same way, and what is not required is taken out of the blood with other impurities by the kidneys, and leaves the body as urine. Some leaves the body as perspiration.

What do we mean, then, when we speak of "the best kinds of food"? We mean those kinds of food that the teeth can most easily break up, the saliva most easily mix with and dissolve, the

gastric juice most easily mix with and dissolve; and that contain the greatest quantity of matter that can be taken up by the capillaries in the stomach and turned into blood. The finest, purest, and best food of all is milk. Other excellent foods are bread, cheese, fish, chupatties, ripe fruit, ghee, butter, and vegetables. Some doctors consider meat an excellent food, and some do not.

Foods that do less good are sweetmeats, pastry, spices, and condiments like pickles, curries, and "made" dishes made up of odds and ends by the cook.

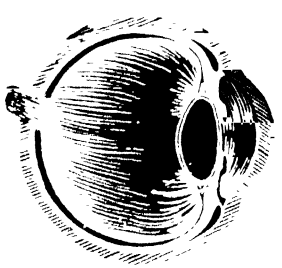
Change and variety of food are good, and all food should be fresh, clean, pure, and, if cooked at all, well cooked. It should be eaten slowly and in sufficient quantity to appease hunger without causing a feeling of fulness and discomfort.

CHAPTER VII.

THE ORGANS OF SENSE.

THE organs of sense are sometimes called the "windows of the soul," because it is by means of them that the soul looks out upon the world, and through them that the light of understanding enters the mind. There are five senses—seeing,

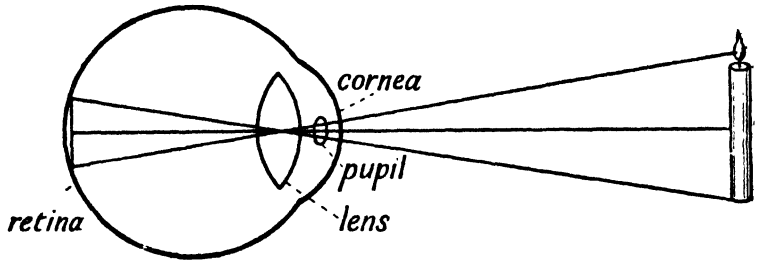
hearing, smelling, tasting and touching; and the organs of sense are the eyes, ears, nose, tongue and the surface of the body—usually the finger-tips. Whatever we know, we know by means of these five senses. With the eye we get knowledge of shape, size, colour, distance, beauty and so on. With the ear we get knowledge by hearing speech, and ideas of beauty, discord and distance, and feelings of pleasure or the reverse. With the nose we get knowledge of decay and wholesomeness, and feelings of pleasure or disgust. By means of the tongue we get knowledge of sweetness, sourness, bitterness, ripeness, unripeness, decay and wholesomeness, and feelings of pleasure and disgust. By means of the nerves just beneath the skin we get knowledge of heat, cold, roughness, smoothness, comfort and discomfort or pain. We use the tips of the fingers for "feeling" any new substance we wish to examine, and for finding out whether anything is hot or cold.



The loss of one of the senses is a terrible hardship, and the utmost care should be taken of the organs of sense, and especially of the eye.

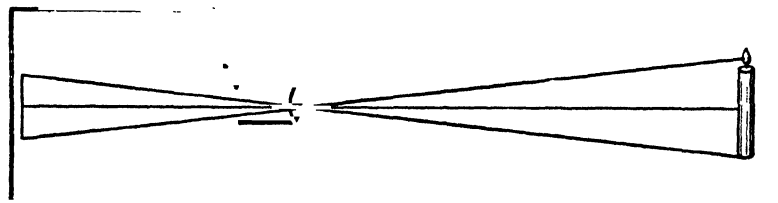
A blind man is perhaps the most pitiable object on earth. A deaf man is at a very great disadvantage, and a man who cannot smell runs

more risks than other people. One who was unable to taste would also be in danger of sometimes eating food which was unfit for use.



As sight is the most important sense, so the eye is the most delicate organ of sense, and the one most easily injured. Do everything in your power to preserve your eyesight, and, if it is not perfect, go at once to the nearest eye-hospital.

The eye is like a photographer's camera, and has its lens and its plate, its shutter and its "diaphragm" for making the hole, through which the light enters the lens, larger and smaller.



The black spot in the centre of the eye, called the "pupil," is really a hole behind the bulging front cover called the *cornea*, which, like a plate-glass window, protects the eye.

Light goes through this clear, glass-like cornea and is admitted to the eye through the pupil. If there is but little light and we cannot see well, the pupil enlarges and lets in as much light as possible. When we are out in the sunlight the pupil contracts and lets in as little light as possible. Behind the pupil is the lens (as in the camera), and behind the lens is the *retina*, on which the picture of what is being looked at is made by the rays of light. It is like the "plate" or film in the camera. The eyelids are something like the shutter of the camera, and the involuntary muscle that makes the pupil larger and smaller is like the diaphragm. (Perhaps your teacher will show you a camera and let you see the picture on the glass at the back. You will then quite understand about the retina.)

All kinds of eye-disease are very common in India, owing to the strong light, dust, famines, smallpox, bad housing, and the ignorance and carelessness of the poor. Strong light causes the "night blindness" known as *rāt kana*, which is due to the exhaustion or tiredness of the retina—as though the "plate" were dimmed and useless. Dust (and germs) in the eye cause inflammation (redness and burning), which if neglected may lead to very serious trouble. In times of famine blindness is very common (especially among famine-orphans), due to

weakness from starvation. In cases of small-pox the cornea of the eye is often destroyed by ulcers. People living in dark, damp, and stuffy rooms very frequently suffer from diseases of the eye, and from weakness and shortness of sight. Poor ignorant people take no notice of sore and inflamed eyes for several days, and then apply "country" medicines, which increase the evil. Often they go to unskilled and unlicensed rascals who blind them for life by cutting the eye under the pretence of removing a "growth" which does not exist. Often they go to hospitals or good doctors and, because the *first* dose of medicine or the *first* use of eye-wash does not cure the disease, they throw the rest away, and say it is evidently useless.

In addition to the common eye-diseases are the injuries done to the eye by over-use and abuse. Indian students very commonly spoil their eyes and injure their eyesight by over-study, by reading by a bad light, by using badly-printed books, by reading in a lying position, by reading while travelling, by scribbling endless miles of notes in tiny writing, and by weakening the body generally. There appear to be more Indian students with spectacles than there are without. (It is, of course, absolutely right and necessary to wear glasses when the eyes require

them, but it is a terrible mistake to abuse good eyes until the glasses are required.) If you cannot see the black-board well, or if you have to hold your book close to your eyes when you read, speak to your guardian at once, and see an oculist (eye-doctor) or go to an eye-hospital.

The number of blind people in India is enormous, and the greater part of them owe their blindness to preventable and curable diseases. The commonest diseases are those of the inside skin of the eyelids and of the "white" of the eye.

When this skin is diseased, the signs are redness, swelling, pain, and difficulty in seeing properly. The disease lasts for ten days or a fortnight, and then, if properly treated, disappears. If neglected, *blindness* may be the result—so see a doctor if you ever have the signs of it. (Often there is an epidemic of this disease at the beginning of the rainy season.) Never put anything into your eyes except by advice of a *qualified* doctor or oculist. It is more likely than not that it will do injury rather than good. Plenty of washing of the eyes in pure boiled water, fresh air, good food, proper light, and rest, are what you can attend to yourself—but eye-medicine or operations are the business of only those who have made a

study of the eye and are trained and qualified men.

Cleanliness is the greatest of virtues in this disease, and it is to be borne in mind that the eye goes on poisoning itself by its own discharge if this is not constantly washed away. Never poultice or bandage eyes except by order of a doctor. The worst thing that could happen is to have foul matter (*pus*) shut up in the eye.

Sometimes this disease of the inner skin of the eyelids takes the form of little lumps on the inner surface of the upper lid; and at times the form of little grains or "granules," like grains of sago, lying in a line along the junction of the lower lid and the eye-ball. Often the lids swell and the upper lid hangs low over the eye, disfiguring the face and giving a look of dulness and stupidity. Neglect of this state of affairs is most dangerous, and, even if a long journey has to be taken, an oculist or doctor should be seen at once. Ulcers of the eye itself may follow, and injure the eyesight for life, and scars on the inner side of the eyelids may change the position and shape of the lids and cause a life-long disfigurement.

It should be remembered that many eye-diseases are "catching," and that anyone using the handkerchief, towel, pillow, or bed-clothes of a person suffering from some disease of

the eye is quite likely to get the disease himself.

When some small object like a grain of dust or piece of grit gets into the eye, it is a mistake to commence winking the eyelid and rubbing the eye. This causes the substance to scratch and hurt the eyeball, and does no good. Shut the eye and keep it still and no pain will be felt. Violent blowing of the nose may cause the thing to pass down the nose. If it does not, the lid should be turned back (in front of a mirror or by another person) and the offending body removed with the wetted corner of a clean handkerchief.

If you wish to take care of your eyes, and to see well without glasses all your life, obey the following rules :

Never read in a bad light—that is, a light which causes you to strain your eyes to see the print.

Never read in a lying-down position or when travelling by train or tram.

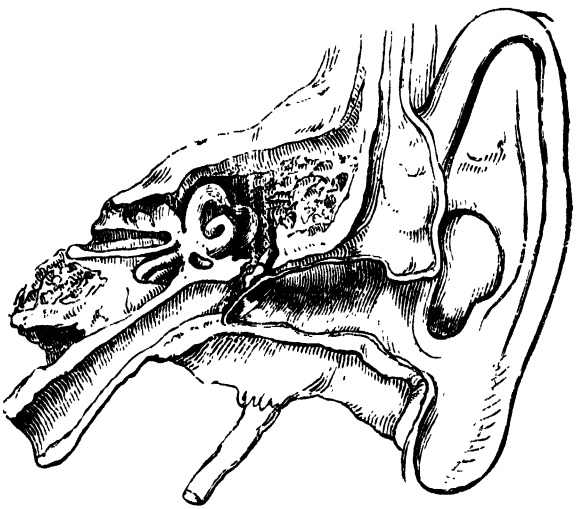
Never read tiny bad print for a long period.

Never overstudy or read for too many hours a day.

Wear dark glasses if you are spending a long period in a bright glare of sunlight, as when crossing sand, sitting where the sunlight falls on a whitewashed surface around you, or

walking for a long distance through streets at mid-day.

Have as much fresh air, good food, gentle exercise, and proper light as possible; eat good food, drink pure water, and keep as healthy as possible.



THE PARTS OF THE EAR.

Little need be said as to the care of the ear, beyond pointing out the folly of letting barbers and such people thrust steel instruments into the ear in order to remove wax. The ear removes its wax itself, as far as the place where it can be washed in the ordinary way—and it should be washed with soap daily.

Should an insect or some small article get into the ear, the best plan is to pour in a little oil, or

to squirt in warm water with a syringe. If this is not successful go to a doctor, and on no account thrust things into your ear yourself or allow any unqualified person to do so. The ear is a most delicate organ, and contains a "drum," the breaking of which causes deafness. A blow on the ear is always dangerous, as the sudden driving of air down the tube of the ear might easily break this drum.

Nor should anything be put up the nose for any purpose. The nose can, and should, be regularly cleaned with cold water, which can be drawn up the nostrils and ejected.

We have now learned a little about the body and how it is constructed. We shall now learn that the keeping of it in the best condition for work and play—that is, the keeping of it in good health—is very largely in our own hands.

If everyone in the world knew the simple laws of health and followed them, there would soon be no disease at all—or very little. Until that happens *we* can, at any rate, take all precautions against getting the diseases which are the results of the ignorance, carelessness, and filthy habits of other people. The diseases will still be there, but we can learn the best ways to avoid getting them.

We can also all do our best to inform and teach others who have not had the same advantages as ourselves. The spread of knowledge of the laws of health will benefit both them and us; because if ignorant and dirty people did not *cause* diseases, we should run no risk of *catching* the diseases.

PART II.

THE CARE OF THE BODY

CHAPTER VIII.

HEALTH.

HEALTH is quite the best form of wealth. It is far better to be very poor with good health than very rich without it. A coolie who never feels ill, always wants his food at meal-times, always goes to sleep directly he tries to do so, and is bright, happy, and cheerful, is far better off than any wealthy man who is in bad health, wants no food, is unable to sleep, and feels dull, sad, and wretched.

There is nothing in the world that is worth taking in exchange for health. An ounce of health is better than a ton of gold.

How can we keep healthy if we are born so, and if we are born unhealthy how can we try and get strong and well?

In the first place there are seven great laws which we must obey. They are:

1. Breathe pure air.

2. Eat good food.
3. Drink pure water.
4. Keep clean.
5. Do plenty of work.
6. Train your muscles.
7. Be temperate.

There are a hundred others, but these are the seven great ones, and anybody who obeys them will have a fair chance of keeping as healthy and strong as he was born to be.

By "do plenty of work" we mean "use all the muscles every day, and the brain as well." Schoolboys and those who do not earn their living with their hands have to do "work" that is play—football, hockey, cricket, tennis, running and gymnastics—if they wish to keep healthy. Coolies and people who work with their hands do not need other exercise for the body.

In some countries, and even in some parts of India, we might add an eighth rule, "Keep the body warm"—but usually the trouble in this country is to keep it cool.

In the northern countries of the world, many thousands of people die, and thousands more are in bad health, because they cannot afford the clothes and the fuel to keep the body warm in winter.

There are people in India who will tell you that the body is not worth care, and that, on the other

hand, it ought to be starved, kept filthy, and ill-treated. They say that the mind and the soul are the real things, and that the body is either nothing or else an evil.

Do not think of these questions while you are young. It will be quite time to decide such matters when you are grown up and have finished your education. When you are a man please yourself, but while you are a boy please your parents and make the best of the education for which they pay. And remember that you have to educate your *body*, your *character*, and your *mind*, if you wish to be a really educated man.

Even if you are so dull and foolish as to think that education is only passing examinations, you will pass the examinations better if you are well, strong, and healthy, and with a clear active brain, than you will if you are sickly, weak, and feeble, and unable to think without a headache.

The Romans, the greatest people of ancient times (and who made the finest empire the world has ever seen, except the British Empire), had a great motto, "Mens sana in corpore sano," which meant "The healthy mind is in the healthy body," and taught that no man can do his best and reach the highest success of which he is capable, unless he takes care of his body—that is, gives it pure air, pure food and water, cleanliness, and exercise.

Let us consider the seven great laws, but first

let us try and get some idea of what "germs" are, as we shall have to refer to them very frequently in speaking about health.

Germs are very, very small bodies, so tiny that the human eye cannot see them. It may help you to get an idea as to how tiny germs are, if you rule a square inch figure on a piece of paper.

DROPS OF DIRTY WATER MAGNIFIED.

Some germs are so small that no less than 400 *million* put close together would not cover the square inch!

There are germs everywhere. They are in the air, in our water, on the ground, the furniture, our clothes, ourselves, and our food. Each time we breathe we take hundreds into our lungs and breathe hundreds out. Do not think that all are dangerous, however. That is not so, any more than that all beasts are dangerous. There are

beneficial germs just as there are beneficial animals; harmless germs just as there are harmless animals; and deadly germs, which cause the death of thousands, just as snakes, panthers, and tigers do.

These dangerous germs are the germs of such diseases as plague, consumption, cholera, enteric, and dysentery. If there were none of these germs there would be none of the diseases, just as there would be no plants if there were no seeds. We may swallow these germs at every breath, yet if we are strong and healthy they can do us no harm. It is only when we are run down that the forces in our bodies are unable to overcome the invaders. We should therefore do all in our power to keep our bodies in good health, and therefore in the best condition to withstand the attack of these evil germs.

CHAPTER IX.

BREATHE PURE AIR.

AIR is a mixture of two gases, Oxygen and Nitrogen. Without Oxygen we could not live for five minutes. Nitrogen too is of use, for it weakens the Oxygen as water weakens brandy, wine, ink, or any liquid into which it is poured, and thus makes it fit to breathe.

If a sick person had to drink brandy he would not do so until at least four times as much water had been added. In the same way Oxygen is not fit to be breathed until four times as much Nitrogen has been added. By itself it would cause death, as it is too strong.

Pure fresh air, then, is air which is one-fifth Oxygen and four-fifths Nitrogen. The more of other gases that get into the air the worse it is for us.

In big towns other gases get into the air from factories, fires, and the breath of millions of people. In the monsoon there is much water-vapour in the air.

The air is therefore purer in the open country than it is in towns; and in dry clear weather than in the damp, misty weather.

During the monsoon, and when living in towns, we have to breathe the air as it is, and there is all the more need to be careful not to have *worse* air than is necessary.

If you were shut up in a room with a certain amount of food, and could not have any more brought to you when you had finished it, you would, in time, die of starvation.

In the same way, if you were shut up in a room into which no fresh air could be brought, you would die of suffocation when you had

finished the air in the room. That is to say, when you had finished the Oxygen in the air in the room.

If the room contained three thousand cubic feet of air there would be about six hundred cubic feet of Oxygen. As one breathes about three thousand cubic feet of air in an hour, by the time you had been in the room for an hour there would not be much Oxygen left. Its place would be taken by the very poisonous organic matter, that is, dead particles of the body, and by the gas, called Carbonic Acid Gas, which is breathed out of the lungs. The Nitrogen would be the same, but the health-giving, life-supporting Oxygen would be gone. The room would smell very nasty, and anyone coming into it would rush out again as quickly as possible, or throw open doors and windows to let in the fresh air.

Class-rooms, theatres, living-rooms, and other enclosed places where many people are gathered together, often smell horrible to anyone coming into them from the fresh outside air, because the room or hall, instead of being full of Nitrogen and Oxygen, is full of Nitrogen, Carbonic Acid Gas, and organic matter. This organic matter consists of very tiny dead particles of the body, so tiny that you cannot see them, and foul gases formed out of them. This matter is in the breath that comes out of the lungs. It is given off as

well from dirty skin, dirty hands or feet, dirty mouths, dirty teeth, and dirty clothes. The more carbonic acid gas there is breathed out, the more foul organic matter goes with it. The air is not bad enough to kill people, but it is bad enough to do them harm, cause headache, and, if they are not strong, to make them feel faint and ill. You would be very sorry to eat or drink poison ; then why *breathe* poison if you can help it ?

The only way to get rid of this bad air is to throw open doors and windows. It will escape through them and mix with fresh air outside, while pure air will rush in and take its place.

Be in the fresh open air as much as you can, and when you are indoors try and have the air of the room as fresh as the air outside by opening doors and windows. If you want to *feel* well, *be* well and *do* well—keep the air of the rooms in which you live by day and sleep by night *fresh*, *sweet*, and *pure*.

There is another reason for opening doors and windows as much as possible. Man's tiny but deadly enemies, germs or microbes (about which we shall read later), love bad air and darkness. They flee before sunlight and Oxygen like mice before a cat—or rather they are killed when sunlight and Oxygen pour into a room as insects are killed when water pours into the hole in

which they are. Light and fresh air are usually their destroyers as they are our saviours.

When we say that air is "pure," we mean not only that it contains the proper amount of Oxygen and no poisonous gases, but that it also contains no germs of disease. A dark room cannot be wholesome. Fresh air might be let into it from time to time, but if it were always dark, people who lived in it would be much less healthy than they would be if it were light. Sunlight helps to keep air pure, and the best praise we can give the room in which we live is to say it is "light and airy."

(This does not mean, of course, that it is a good thing to be in hot sunshine all day long. The sunshine will kill the germs, but it might also kill *us*. Very many thousands of people have been killed by the sun. Just as Oxygen, the great supporter of life, is too strong *by itself*, and would quickly kill anyone who breathed it, so sunshine, although necessary to health, can cause death. Even people who belong to very hot countries sometimes suffer headaches, sickness, and even death by being exposed to the sun's rays without proper covering.)

When the matter lies in our own hands, then, let us always breathe pure air, and remember that light is necessary to purity.

When light does not come the doctor must.

Fresh air is the best medicine.

CHAPTER X.

EAT GOOD FOOD.

THERE are a few millions of people in the world who might reply, "We should be glad of the chance," if one said to them "Eat good food." There are also millions of people, however, who *do* have the chance but who do *not* eat good food. That is to say, they do not eat the kind that is best for them, cooked in the best way, in the proper quantity, and at the proper time.

There is a saying, "We are what we eat." This is not true, but our health depends to a large extent on what we eat. We cannot be as strong and healthy as we otherwise should be if our food is not right.

What is the proper kind of food to eat? That depends on the climate in which one lives, and the kind of food usually eaten by one's ancestors.

An Esquimaux lives on meat, fat, and oil. If he did not, he would die in the extreme cold in which he lives—for this diet is very heating. But if he came to India, the kind of food which he eats in the Arctic Regions would kill him. In the same way, if an Indian went to the Arctic Regions, he could not live on rice, fruit, and sweets—even if he could get them.

A man whose forefathers have been vegetarians

for centuries would be unwise to eat meat. A man whose ancestors had eaten meat for many generations would be unwise to suddenly become a vegetarian.

"What is one man's meat is another man's poison," and the proper kind of food is the kind which long experience has shown to be most suitable to the climate of the country and the habits of one's people. Do as your ancestors did in the matter of meat-eating or vegetarianism.

The man who works hard with his hands requires more food than the man who works with his brain, and who sits down all day. As muscle is worn away it requires rebuilding, and the materials for the rebuilding must be supplied by the food. If enough food is not eaten, and the wasted muscles are not rebuilt and the lost matter replaced, the man gets smaller and lighter. He looks thin and shrunken, and we say he is losing weight. His body is spending more than it is earning, and he is like a man who takes more out of his bank each day than he puts in.

The man who does no work, and eats as much food as the strong man who does a great deal of work, is as badly off as the man who does not eat enough. He is something like the man who keeps on buying new furniture until his house is stuffed so full that he cannot move in it, or

the man who puts on so much clothing that he cannot stand.

Too little food weakens us; too much poisons us. What is the right quantity? The right quantity is that which keeps us from losing weight and from gaining weight. If a full grown healthy man is growing lighter and lighter, he is not eating enough. If he is growing heavier and heavier, he is eating too much.

A growing boy is not likely to eat too much. He is nearly always hungry, and he eats as much as he can. This is a good thing, because his food has not only to supply the material for rebuilding waste tissue, but to supply still more for the *growth* of his body as he gets bigger and bigger. He needs food for both building and rebuilding; for "new works" as well as for "repairs." A full-grown man is not growing taller and broader every day as the boy is, and he only requires enough food for *re*building; for "repairs" and not for "new works."

The proper *quantity* to eat at one meal is enough to satisfy one's hunger without making oneself uncomfortable. One should stop when one could eat a little more, and not go on until one could not possibly eat another mouthful.

The proper *time* to eat is when one feels hungry. If meal-time comes and one does not feel hungry, one is better without food at all.

Constipation and dysentery are both very common indeed in this country, and are both largely due to the eating of too much at one meal, and of eating when there is no feeling of hunger. Nature tells us what is right, and if we will not obey her laws we have to take her punishments. Constipation and dysentery are the punishments for being greedy and eating too much, or for being greedy and eating when food was not needed.

Eat to live, do not live to eat. Make hunger by exercise and work, and satisfy hunger by eating *enough* good plain food. Enough is the amount that keeps your weight right.

What we call "food" is made up of the chemicals Oxygen, Hydrogen, Nitrogen and Carbon.

Water is nothing but Oxygen and Hydrogen. Eggs, meat, milk and grain contain Nitrogen. Sugar and starch contain Carbon.

A strong man in good health, doing plenty of work, wants about 3 pounds of food daily. Of this, 5 ounces should be nitrogenous (milk, eggs, grain, or meat), 15 ounces should be carbon (starch and sugar), 3 ounces fat, 1 ounce salts, and 24 ounces water.

A hundred ounces of milk contain 86 ounces of water, 4 of nitrogen, 3·7 of fat, 4·8 of carbon (sugar and starch), and ·7 of salt. Milk is an

almost perfect food in itself, but one would be very foolish to try and live on milk alone. Diet should be varied as much as possible.

A hundred ounces of butter contain 11 ounces of water, ·5 of nitrogen, 87 of fat and ·5 of carbon.

A hundred ounces of cheese contain 36 ounces of water, 33 of nitrogen, 24 of fat and 5 of salts.

In fat meat the proportions are about 51 of water, 14 of nitrogen, 29 of fat, and 4 of salts.

In lean meat they are about 72 of water, 19 of nitrogen, 3 of fat and 5 of salts.

In wheat they are: water 14, nitrogen 12, fat 1, carbon 70 (sugar and starch).

In peas they are: water 14, nitrogen 23, fat 1·5, and carbon 53.

A hundred ounces of potatoes contain 76 ounces of water, 2 of nitrogen, ·2 of fat and 21 of carbon.

It is said that the following quantities of food are all of exactly equal value to the body: 5 lbs. of beef fat, 7 lbs. of butter, 11 lbs. of cheese, 13 lbs of oatmeal, 23 lbs. of bread, 35 lbs. of lean beef, and 50 lbs. of potatoes.

Whether pure vegetarianism is better, or whether meat-eating is better, it is certain that in hot countries like India light, easily-digested, and less heating foods such as grain, rice, and sugar are better than animal foods. It is to be

remembered, however, that the stomach has to be over-burdened and distended at least three times a day with vegetable food, in order that the body may receive enough nourishment from such a diet. A great deal more time and energy are required for the digestion of a big stomach-load of vegetables than for the digestion of that quantity of flesh food which would contain as much nourishment. Flesh food contains more nutriment than *the same quantity* of vegetable food. On the other hand, flesh food causes gout and nervous diseases if too much be taken.

Where one's religion does not forbid, the best diet seems to be one that includes fish, eggs, milk, and a little meat, with grain, pulse, and fruit. The mixed diet is the best diet, but a *little* meat is *enough* meat in India; and millions of people keep strong and healthy without any. Whether they would be stronger and live longer if they were meat-eaters is another question.

Alcohol is *absolutely unnecessary*, and, except as a medicine, harmful.

CHAPTER XI.

DRINK PURE WATER.

BUT suppose we live in a place where the water is *not* pure. What can we do then?

We can *boil* it. Boiled water is pure water so far as drinking purposes are concerned. To be really healthy and strong (and not to live in constant danger of some horrible disease like cholera or enteric fever), we *must* have plenty of *pure* water. It is even more important than food, and a man can live longer without food than he can without water.

The water you drink is not good unless it is perfectly colourless, quite clear and transparent, entirely free from smell of any kind, pleasant to the taste, sparkling and bright, and not what is called "hard." (Hard water is the kind that prevents soap from making a good lather and feels unpleasant to the skin. It contains lime.)

There are two kinds of impurities in water, one mineral and the other animal and vegetable (called "organic"). The mineral impurities are usually either salt or lime, and are not nearly so injurious as the "organic" kind. Of these, the vegetable impurities, like dead leaves, although they sometimes cause diarrhœa, are not so dangerous as the animal impurities, of which the worst is sewage.

Where a cesspool, dung-heap, urinal, latrine or stable is near enough to a well for the liquid to soak into the ground and reach it, or for rain to carry the foul matter into the well—there is a certainty that cholera, dysentery, enteric, or

diarrhœa will break out among those who use the water.

Whenever such outbreaks occur, medical officers at once suspect the water and examine it with the microscope and in other ways. If they find disease germs in the water they know that something—such as sewage—is poisoning the water. Sometimes a decaying dead body is found in the well. Often it is found that people bathe, wash their clothes, and water their animals in the same pool from which they themselves drink.

In the case of one very bad outbreak of cholera, during which many hundreds of people died, it was found that the people were drinking from a rain-pool which had formed in a hollow wherein was a Mahommedan graveyard. There were scores of corpses (just under the water) that had been buried for periods varying from a few days to a few months!

Yet even this water would have been harmless if it had been well boiled. Nothing can live in boiling water for very long, and disease germs are *living things.*

If a tiger or a leopard is doing harm to a village, the people try and kill it. Disease germs can be killed, and must be killed, just like tigers, leopards, snakes, and other harmful creatures. A dead germ does no harm.

We must do everything that we can, then, to

prevent impurities getting into our wells, and then take care to *kill* the living ones, which are by far the most dangerous, before drinking.

No disease germ or other impurity which may get into a vessel of water can do any harm if the water be boiled. Boiling kills germs. Strain the water first if you like, but boil it before you drink it. Many persons are poisoned by milk, for germs get into milk as well as into water. Milk, too, should always be boiled before it is drunk, and kept covered up after being boiled until it is drunk.

Germs are far too small for the human eye to see, but boiling kills them.

Many thousands of English soldiers were killed in South Africa by drinking impure water. Had they boiled it first they would have been uninjured. Germs killed more men than bullets did, and enteric fever (caused by drinking bad water) was by far the deadliest enemy they met. A pool could kill more men than an army.

In India cholera, enteric fever, dysentery, diarrhœa, and other diseases of the stomach and intestines are caused by the pollution of wells.

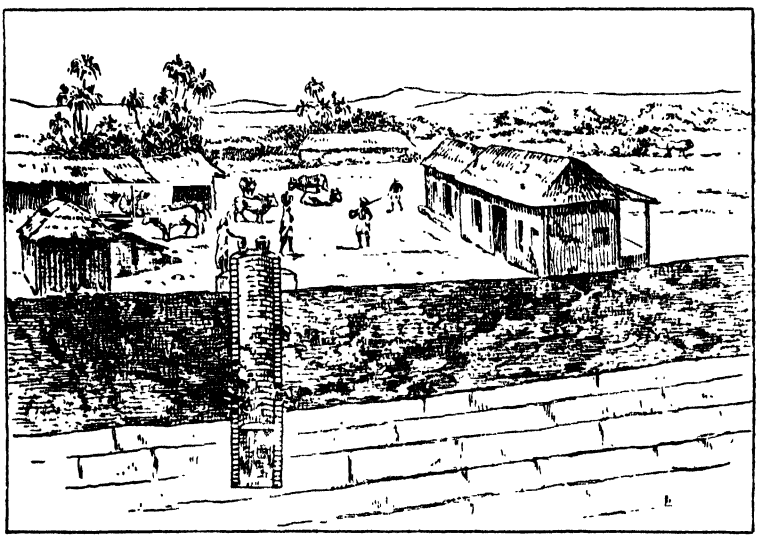
A man deserves imprisonment, who, by his carelessness and filthy habits, makes the village well a public danger.

Truth is said to live at the bottom of a well. People find the truth about disease there if they

do not take care of their wells, and a very bitter truth it is.

Not only should nothing be able to get into a well from above, but nothing should be able to get into it from below either.

What *can* get into it from below? Why liquid (from stables, urinals, latrines, cesspools, or



LEAKAGE FROM DUNG-HEAP OR CESSPOOL TO WELL.

burial places) containing disease germs. Look at the picture and you will see at a glance how it happens.

No dwelling-place for man or beast should be near a well, nor anyone be allowed to wash himself or his clothes near to it.

If villagers allow people to pollute their wells, or have stables, pounds, cesspools, latrines, dung-

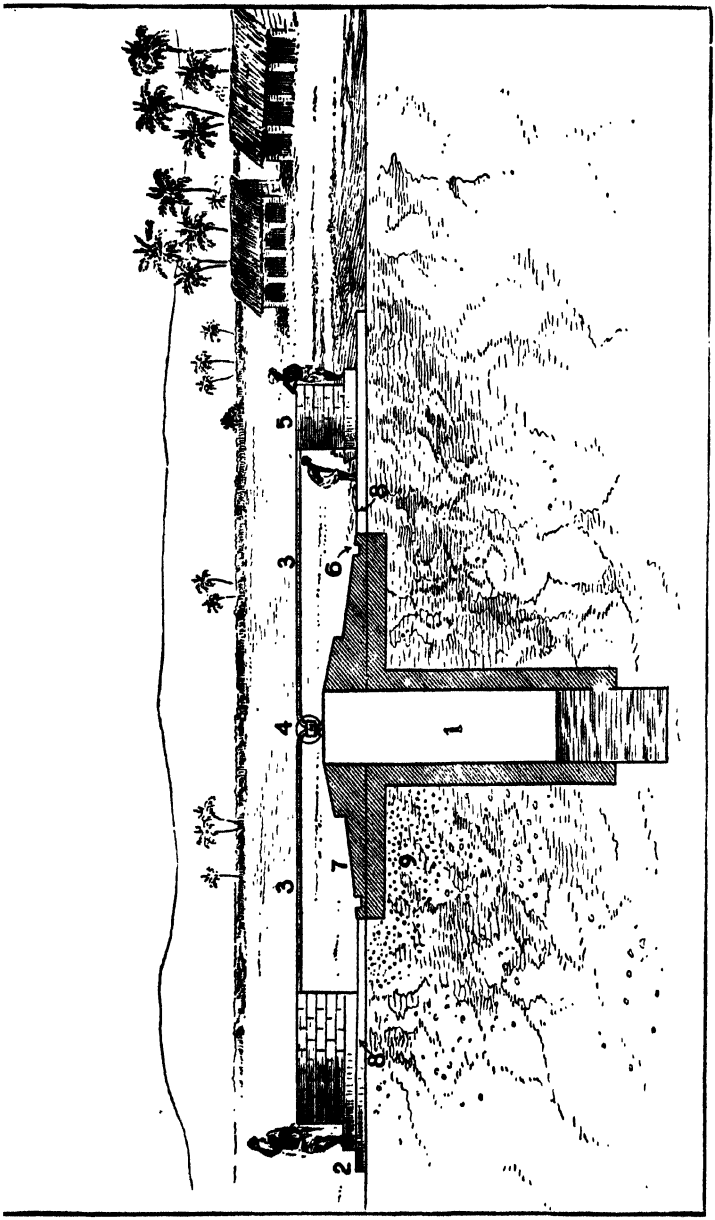
heaps, urinals, rubbish-heaps, slaughter-houses, or burial places near to them, they may well say that it is "written on their foreheads" that they will have cholera. It is not written there if they take care to have pure water, or to boil all the water they use for drinking purposes.

In the next picture you see a well in which the water cannot be polluted. It has stone walls and is covered in. A pump brings the water up and two pipes carry it to two different cisterns. At one, people can wash themselves and their clothes. From the other, some distance away, they get their drinking water. A stone pavement prevents dirty water from getting into the earth round the well.

Suppose a well *is* polluted, how can the water be purified? By the use of a most valuable chemical called "permanganate of potash," of which we shall read more later on. It is very cheap, and can be obtained at any chemist's shop.

A doctor, who has made a careful study of the causes of cholera and similar diseases in India, has written as follows: "Permanganate is a salt-like substance in whose preparation only mineral substances are employed, and therefore its use ought not to be objected to by the strictest Hindu. Permanganate is not a medicine for patients, but merely a means of cleansing water.

"Put two ounces of permanganate in the solid



SHOWING HOW THE POLLUTION OF THE WATER OF WELLS MAY BE PREVENTED.

1. Well with masonry walls. 2. Bathing platform at a safe distance. 3. Water pipe. 4. Pump. 5. Drinking water in cistern with cover and tap. 6. Drain for waste water. 7. Masonry pavement around well. 8. Ground surrounding pavement. 9. Surface water kept out of well.

state into a *dol* or bucket that has been filled with water from the well about to be treated. Stir it up and pour the red solution thus produced into the well, leaving the portion of permanganate that is not yet dissolved at the bottom of the *dol*. Lower the *dol* into the well, draw it up, pour back the water as before. Repeat the process till all the permanganate has been dissolved. After half an hour draw up some of the water and examine it. If a red colour is still present, enough has been added. If the red colour has disappeared, then more permanganate should be added to the water in the well. In all cases enough permanganate should be added to produce a faint red colour lasting 24 hours.

"If the water in the well is bad, more permanganate will be necessary. In such a case it will be found that the strong red colour at first produced slowly changes to brown, and then fades away. This is because permanganate and dirt destroy one another. Therefore, more permanganate must be added in order to produce a lasting colour. If the water in the well is clean, a smaller quantity of permanganate will be found to be sufficient. From one to eight ounces of solid permanganate will be found to be sufficient for ordinary wells. If possible the permanganate should be added at night in order to leave the wells undisturbed as

long as possible. The water will be fit to drink on the following morning. If at this time the water has the red colour, it will have a slightly unpleasant taste, but it is perfectly harmless. If the inhabitants do not like the taste, they should pump out the water until the colour vanishes. Always care should be taken to treat with permanganate all the wells in the place, not only those used for drinking, but also those used for washing purposes. The village police may be employed to show the operator the positions of the different wells. After, but not before, these wells have been found and treated, search should be made for a well near the police station that the police will have forgotten to show. This well or any other suitable wells should be treated with a double quantity of permanganate. Bhisties may then be employed to pump out its water until the colour has nearly vanished. The inhabitants should be advised only to use this well until the following morning, when the water of the other wells will be fit to drink. The well thus selected for immediate use may afterwards be further treated with permanganate.

"Usually water is stored in the houses in *ghurrahs*, or pots, for washing and other purposes. This should be poured away, and, if possible, the inhabitants should be persuaded to

wash their *lotas* and other vessels with water containing permanganate. Unless this is done, cases of cholera are likely to occur even four or five days after the treatment of the wells" (*Hankin*).

But the best and safest way to keep the water in a well pure and safe to drink is to keep it covered, and put a pump into it so that the water may be pumped out without taking the cover off. This water ought to be quite fit to drink; but if there be any doubt about it, and if disease be about, boil even this water before you drink it. You may say that this will mean taking trouble. No doubt; but it is better to take trouble than to get ill and perhaps die.

CHAPTER XII.

KEEP CLEAN.

THIS is one of the greatest of the great laws of health, and means not only keep your bodies, teeth, ears, eyes, nose and hair clean, but keep your clothes clean, your houses clean, and your compounds and streets clean.

What is dirt? It is matter in the wrong place. What is very valuable soil in one place may be foul filth in another, and it is our duty to see that matter is not in the wrong place.

The body should be kept clean because dirt chokes up the millions of little holes through which we perspire, and perspiration contains salts and impurities which must come out of the body if it is to be healthy.

Germs love dirt; and soap removes dirt, and with it the germs. Indians are a most cleanly people in the matters of bathing and of tooth-cleaning—but it is to be remembered that cold water does not kill germs and cold water will not remove fatty, oily matter. Try and clean a greasy vessel with cold water and you will see. However often we may wash with cold water alone, we should also wash with warm water and soap as well,—and the more frequently the better. Not only does the heat of the water and the action of the soap remove the natural grease from the skin, but the soap, as said above, removes germs. Plenty of soap and water is one of the finest preventives of disease.

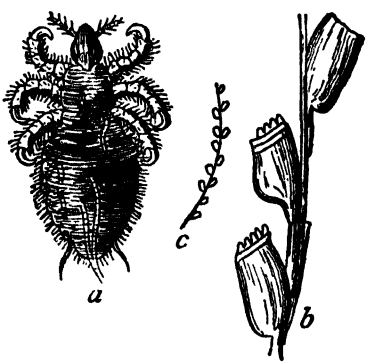
It is not true to say that every dirty man in the world dies of disease, but it is quite true to say that every dirty man runs a greater risk of disease than a clean man, and is less healthy than he would be if he were clean.

Nor is there much sense in washing the body daily and putting dirty clothes on a clean body. Clothes that are dirty are a danger. They harbour germs, invite vermin, and cause skin

diseases. Those which can be washed should be white in colour and should be washed directly they begin to lose their whiteness. Those that cannot be washed should be put in the sunshine frequently. Many people who are most careful about the whiteness and purity of their shirts and dhoties, wear coats which are really filthy because they are not made of a washing material and do not show the dirt.

Smell is a danger signal, and our noses are given us that we may detect the danger signal. Any clothes that smell are dangerous as well as disgusting.

It sometimes happens that poor children from dirty homes are found to have vermin in their hair. It is quite useless to kill these insects, and to leave their eggs. Cold water will not kill either — but kerosene oil will kill both. A child whose hair is found to be in a verminous state should be made to rub kerosene oil in his head, and then to wash it well with hot water and soap.



a, the head louse; *b*, nits on hair (magnified); *c*, same (nat. size).

Cleanliness is next to godliness, and a really clean mind can hardly exist in a really dirty body.

THE SKIN.

WHEN we say that the body should be kept clean, we mean that the skin should be kept clean.

The skin is like a glove which fits tightly to the body and covers every part of it. It consists of two parts, an outer layer called the *epidermis* and an inner layer called the *dermis*, or cuticle, or true skin.

The epidermis has no nerves and therefore no feeling in it. It is constantly being rubbed, worn away, and renewed, and is very thin. The dermis is thick and tough. It is this skin of some animals that is made into leather.

The dermis is full of blood-vessels and nerves. If you cut it ever so little, the blood comes out; and if you prick it, even with the point of a pin, the nerves send the news to the brain and you feel the pain.

The dermis also contains the roots of the hair. In it is formed the sweat or perspiration, that bursts out through the tiny openings or pores, more than a million in number, in the outer skin, and a kind of oil which also comes through the pores and makes the skin soft and pliable and keeps it from getting dry and cracking.

The sweat is water with a saltish acid dissolved in it, as well as organic dead matter which it washes out of the body. It has an unpleasant

smell. About two pints are poured out every day by a grown-up person, and much more in a hot than in a cold climate, and after violent exercise. When much oil escapes from the skin, it looks dirty and greasy and smells nasty.

If the pores in the skin be choked up with dirt, the sweat and the oil cannot escape, and act like a poison. Various skin diseases, *e.g.* what is known as *itch*, break out.

Here is a picture of a part of the skin. It is very highly magnified, so that it looks much larger than it does to the naked eye. At the top you see the layer called the epidermis. Below it there is the dermis or true skin. The long lines going downwards are the pores leading to the round sweat-glands, from which the sweat pours out over the skin.

The skin protects all the internal parts of the body. Being elastic, it allows free play to the muscles underneath it. It is, as we saw, the chief organ of the sense of touch. By it we know whether anything we may touch is hard or soft, or rough or smooth, or hot or cold. It throws out impurity from the body in the form of sweat, and thus keeps it clean. And besides all this,

it *regulates* the temperature of the body, that is to say, it keeps it from getting too hot or too cold. This is so important that it will be well to explain it more fully. Why does the skin perspire when the body is heated, and of what use is perspiration?

Below the skin there is the hot fluid blood in the blood-vessels, so that the skin is always much hotter than the air. As a bar of hot iron throws off or radiates its heat into the air, so the hot skin throws off or radiates some of the heat it has received from the blood into the air, and thus cools the whole body. But besides this; the sweat, which is, as we have seen, water with acid and organic matter dissolved in it, evaporates as fast as it comes out through the pores in the skin. This, too, makes the skin cooler, for it loses the heat which is carried off by the water-vapour, and is absorbed or sucked in by the dry air all round it.

And yet, although the outside of the body—the part underneath the skin—is more exposed to cold than the inner parts of the body, the temperature of the whole body when in health always remains about the same. How is this?

The body is, indeed, a "living stove" or fire-place, in which, as we saw before, there is always burning going on. In every part of the body there is this burning, although there is no flame

and no smoke. In the lungs the oxygen of the air is mixing with the blood. This is one form of burning. The red blood in the arteries is flowing all over the body and burning up waste matter. Each little blood-vessel is a tiny fire-place in which there is something burning.

The hot blood that comes up to the skin is there cooled by the evaporation, as we have seen, and this cooled blood rushes off to other parts of the body and cools them too. The blood-vessels are like the hot water pipes which warm a house in cold countries. If the house gets too warm, the pipes may be cooled by putting a wet cloth on them. The water evaporates and the pipe is cooled. The skin is wetted by the perspiration as a pipe is wetted by a damp cloth, and is cooled by the evaporation. The more the body is heated by exercise, the faster the skin pours out the sweat, and the greater the evaporation and the more the heat which is thrown off. When there has been little or no exercise, the whole body is cooler, and as less sweat is poured out, there is not so much evaporation. Less heat is thrown off and the skin is not cooled so greatly as it is when there is much evaporation. The body is thus kept at the proper temperature.

Thus we see how the skin *regulates* the temperature of the body. Unless it be kept clean, and the pores be kept open, the sweat cannot get

out, the heat of the body is too great, and we have fever.

The *hands* should always be well washed before meals, particularly if they be used, as is the custom of Indians, to put food into the mouth. The nails should be carefully cleaned as well, for dirt may easily get under the nails, and dirt may contain in it deadly germs. Nothing looks so nasty as hands with dirty nails and nothing can be more dangerous to health.

The *teeth* should be carefully washed in the morning, and after every meal as well. They should be cleaned by rubbing them with a soft tooth-brush, and the mouth should be rinsed out with warm water if it can be had, and if not, with cold water. Germs quickly collect and increase very rapidly in dirty teeth, and the food that gets into the spaces between the teeth soon rots and foul gases are formed, and the breath smells very offensive. The teeth, themselves decay if they are not kept clean, and bad teeth mean disease and perhaps death, for unless the the food be properly chewed into a fine pulp before it is swallowed, the stomach cannot digest it.

CHAPTER XIII.

DO PLENTY OF WORK.

THERE is an old English saying to the effect that it is better to wear out than to rust out. If a bicycle or a gun were left to rust it would very quickly become quite useless. If it were properly used it would last for a very long time.

Similarly with the human body. The man who does a great deal of work with his body and brain will (other things being equal) live longer than one who sits still and does nothing. He will also be healthier and happier, as well as being of some use in the world.

To take *too* much exercise and to *over*work is perhaps worse than doing nothing—but it is not easy to do too much if one sleeps and eats properly, and at the proper time. Work is sometimes spoken of as a curse put upon man for his sins. It is a blessing put upon him for his benefit. No one is so much to be pitied as the man who has nothing to do.

Why is work (or exercise) necessary to health? There are many reasons, of which the following are the most important.

In the first place, when we work hard, whether for profit, with tools, or, for pleasure, with bats and balls, we have to breathe faster and deeper. We

get more air into our lungs and get the fresh air in oftener. The air contains oxygen, and oxygen is the great health-giver, purifier, and support. Breathing more quickly in the open air means purifying the blood more quickly, and improving it. If our blood is healthy we are healthy; if there is anything wrong with it there is something wrong with us. It is the "stream of life," and exercise benefits it in every way.

Again, exercise makes us perspire, and perspiration caused by exercise is good. The blood is further purified because every drop of perspiration contains waste and refuse matter from the blood.

Exercise is good for all the organs of the body. It strengthens and improves the heart (if not *over*-done) by giving it more work to do, it expands and strengthens the lungs by giving them more work to do, it shakes up the liver and makes it more active in its most important work, it stirs up the stomach and intestines and prevents their getting lazy and sluggish, it makes the kidneys work better, and, in fact, acts towards all the organs of the body as a whip to a lazy horse.

And just as the extra breathing and the perspiring were good for the blood, so the increased work of all these organs is good for the blood, and it is kept pure and clean and healthy. The

result is a good appetite, good sleep, good temper, and still further improved health. The good sound health means happiness of mind, and the happiness of mind again still further improves the health, and so things go on getting better and better.

The man or boy who sits on a *charpoy*, or bedstead, all day, and neither does work nor takes exercise, loses all these benefits. Not only does he lose the benefits, but he suffers evils. He sits indoors, and breathes bad air. This is bad for his lungs and heart and blood. He does not perspire, and so keeps more salts, water and waste matter in his blood than the kidneys can remove, and his blood gets worse still. None of his organs are roused, stirred and shaken up. His liver gets sluggish and lazy, and he feels ill at once; his stomach and intestines become sleepy and idle, and none of his organs do their work properly.

The result is constipation, headache, loss of appetite and sleep, and certain, if slow, loss of health. Bad health means unhappiness, depression of mind, gloomy thoughts and misery. The wretched mind makes the wretched body still worse, and unless he rouses himself and does some honest work or takes some healthful exercise, a miserable life ends in an early death.

For some reason educated men take far less

exercise than uneducated men in this country. The coolie *has* to work to live, but the educated man also has to work—if he wants to keep healthy. Sitting in an office is not "work" in this sense; and if his daily duty does not make him do *muscle-work*, he must make himself do muscle-work by taking exercise. He can walk if he can do nothing more; but unless he is too old or feeble or fat, he can play tennis or cricket, if not hockey or football. Nothing is so good for health as enjoyable games played in the open air with agreeable companions, and without strain and fatigue.

We call this *recreation*, and it is *re*-creation. It is new creations of pure blood, healthy flesh, active organs, and a bright cheerful mind.

A walk alone is good; a walk with pleasant companions is better; a game is best. It is a very great pity that so few Indians of the brain-work classes and leisured classes play games. They would live longer and live happier if they did, and there would be fewer suffering from the almost national diseases of dyspepsia and consumption. Not only that, but fewer would die in times of epidemics, as their robust health would be a great protection. One hears people make such remarks (about golf, for example, in which the object is to drive a ball across country from a certain spot to a certain

hole in the smallest number of strokes), as "Fancy an elderly man playing about with a stick and a ball like a child!" The person who makes the remark is more "like a child," for he has not the sense to see that the player is a wise man who is getting change and exercise for his body and change and rest for his mind. His body has been still all day as he sat in his office chair. His mind has been very busy, active, and anxious for hours together. As he plays golf his body gets the fresh air, change, activity and exercise it needs for the purification of the blood, and his mind gets the change, rest, and peace it needs if it is to do its work well on the morrow.

Action is what we need. Let us *do* something. Leave fools to sit and chatter nonsense, smoke cigarettes, exchange idle rumours, and tell lies; but let *us* be active, strong, and healthy by taking exercise when our brain-work is done. Why should labourers and coolies be stronger and healthier than educated men? There is no reason, for we have plenty of time and means to make ourselves strong and healthy if we wish to do so.

There are many Indians, who, *most* unfortunately for themselves, were never taught a game at school, and so were never provided with the best means of healthful recreation. It is said that it is never too late to learn, but this hardly applies to games. Early youth is the time to learn all such things as riding, swimming, rowing, and all games. But if a man is too old to learn a game, he is never too old for "physical culture" (education of the body), which is simply the care and exercise of the muscles, and the rousing and stirring of the organs.

There is no need for such a man or boy to buy expensive elastic—or spring—apparatus, and try and obey rules which tell him to concentrate his will upon seven different pairs of muscles at once.

He can see the principal muscles of his body, and he can see how they act. He can perform the motion which makes one of them act, and can fix his mind on the muscle as he does it. He need have nothing in his hand, and, above all, he should not have a heavy weight. He can then take another muscle and perform the motion which makes that one act, and fix his mind on the muscle as he does so; and in the same way exercise each of the twelve or twenty most important muscles of the arms, chest, back, abdomen and legs.

What is the object and use of doing this? Very much the same as the object and use of playing games; but though the mental benefit is less, the physical and muscular benefit is more.

If done in the open air, as it should be, the breathing benefits are the same as those of playing games. The perspiration benefits are the same, and the good done to the liver, stomach, and intestines may be greater.

Where this physical culture is less beneficial than games is in the fact that it is done alone; there is no complete change of thought, and none of the great interest and pleasure felt by the skilful player in a game.

If a man or boy could play some game with cheery companions in the evening after work, and do ten or fifteen minutes exercise for physical culture in the morning, and so combine the benefits of both, there would not be much need for fear about his health.

In the next chapter will be found a description of a set of exercises for all the important muscles. No apparatus is needed for performing the exercises, and there is no chance of strain, fatigue, or any injury.

But you *must* think of the muscle, and look at it (if you can) while you exercise it.

CHAPTER XIV.

THE TRAINING OF THE BODY FOR HEALTH AND STRENGTH.

ANY boy who wishes to grow up into a strong, sturdy and healthy man can do so if he follows the laws of health, and exercises all his muscles and organs. We might merely say "if he exercises all his muscles," since in doing this he does exercise his organs. (By organs we mean the lungs, liver, stomach, heart, etc.)

One of Nature's great laws is "*What is exercised grows and develops, while what is not exercised dwindles, dies away, and disappears.*" The brain of the thinker is larger and more highly developed than the brain of the labourer. The muscles of the labourer are larger and more highly developed than those of the thinker. Is there any reason why the thinker should not use and exercise his muscles until they are as large and well-developed as those of the labourer? None whatever. In fact, if a thinker devoted his brains and mind and will to the development of his muscles, he could have a much better-developed and finer body than the labourer.

It is strange but true, that mind has an effect and influence on muscle. If you use a muscle a hundred times, without thinking about it, it will

not develop as much as it would if you used it ten times and fixed your mind upon it as you did so.

A postman walks enormous distances, but his leg-muscles do not develop more than those of other people—although they are, of course, hard and strong, and in good condition.

A man who exercised his leg-muscles for ten minutes a day, with his mind and will fixed upon them, would develop them more quickly than he would by walking ten miles a day, and giving them no thought.

Attention and thought are better than dumb-bells and clubs. Attention and thought can do no harm; dumb-bells and clubs *may* do great harm, and certainly will do great harm if they are too heavy or are used for too long.

The proper way to develop the muscles is first to find them out; secondly, to see what special work they are for; and, thirdly, to let them do that special work, while fixing the whole attention, mind, thought, and will upon them. It is well to watch the muscle that is being used, either directly or in a mirror, as this helps one to fix and concentrate the will upon it.

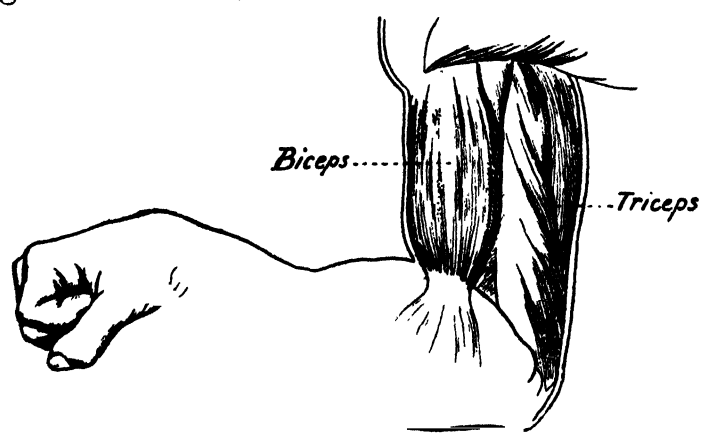
It is to be borne in mind that this exercise for the development of the muscles not only gives health and strength to each muscle, but it stirs up and "stimulates" the internal organs of the

body, and benefits the blood by causing perspiration. The increased speed of breathing is good for the lungs and heart, the movement and bending is good for the liver, stomach, and intestines, and the change is good for the brain and nerves. It is all good in fact, good for body, mind, and character.

Let us take the important muscles in turn, and learn a good exercise for each.

We can attend first to the arms; then to the chest, abdomen, neck, shoulders, and back; and then to the legs.

Exercise for the muscles of the abdomen is the best exercise of all, because it is so very good for the organs of digestion, as well as for the muscles themselves. As a rule, when a man's digestion is good he is well, and when it is bad he is ill.



The first muscle of the arm to exercise is the big one that goes from the shoulder to the fore-

arm. It is called the biceps muscle. As you can see for yourself, its work is the raising of the forearm.

When the brain sends a message to the biceps muscle, "Raise the forearm," it contracts; this shortens it, and as it shortens, the forearm is bound to rise towards the shoulder (Fig. 1). The way to develop and strengthen the biceps, then, is simply to raise and lower the forearm by contracting and expanding this muscle. While doing this, *look at it, think about it, fix the mind on it, concentrate the will upon it*, and make it contract so as to bring up the forearm.

FIG. 1.

Imagine that the hand holds a very heavy weight, although it is really quite empty, and put all your strength into the action. Work first with one arm and then with the other. If you do this for ten minutes every day you will soon find that the biceps muscle is growing larger, harder, and stronger, and, when contracted, makes a round hard lump on the upper arm.

When the forearm is drawn up to the shoulder by the biceps muscle, how does it get back again? Does the biceps push it as it expands? No, it is pulled back into its place by the muscle at the back of the arm. This muscle is called the

"triceps." To exercise it, let it do its work of pulling the arm straight again after it has been bent.

FIG. 2.

Bend the arm, and then try and imagine that the hand holds a rope; pull the arm straight slowly (Fig. 2), and, while doing so, look at the triceps muscle in a mirror, sideways, if you can, think about it, fix the mind on it, concentrate the will upon it, and make it contract so as to bring the forearm back into line with the upper arm. Do this for two minutes daily, and slowly increase the number of times that you do it, day by day.

Next, look at the forearm, and you will find muscles at each side, or edge, as you stretch the whole arm out straight, with the palm of the hand uppermost. These muscles of the forearm are used in turning the hand over, so that the back of the hand is uppermost, and in bringing it back to its former position. If we do this while thinking of the muscles, they will be developed and strengthened. Stretch the arm out straight, with the palm of the hand uppermost. Close the fist, and then turn the hand over so that the back of it is uppermost (Fig. 3). Do this slowly, and with strain and

difficulty, as though the hand held the centre of a long heavy iron bar, and had to turn it right over. As before, watch the muscles and fix the mind upon them; think of them, and concentrate the whole will and attention upon them. It is useless to do it lazily, carelessly, and without giving any thought to the muscles as they do the work. Put all your strength into it. Do this exercise for a couple of minutes daily for a week or so, and then each day increase the number of times by one or two. Use first one arm and then the other.

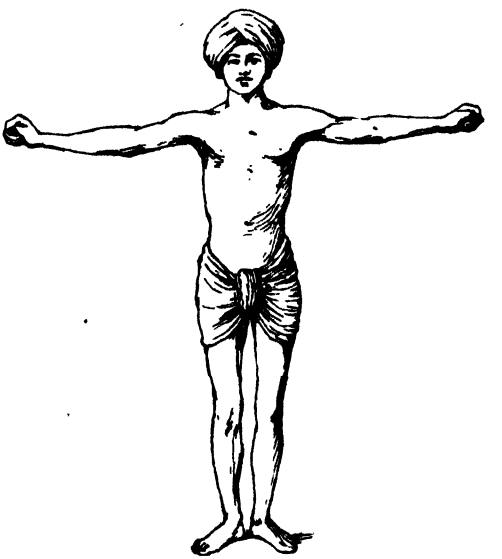


FIG. 3.

A good strong wrist is very useful both in work and in play. In tennis, rowing, hockey, and cricket it plays an important part. The muscles of the wrist bend the hand forward towards the front of the forearm, and backwards towards the back of the forearm. Do this, then, to exercise the wrist muscles.

Hold the forearm upright and close the fist.

Imagine that the hand is being pulled *backward*, and bend it *forward* as far as possible. Do this with strain and as though it were very difficult to overcome the force which is pulling the hand backward (Fig. 4). When the hand is bent as far forward as it will go, imagine it holds a very heavy weight, and bend it backward as far as it will go. Do this also as though it were very difficult, and put all your strength into it. Concentrate the attention upon the muscles the whole time, and think of nothing else. Exercise the muscles of the *hand* by *gripping*. Clench the fist as tightly as possible, and imagine that you are trying to *crush* something (such as a walnut) by the sheer strength of the hand. Open the hand and again close the fist, and squeeze with all your might. Keep on doing it for one or two minutes.

FIG. 4.

Let us now turn to the muscles of the chest. The most important of these are the two big rounded breast-muscles, on which the nipples of the breasts are seen. The use of these muscles is to draw the arms and shoulders downwards and together, as when folding the arms. To exer-

cise these muscles raise the arm sideways to the level of the shoulder, imagine it holds a rope, and draw it down straight in front of the body, making the breast muscle swell up. Do this with each arm, and then with both together (Fig. 5). Put all your strength into the movement, and try and make the breast muscles as large as possible. Keep the arms stiff and, as always, concentrate the will and fix the thoughts upon the muscle being exercised.

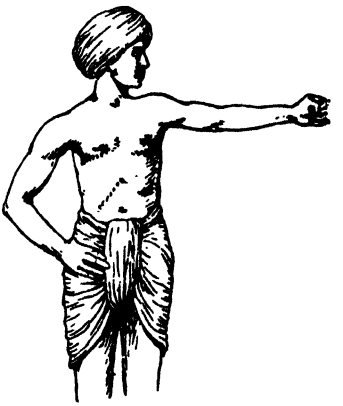


FIG. 5.

Another very important pair of chest muscles are the upper chest muscles, which run from the shoulder, in front of the armpit, to the chest. These muscles pull the raised arm round from the side to the front of the body. They are useful in bowling, in striking certain blows, and in swimming. To exercise these muscles, raise the arm sideways as in the last exercise, and swing it round to the front of the body, so that from being in a line with the

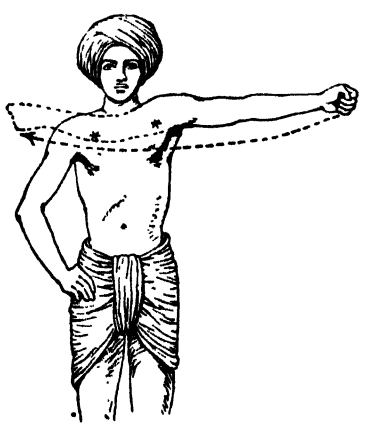


FIG. 6.

shoulder-blade it comes to be at right angles to it (Fig. 6). Imagine that something is pushing or pulling against the arm, and put forth all your strength as though to overcome resistance.

The exercise known as "doing *zores*" (Fig. 7) is a very good one for the muscles at the side of the chest (as well as for those of the arms). It is a difficult feat to perform many times, and the

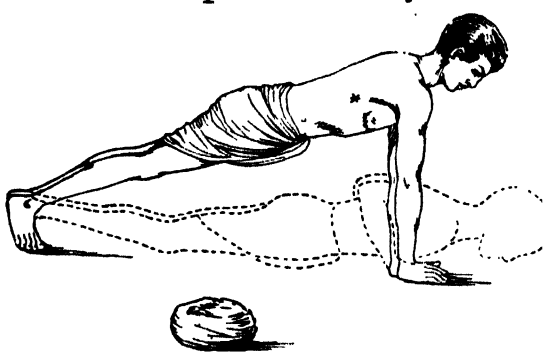


FIG. 7.

best plan is to do it six times a day for the first week, seven times a day for the second week, eight times a day for the third week, and so on until twenty or thirty can be done straight off.

The muscles of the abdomen are usually neglected and weak, and yet it is *most important* to take some exercise intended for the good of the digestive organs and the muscles of the abdomen.

There are five excellent exercises for the muscles which run up the front of the abdomen, across it, and sideways to left and right. Four

of them have to be performed in a lying position, and one standing. Some of them are difficult at first, but soon become easy. First lie flat on the back with the hands stretched out behind the head and try and sit up, bringing the hands over the head in a semi-circle, without touching anything with the feet *or lifting the feet from the ground* (Fig. 8). If this cannot be done at first, practise

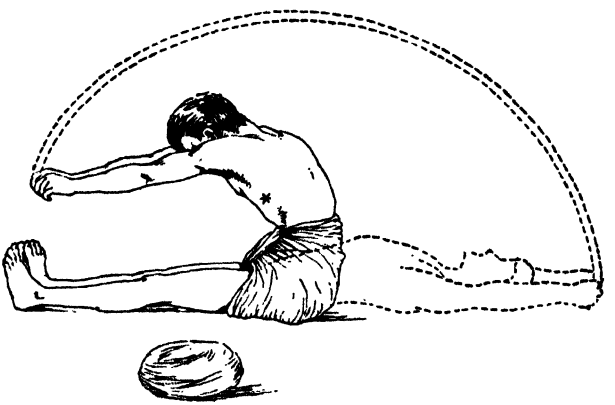


FIG. 8.

by putting the feet under a cupboard, and so getting help in raising the body. When this exercise can be performed quite easily, try it with the hands clasped behind the head, and then with the arms folded. Be careful not to overstrain the muscles. Do it with help, if necessary, at first, and only a very few times. Increase the number of times weekly.

Next lie down as before, and raise both legs until they are at right angles to the body

(Fig. 9). If this cannot be done, raise them as far as they will easily go, and get them

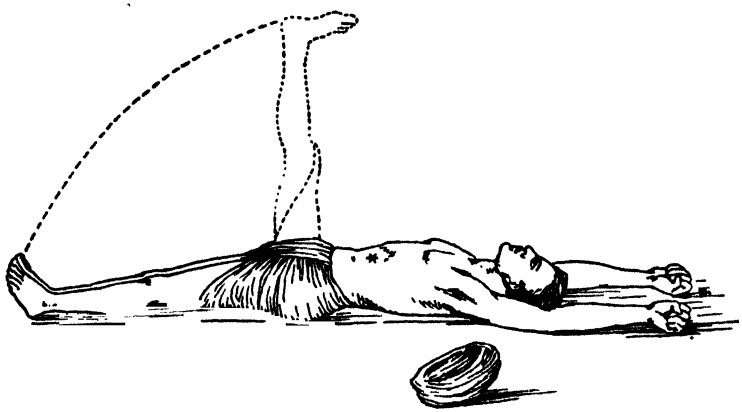


FIG. 9.

further and further each day, until they can be raised at right angles to the body without any difficulty. Do not bend the knees. Point the toes upward.

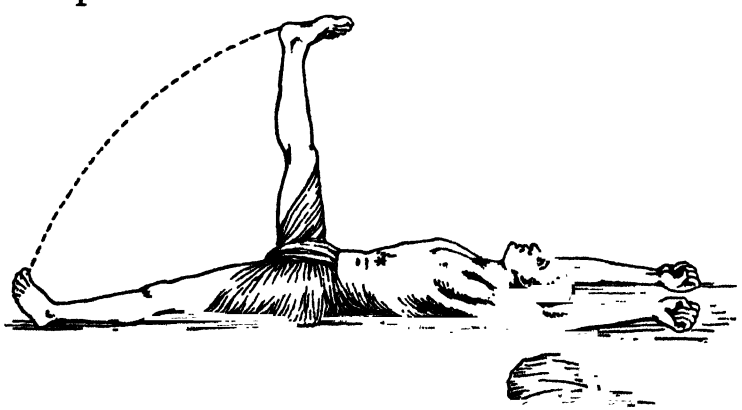


FIG. 10.

In the third exercise only one leg is raised at a time, but the other, which is not being

raised, must not quite touch the ground. Raise the right leg at right angles to the body, lower it until it is an inch from the ground, and, at the same time as it is lowered, raise the left leg at right angles to the body (Fig. 10). Do this several times, keeping the knees stiff and pointing the toes straight upward.

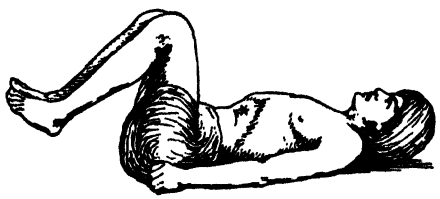


FIG. 11.

In the next exercise the legs are bent at the knee. Lie flat on the back and draw the knees up as far as possible (Fig. 11). Stretch the legs out again. Do this several times.

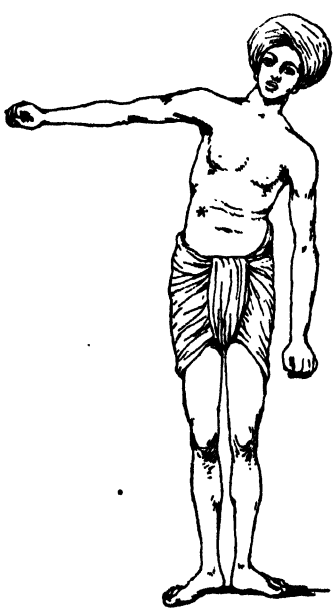


FIG. 12

For the fifth exercise for abdomen muscles stand up straight, and, without bending the knees at all, lean over as far as possible to the right, and see how far you can reach down the right leg. Next bend over to the left and see how far you can reach down the left leg with the left hand (Fig. 12).

In doing each of these five exercises for the muscles of

the abdomen be sure to fix the attention upon them, and think about them the whole time.

The muscles of the neck should also be exercised. This is done by turning and by *bending* the head.

In the turning exercises turn the head to the right and look over the right shoulder as far as possible, and then turn the head to the left and look as far behind the left shoulder as possible. Do this several times, and try and *feel* the muscles that cause the movement.

FIG. 13.

Next *bend* the head down sideways to the right until the right ear nearly touches the right shoulder. Then bend the head over until the left ear nearly touches the left shoulder. Next bend the head forward until the chin touches the chest, and then bend it backward as far as it will go. Do each of these exercises several times, and fix the mind upon the neck muscles while doing them.

In the shoulder there are three important muscles—that in the front, the one at the side, and the one at the back. The front shoulder-muscle (in front of the shoulder-joint) is used in

striking a blow straight from the shoulder and in pushing. The best way to exercise it, then, is to strike or to push. Close the fist, raise it to the shoulder, and then drive it forward hard, as though against resistance (Fig. 13). Do this several times with each hand.

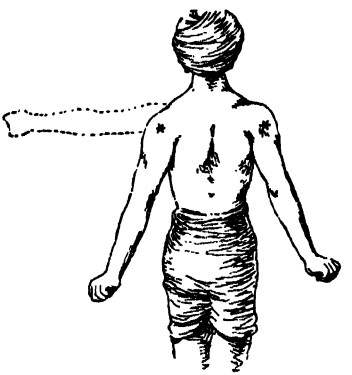


FIG. 14.

The side shoulder-muscle at the top of the arm is used for raising the arm sideways. Do this to exercise it then. *Imagine* that the hand holds a heavy weight and raise it straight out sideways, until it is level with the shoulder. Lower it slowly and raise it again (Fig. 14). Do this several times with each hand, and concentrate the mind on the side of the shoulder.

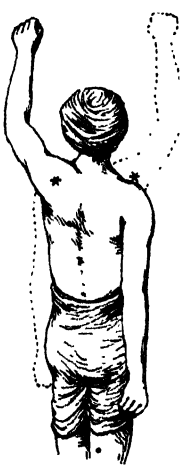


FIG. 15.

The back shoulder-muscle (behind the shoulder-joint) is used in swinging the arm straight up in the air. Do this to exercise it then. Imagine that the hand holds a very heavy weight, and raise it straight outwards and upwards until it is above the head. Lower it slowly and repeat (Fig. 15). Do this several times with each hand and

fix the mind on the back of the shoulder-joint while doing it.

The muscles of the back must be exercised like all the others. They are mostly flat broad muscles like those of the chest. There are three useful exercises for the flat ones, and one for the long muscle that runs along the back-bone.

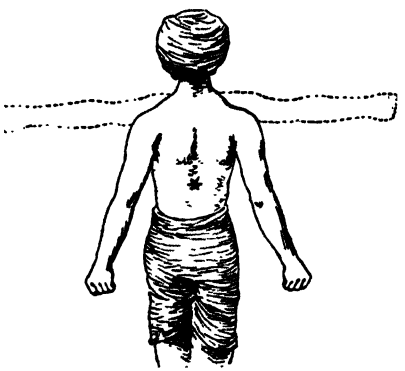


FIG. 16.

First put the hands straight down behind the back and then swing them sharply up until they are in a line with the shoulders (Fig. 16). Think that each hand contains a heavy weight, and put all your strength into the movement, as though it were very difficult. Repeat several times.

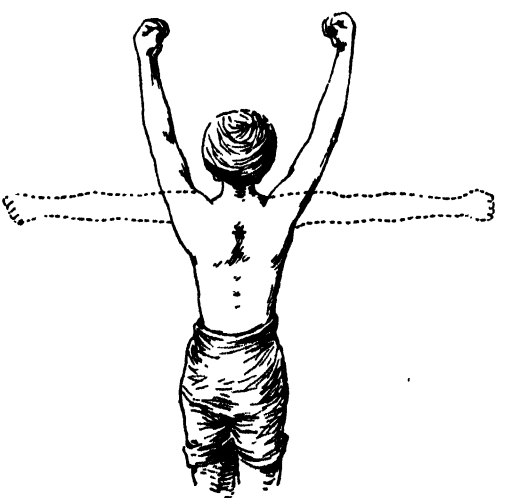


FIG. 17.

For the muscle just below, and between, the

shoulder-blades, raise the hands straight above the shoulders, and bring them sharply down to the level of the shoulders, as they were in the last exercise (Fig. 17). Imagine that each hand holds a rope and that it is very difficult to pull it down into the required position.

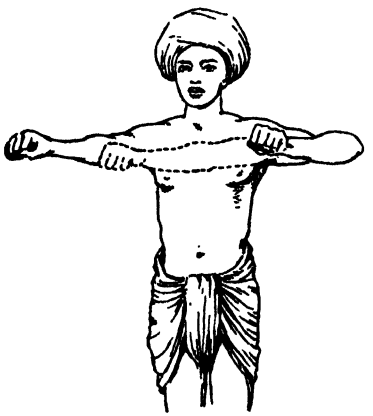


FIG. 18.

In the third exercise for the flat back-muscles, bring both hands up to the shoulders, close them, and drive them forward *together* as though against resistance (Fig. 18). Try and *feel* the back muscle working as you do this; think about it; and see if you cannot actually stretch it. Repeat the action several times.

The long strong muscle up the middle of the back is used for pulling the body upright again, after the muscles of the body have bent it forward.

Stand with the body bent over so that you can touch your toes (without bending

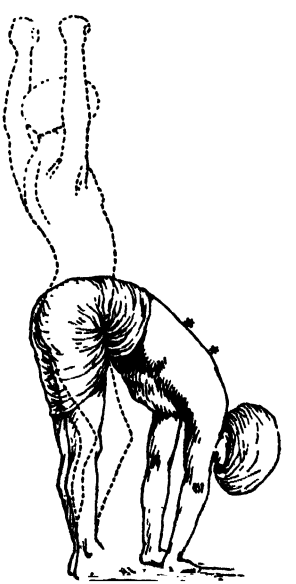


FIG. 19.

the knees), and then rise up straight, keeping the arms stretched out (Fig. 19). Imagine that there are heavy weights in the hands, and that the movement can only be made with great difficulty. Bend down and rise again several times, keeping the knees stiff and fixing the thought on the back-bone muscle.

FIG. 20.

In the legs there are several very powerful and important muscles. One of these is a big muscle in front of the thigh called the "quadriceps." To exercise this muscle rise up on tip-toe with the heels touching, and then sink down as low as you can (Fig. 20). Rise up again, still keeping on tip-toe, and repeat the exercise several times. Watch the front of the thigh, feel the muscle at work, and fix the mind upon it.

Two other important muscles in each thigh are the one on the inside and the one on the outside. These enable the leg to be

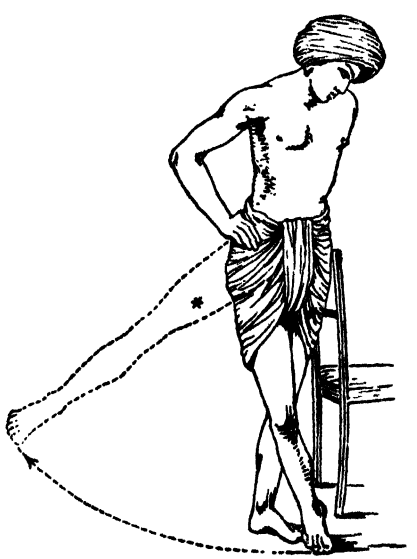


FIG. 21.

raised up sideways, and to be brought back into position.

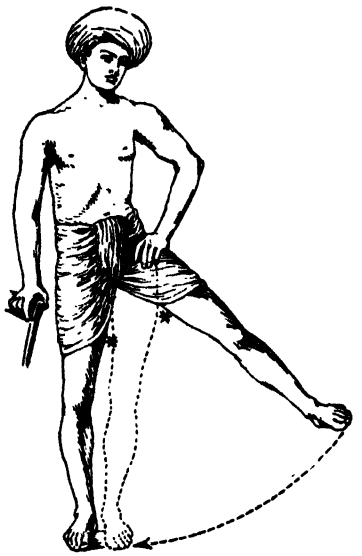


FIG. 22.

To exercise the outside thigh-muscle, raise the leg outwards and sideways as high as it will go (Fig. 21). Hold a table or chair to keep you steady as you do so. Imagine that a heavy weight is tied to the foot and that it is very difficult to raise the leg. Put all your strength into it and watch the muscle. Perform the action several times.

The inside thigh-muscle is exercised in the opposite way. Raise the leg outwards and sideways as high as it will go, and imagine it is held there by a rope, and that very great force is required to bring it back again to its place. Put a strain on the muscle and bring the leg down again slowly, as though against strong resistance (Fig. 22). Watch the inside thigh-muscle and concentrate the will upon it.

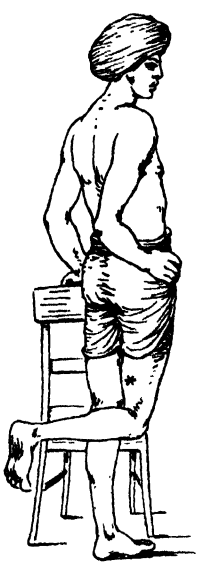


FIG. 23.

The muscle at the back of the

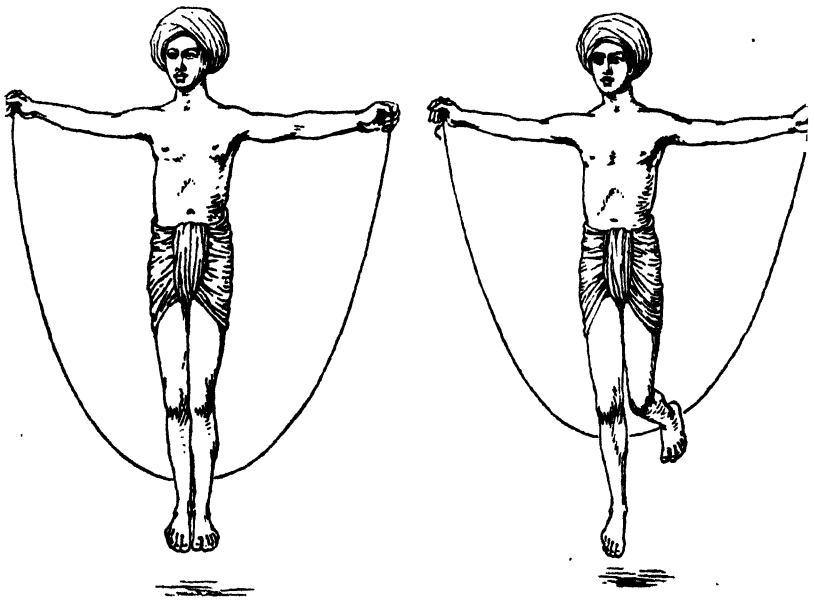
thigh is called the "biceps of the thigh," and acts like the biceps of the arm. As it contracts, it raises the lower part of the leg backwards on the hinge joint of the knee. To exercise the biceps of the thigh, stand on one leg (using a table or chair for support) and raise the lower part of the other leg backwards until it is parallel with the ground (Fig. 23). Fix the mind on the thigh-muscle that is doing the work. Repeat this several times and then use the other leg. Below the knee the calf-muscle is the largest. This may be exercised by rising on the toes, and should be repeated several times.

An excellent form of exercise for strengthening the leg-muscles is *skipping*. This should be practised first on both feet, and then on one foot alone—first the right and then the left.

Anyone who is going to make a serious attempt to train all his muscles, and make his body strong, healthy, and vigorous, should fix a certain time each day for these exercises, and then perform them daily, as regularly as he takes his meals. He should begin with a very small number, and gradually increase the number until he does a good deal daily, and lengthens the time of exercise from five minutes to an hour.

The best time to take for exercising is the time that suits you best, so long as this is not a time when the body is faint and weary before a meal,

nor just after a meal. To exercise when one is hungry and tired is bad, as there is a risk of real fatigue and also of straining the heart. To exercise just after a good meal is also bad, as there is a risk of indigestion. Two hours after a full meal is a good time, but any time except the two above-mentioned will do.



Do not think to yourself, "Well, I have no desire to develop my body until I am like a professional wrestler or champion 'strong man'; I have something better to do with my time." There is no need to give so much time as all that, but there is nobody of whatever age, sex, or position, who is not, or would not be, all the better for a few minutes daily *conscious* exercise

of each muscle. The circulation of the blood is improved, the action of the heart, lungs, and skin is improved, the digestive organs are stirred, and nothing but good can result.

CHAPTER XV.

TEMPERANCE.

"TEMPERANCE" is a fine watchword and motto for one who wishes to be healthy and to keep so. Temperance does not mean (as many people seem to think) an intemperate hatred of alcohol because so many people misuse it.

Temperance means the habit of being moderate and wise in the use of *all* food and drink, and of acting moderately and wisely in *every* way. To be healthy we must be temperate in eating, drinking, working, exercising, sleeping, and in all conduct.

Intemperance in food is very bad for the health. If a man eats too much, a part of it cannot be digested and turned into blood by the stomach and intestines. He gets indigestion, constipation, headache and loss of appetite. Dysentery and dyspepsia may follow. Or the stomach may digest it all, and the blood get far more food than it requires and be unable to use it properly. It is like a fire on to which so much

fuel has been thrown that it cannot burn, but can only smoke and smoulder. The blood being in a bad state, the whole body must be in a bad state, and the man is ill.

Intemperance in drink is worse, if the drink be some form of alcohol. If a man wishes to ruin himself, injure himself, kill himself, he can do it in no more certain and horrible way than by drinking alcohol intemperately.

But there can be intemperance in the use of tea and coffee. Many people drink far too much tea—which is itself a stimulant, as alcohol is. Strong tea drunk in excessive quantities is very bad indeed for the stomach and for the nerves. It contains a substance called "tannin" which is used for tanning leather—and the very tender and delicate walls of the stomach do not want to be treated as if they were ox-hide.

Even too much water is not good for one. The quantity in excess of what is required is useless, and what is useless is harmful.

Many people are not temperate in work and exercise. Some do too much and some too little. People who overwork get ill, and so do those who sit idle. We need enough work or exercise during the day to make us tired by night, and ready for bed. We want enough to give us a healthy appetite and to keep all our muscles and organs active and strong. But we do not want

enough to make us weary and ill, and so tired and worn that a night's rest is not enough to rest the brain and muscles. Fatigue is bad—but sufficient tiredness to make rest and sleep desirable is good. The man who does not make himself tired does not make himself hungry.

To return to the subject of alcohol, the great mistake that people make about it is forgetting that it is a *medicine* and using it as a *drink*. There can be no doubt that alcohol is thoroughly bad in every way for young people, and little doubt that it is bad for full-grown people as a regular drink. In some forms, such as good wine, it *may* be good for old people or for invalids.

The ordinary forms of alcohol are wine, beer, and spirits; the common forms of "spirits" being whisky, brandy, gin and rum.

If you have never tasted alcohol make up your mind that you never will—unless a doctor gives it you in illness. There are millions of people in the world who drink whisky daily, and are none the worse for it so long as they are in good health. Should they fall ill, however, the doctor finds it more difficult to cure them, for two reasons. One is that the alcohol has made the liver less active and efficient, and the other is that if he wants to give something to "stimulate" (that is to stir up and rouse) the heart he cannot do it. It has been "stimulated" too much, for years, by

the alcohol already drunk by the patient. It is useless to give a little cut with a whip to a horse which is already being flogged along as hard as he can go—for it will not affect him at all. If a patient has never been in the habit of drinking alcohol, the doctor can often use it with great effect, and many lives have been saved by its use. Let us keep it *as* a medicine since it *is* a medicine. When a man says, however, "all people who drink wine, beer, whisky, brandy, gin, or rum are beasts, and they are drinking poison," he is merely talking like a fool, and only fools believe him. No doubt they are drinking what is not as good for them as water would be, but then they are also eating food which is not as good for them as bread would be—but this does not make them beasts, nor is the food poison. Too much bread is bad for anyone just as too much alcohol is bad for him. Too much of *anything* is bad or it would not be *too* much.

Many of the wisest, cleverest, most learned, most virtuous, best, and noblest men in the world use alcohol as a drink. They do not drink too much and they believe it is good for them.

Do not use alcohol yourself (because it has not been the custom of your forefathers)—but do not despise others because they do. People who use it *in excess* must expect to be despised by everybody, however. There is no lower and more

degraded creature on the earth than the wretched drunkard who reduces himself from the class of the first and highest of all created animals to something lower than the lowest of the beasts—a helpless, senseless, brainless brute. There is always the *possibility* of becoming a drunkard if you drink alcohol at all, there is *no* possibility if you never begin—so don't do it.

The career of the drunkard is short and horrible, and his physical, mental, moral and social ruin is quick and sure. After each period of drunkenness his blood is less pure, his organs less active, his brain less clear, his character less strong and honourable. His appetite is less, the strengthening power of his food is less, and his sleep is less. He loses his post and rapidly sinks until he is a beggar, a disgrace to his family and caste, and the poor useless wreck of what was a man.

Or supposing he has sufficient self-respect to keep him from falling so low, and does not drink enough to earn the awful name of "drunkard," but still drinks too much—his case is still a very sad one. Any illness that he may get will certainly be fatal, and to many illnesses he will be much more prone than other men. None of his organs will act properly, and he will never feel well. His appetite will fail, his eyesight will be bad, his memory will weaken, he will lose strength,

and his work will surely suffer. When not drinking he will be longing to drink, and the craving will be so strong as to spoil both work and pleasure.

He will shorten his life and render it miserable.

Even should a man drink alcohol moderately he is paying highly for what does him no good, as it is not digested. It was alcohol in the bottle, and it remains alcohol in his mouth, stomach, intestines, and excreta.

Nobody was born with a taste for it, and most people heartily dislike their first taste of it—so why acquire the taste since it does no good as drink? (And the same applies to tobacco. No one is born with a liking for it. If you never acquire the liking for it you will save your pocket a good deal. For young people it is *very bad indeed.*) Once again, keep alcohol as a medicine and give it the chance of doing the only good it can do. Take alcohol as a *drink* when you take pills as a *food.*

Opium is a drug that is made from the poppy. It is used by doctors as a medicine, and as a medicine it is very useful. But it is also eaten and smoked by some people, and may do great harm. When a man once takes to eating opium it is almost impossible for him to leave it off. It becomes a habit which he cannot break. Thousands and thousands of people have been

ruined by the opium habit, particularly in China, for the Chinese are very fond of eating opium. A man who wants to have a healthy mind in a healthy body should never touch opium.

Hemp yields a drug which is known as *gānja* and *bhang*. It acts strongly on the brain, and may drive anyone mad who eats it or smokes it. No one who looks for health or happiness should ever indulge in this deadly drug.

Cocaine is a drug made from the leaves of the coca tree. It is one of the most useful drugs known to medical men, for it takes away the sense or feel of pain in any part of the body into which it is injected. But for all that, it is a slow poison when used often. Anyone who takes it soon becomes a slave to the habit, and is ruined in mind and in body.

PART III.

ENEMIES OF THE BODY.

CHAPTER XVI.

GERMS.

As we have already seen, germs are tiny living things, and they alone are the causes of certain kinds of illness. A man may be ill because he has eaten or drunk too much, or done some other evil and foolish thing. He may be ill because his forefathers lived foolishly or wickedly and left him a legacy of gout or other illness. He may catch a chill and suffer from excessive cold, or get a sunstroke and suffer from excessive heat, but he will not get any of the terrible diseases which kill millions of people in India, except by getting living germs of the disease into his body.

Nearly 80 out of every 100 deaths in India are caused by diseases due to germs—and diseases due to germs *can be prevented* if people will have the sense to try and prevent them.

Between 1890 and 1900 nearly *45 million* people died in India from germ-diseases—con-

sumption, plague, cholera, malaria, small-pox, and dysentery!

Had these forty-five million people, and those among whom they lived, all done their best to breathe pure air in their houses, eat pure food,

CHOLERA GERMS MAGNIFIED 1500 TIMES.

drink pure water, and keep clean, most of them would be alive now. When the towns of Europe were filthy, Europeans had the plague as Asiatics do. The plague disappeared in Europe when people began to obey the laws of health. It will do the same in Asia.

Germs which are dangerous must be killed.

Heat will kill them, and so will sunlight and oxygen. If food is well cooked, water well boiled, clothes and bedding, carpets and furniture put in the sunshine, and rooms filled with pure fresh air, disease germs will vanish as wolves have vanished from England. Why did the wolves die out? Because the forests they lived in were cut down and turned into fields, and because all men tried to kill them. They had nowhere to live and nothing to live on. So with the disease-germs, if the foul and filthy rags, the dirty, filthy puddles of water, the dark, airless, stinking rooms are done away with, they will have nowhere to live. If all men try to kill them by living cleanly, and giving them no dark and dirty places to live in, they must die out like the wolves did.

Although you have never seen one germ—because one is too small to see—you have often seen great masses of germs. When blue spots appear upon an orange or mango or on a piece of bread we say it has "gone mouldy." The spot of "mould" is a collection of millions of germs. These, however, are different from the disease-germs.

Germs, like plants, require a proper and suitable "soil" to grow in (some germs seem to find our boots and clothes very good soil in the monsoon), the proper amount of moisture, and the

right amount of heat. Unlike plants, they do *not* want light.

What is the best soil for germs? Anything that has been alive and has died is excellent. The living bodies of men and animals suit some germs very nicely, and their families increase by thousands a day. Some prefer rotten fruit and decaying vegetable matter, others like the earth itself, and nearly all love the dead body of an animal. The horrible smell that comes from a dead dog, or other decaying body, is due to the germs which make it rot. Anything nasty, like refuse, rubbish, stale food, filth and dirt, is good germ-soil. Human excreta, both solid and liquid, are about the most perfect homes for dangerous germs.

Is it not clear, then, that if we don't want the germs we can remove their habitations? We can have nothing that is stale, dead, rotting, dirty or stinking, anywhere in or near our houses. Germs must have homes; let us see that the deadly germs of plague, cholera, malaria, and dysentery have no homes near us.

Like most plants, germs want plenty of moisture; and, like all plants, they die if they get none. In damp, swampy places they thrive and flourish; in dry arid deserts they die. We all know how the "mould" germs appear on our boots in the wet weather, and never in the dry weather.

People who are ill with certain diseases are often sent by their doctors to drier climates.

We cannot change the climate of the place we live in, but when the monsoon season comes we can take special care that though the moisture is favourable to dangerous germs, there shall be no favourable soil for them in our houses, nor the darkness and foul air which they love.

With regard to temperature again, the germ is like the plant. Great heat kills both, and so does cold. The grass dries up and dies in the hot season, and if sharp, cold weather comes when the crops are young it kills them. It is much harder to kill germs, however. In the hot deserts where plants cannot live, germs could live if there were enough moisture, and the cold which kills young plants will not kill germs. It prevents their growing, however, and the cold weather is generally the "healthy" weather. The Arctic Regions and high mountains are bad places for germs. Again, we cannot change the climate of the place we live in, but we can apply our knowledge of the fact that heat will kill germs, by boiling the water in which they are, and by cooking the food in which they are. We cannot kill them by freezing food and water for a short time. It is useless to boil our water and then put a lump of ice into it when cool, so as to make it cold. A cubic inch of ice might contain

thousands of dangerous germs all alive and well. An ice-cream might be more dangerous than poison, on account of the germs in the milk from which it was made.

And, lastly, we can give the disease-germs every chance to thrive and increase by keeping the rooms in which we live dark and gloomy. This would kill plants kept in the rooms, but would favour the growth of the germs.

Or we can make our rooms uninhabitable for the germs by keeping them light and airy, and we can make a habit of putting everything movable out into the sunlight as often as possible. Putting a germ into the sunshine is like putting a fish into air or a boy into water—sunshine kills it.

And since there are so many millions of these germs all around us, and on everything we touch how is it that we are not all killed by them ; and how, again, is it that some people die and others escape during a bad season of plague or cholera ?

In the first place it must be remembered that not *all* germs are hurtful. There are beneficial germs, harmless germs, and the dangerous germs of deadly diseases.

Yeast, which is used in making bread, is a beneficial and useful germ. Some of the beneficial germs kill the harmful germs, as some beneficial animals kill harmful animals (the mongoose kills the snake for example).

We may drink in, or breathe in, or otherwise get millions of germs into our bodies, and none of them may be harmful. Or we may get the germ of a disease into the blood, and it may never do any harm. If a man is strong and in good health, living wisely and soberly, the germ will probably not hurt him. What becomes of it then ?

In the blood there are, besides the tiny red cells (corpuscles), a number of tiny white cells which crawl about in the blood by changing their shape and working their way along. These tiny white cells are the "sweepers" or scavengers of the blood, and they seize and eat up anything like a disease germ that has got into the blood from outside, just as fish go about in water and eat up insects. The stronger and healthier a man is, the more numerous and active the white cells are, and the less chance the disease germ has of living and breeding more germs. If a man is not in good health (through bad food, bad air, overwork, drunkenness or vice), the white cells in his blood may be unable to kill and eat the disease germ until it has increased to such numbers that the germs are stronger than the white cells and win the battle. Then, unless the doctor can give the man medicine which will kill the disease germs, they will kill him, except in the event of the doctor being able to keep him

alive until the germs have run their course, lived their lives, and died.

So, not only must we try and keep the disease germs out of our bodies, but we must try and keep so strong and healthy that those that get into our bodies cannot live and do us harm.

It should always be borne in mind that germs may not only enter the body through the mouth in food or water, and through the nose in the air we breathe, but through the skin itself, if it be cut.

The whole body is covered by a skin, and the skin is a wall and protection against germs. But what if there be a breach, or hole, in the wall? The enemy can get in. Hundreds of times it has happened that a surgeon has taken the disease of his patient through cutting his own finger when "operating" on him.

The tiniest scratch is dangerous, as being a doorway for the entrance of a disease germ. A man with a cut, wound, or sore (or other injury which has broken the skin) on his foot, would almost certainly get the disease germs into his blood if he walked with it uncovered over ground containing them.

Directly any part of the skin is cut, or broken through in any way, it should be covered up at once (with some clean material) to prevent the entry of disease germs.

It is through the skin that malaria germs are

put into the body by mosquitoes, plague germs by fleas, hydrophobia germs by the teeth of a mad dog, and many other germs by knives, needles, nails, or any other sharp-pointed objects which cut, stab, or scratch the body.

CHAPTER XVII.

THE HOUSE-FLY.

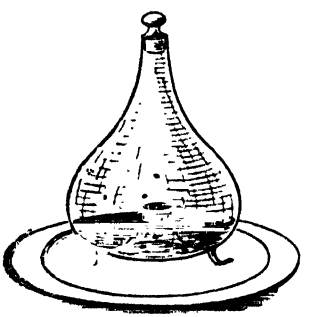
MAN has very many enemies in India. Which is the worst? Is it the tiger, the panther, the wolf, the cobra, the krait, or some other of the creatures of the jungle who, between them, kill thousands of people every year? Is it the deadly mosquito which spreads malaria from man to man, and causes the deaths of tens of thousands of people every year? Or is it the rat-flea which, leaving the dead rat that has died of plague, bites human beings and gives them the plague, which causes the deaths of hundreds of thousands of people every year?

It is none of these—bad as they are. The worst and deadliest enemy that man has got is the *fly*—the common house-fly—which looks so harmless, never seems to hurt, and is found in every part of the world.

How can a fly hurt a man? He has no sting like a wasp, or pincers like a big black ant. He

does not make cobwebs about the house like the spider. He does not suck the blood like the mosquito. No; but he is the nastiest, dirtiest, lowest, vilest, and most filthy of all vermin. He belongs to a *very* depressed class indeed—in fact, he is the lowest of all low-caste creatures, and his touch should be dreaded more than anything.

Flies come from eggs, and these eggs are laid by the mother-fly in the foulest filth she can find. Such places as latrines, dung-heaps, dead dogs, stables, and rotten fruit suit her best. Out of the eggs come maggots — like very tiny white worms; and these maggots live and crawl in the filth in which the eggs were laid.



FLY TRAP.

In time the maggots become flies (just as caterpillars become butterflies), and the flies still have the same filthy habits. They love to walk on things which make one sick to think of them; and, as they fly away from the rotten animal or vegetable matter, diseased corpses, or dung, on which they have been feeding, they carry tiny particles on their feet. These they leave on the next surface on which they settle. A fly may come straight from a cholera corpse and fall into your tea. It may fly into an hospital, and then

into a school-room. It may settle on a beggar's sore, and then on the lips of a baby. It will go from the diseased eye of one man to the sound eye of another. It will settle on excreta, and then on your food.

Wherever there is anything most disgusting, stinking, and deadly, flies will come in crowds, and from it they will go in all directions carrying the germs of disease. These things are not pleasant to think about. They are still less pleasant things to happen. But they are happening everywhere where there are flies; and millions of people are the victims of these foul and filthy creatures. If you live in a town, and leave your food uncovered for flies to settle on, there is no filth you can think of that you may not be eating!

There are men who throw away their food if the *shadow* of a low-caste person falls on it. It would be a good thing if all people threw away their food if house-flies had settled on it.

Besides the actual filth which they carry on their feet, flies spread cholera, dysentery, enteric, consumption and other diseases.

If a man suffering from consumption spits on the ground, and a fly settles on it, even after it has dried up, the germs of the disease will be carried away on the insect's feet, and may be

placed, as it settles here and there, where they will infect a hundred people.

In the case of enteric fever (which has killed hundreds of thousands of people) it is only through the excreta of the sick person that the infection is carried. This is done by the fly—for his favourite settling-place is on excreta.

What can we do then to protect ourselves against this enemy more deadly than all the wild beasts and reptiles of India put together?

Where religion does not forbid, we can destroy flies by means of poison, fly-traps and fly-papers.

These defences are rare in India, but one would find them in almost every kitchen in England.

There, all chemists sell squares of poisoned brown paper for poisoning flies. The paper is laid on a plate and covered with water. The poison soaks out of the paper and poisons the water. Flies come and taste it, and fall dead. Where these papers are not sold in India, a fly-poison can easily be made by putting a teaspoonful of *formaldehyde* in a cup of water. If this is made sweet with plenty of sugar, and put in a plate, it will soon clear a room of the flies that live in it.

Bichromate of potash dissolved in water (one dram in a teacupful) has the same effect. Either of these can be bought at a chemist's shop for an anna.

Glass fly-traps are cheap, and hundreds of flies

are caught in one daily. The trap should be put on a plate, in which a mixture of sugar and water, jam, wine, or something else that is sweet, has been placed just under the trap. If some liquid, such as sweetened water, toddy, or kerosene and water, is poured into the trap, the flies that fly up into it fall into the liquid and are drowned. If only plain water is poured in, some of them will be able to crawl out and escape.

Another way of ridding a room of flies is to hang a sticky paper on the wall. The paper is sticky because a kind of gum has been spread over it. When a fly settles on it, his feet stick, and, as he struggles, his wings also get caught, and before long he dies.

This is a cruel way of killing flies, but it is better than the flies' cruel way of killing us.

People, who, like the Jains, are forbidden by their religion to take life of any kind, can only protect themselves by covering their food with muslin or some kind of netting or cloth.

Everyone should do this where there are flies, and very special care should be taken in the case of milk. Milk is the very best and richest food for germs, and they increase and multiply more quickly in milk than in anything. There is no food through which mankind gets so much disease as through milk. There is no finer and purer food than good, fresh, pure milk, but there

is nothing more dangerous than milk which has been left exposed and is full of disease-germs.

It would be a very good plan if no one would buy any food from shops or stores where it is left uncovered. It is not covered with a cloth, and before long it *is covered* with flies! Think of a pile of sweetmeats (*black*, as we all have often seen them, with insects), on which there are a thousand flies. Then think of the awful, horrible places in which these flies have been, and the disgusting, filthy, foul things on which they have crawled. Is there any room for wonder that disease is so common?

How easy it would be to lay a piece of muslin over the box, basket, or tray; and what sickness, suffering, misery, and loss would be avoided if everyone would see that food was so covered when exposed for sale, or set out in the house for a meal.

Let us then fear the fly more than the snake, and keep the following rules:

1. Keep flies out of the house as far as possible by removing filth that attracts them.

2. Kill those that are in the house by means of poison and traps.

3. Cover all food, especially milk, in such a way that flies cannot settle on it.

4. Cover the face of a sleeping child with muslin, or use mosquito curtains, if possible.

5. Have rooms white-washed as often as possible to destroy any eggs of the fly.

6. Keep stables clean, and remove the litter daily to a distance, and cover it with earth. A filthy stable is a happy home for flies.

When you see a fly walking on your food, yourself, your bed, your clothes, your books, or anywhere near you, think of a man who has been cleaning a stable (or walking in filthy mud, and treading in excreta and unspeakable filth) coming straight into a durbar tent and walking on a beautiful red carpet, and leaving a dirty mark of filth at every step! *That is like what the fly is doing as he walks on you.*

Surely that is even worse than the shadow of the lowest of low-caste *men.*

CHAPTER XVIII.

THE MOSQUITO.

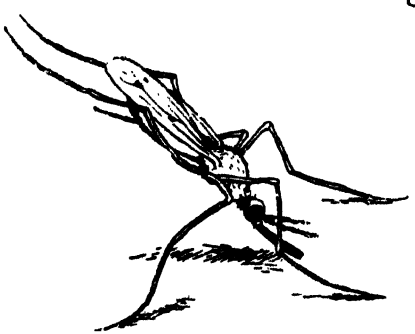
ANOTHER murderous, deadly enemy of mankind is the mosquito, because it is only through the mosquito that man gets malaria—a disease which kills millions of people every year, and ruins the health of millions more.

As a matter of fact, it is only one kind of mosquito (called the "anopheles") that puts the malaria germ into man's blood, but we cannot

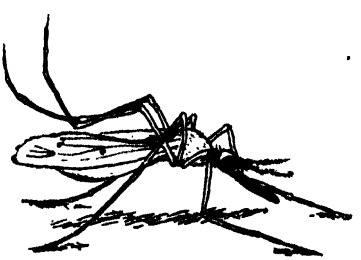
stop to examine the mosquito that is biting us to find out whether it is of the dangerous or the harmless kind. It is safer to consider all mosquitoes as dangerous, and to take every kind of precaution to prevent them from biting us. About this we shall read later when dealing with Malaria.

If at any time you notice a mosquito standing on the wall, and see that it stands with its body nearly at right angles to the surface on which it has settled, you may know that this is one of the deadly and dangerous kind, and that you are in a place where extra special care is required if you do not want to get malarial fever.

The harmless kind of mosquito stands with its body parallel to the surface on which it is resting. In speaking of mosquitoes in future we shall understand that the dangerous kind is meant.



DANGEROUS.



HARMLESS.

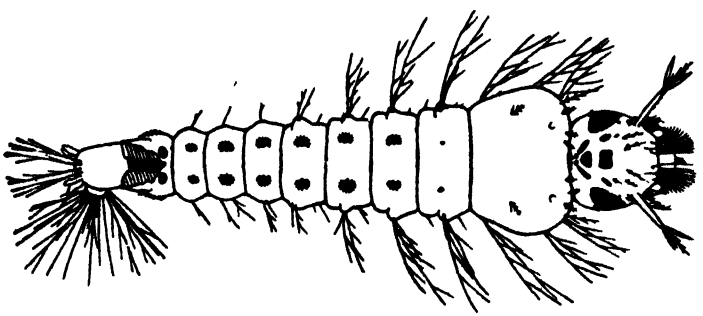
The mosquito is not one of those creatures which grow gradually from birth to full size, as birds, beasts, fishes, and many insects do. It

has different stages, each quite different from the last, and so little alike that in one it is a swimming insect and in another a flying insect.

Mosquitoes are hatched from eggs laid in water, and, as we shall read later on, the creature hatched from the egg cannot live in water, without air, for very long. When it is first hatched, it breathes water like a fish, and moves about near the surface in search of its food, tiny germs too small for the human eye to see. It frequently throws off its skin as it grows, in the same way that a snake does. In this stage it is called a larva. In about a week it throws off its skin for the last time, and comes out of it in a different form and is a different creature. It can no longer breathe water, and must continually come to the surface to breathe air. If it is prevented from doing this it is drowned, just as you would be yourself if you were held under water and not allowed to come up to breathe. It is this fact that will enable us to get rid of malarial fever if we are wise.

For about two days the pupa stage lasts, and then the skin of the pupa bursts and the flying insect comes out—and is ready to spread illness, ruin and death among the people who have been foolish enough to let it live, and who are now foolish enough to let it bite them as they sleep.

Mosquitoes are often found more than ten miles from the nearest water, probably carried along by a gentle breeze. As a rule they do not go very far from their birth-place. They fly to the nearest building or other place of shelter, and are to be found hiding during the daytime in dark corners of rooms, in cupboards, upon dark-coloured hangings and clothing, and under the low roofs of sheds and huts.

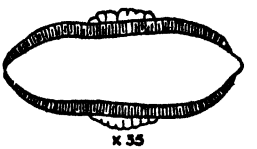


LARVA OF MOSQUITO.

It is the female mosquito who wants our blood. The male prefers sugar, sweet fruit, sweetmeats, and sugary juices. The male dies in a few days, while the female continues her wicked life of blood-sucking and poisoning for a month.

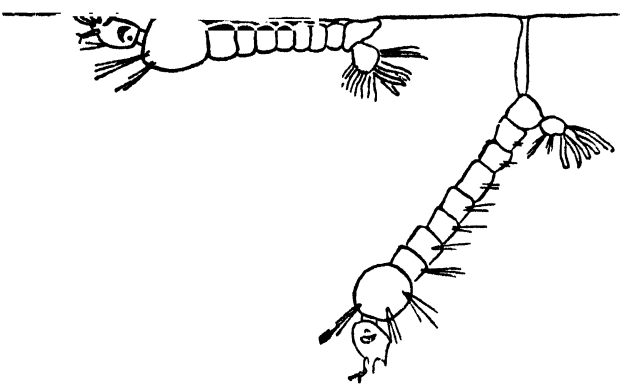
If you care to watch the life of a mosquito you can easily do so by taking water from some stagnant pond in a small glass bottle and studying it daily. If it contains eggs of the mosquito, as is very likely, you will soon see several mosquitoes in the larva stage. You may not notice the egg,

which is like this when magnified thirty-five times, but you cannot fail to recognise the larva, which, when greatly magnified, is like the picture.



These larvae will be found to spend most of their time at the surface of the water. They are not breathing air, but catching and eating the millions of tiny germs which cover the surface of dirty, stagnant water like a film. If they are disturbed they wriggle along or sink down into the water.

Before they have been in the water a fortnight, a piece of paper should be tied over

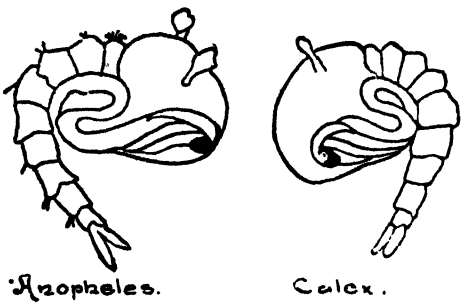


SHOWING USUAL ATTITUDE ASSUMED BY ANOPHELINE AND CULICINE LARVAE IN WATER.

the top of the glass, so that when the larva has become a pupa and the pupa has become a mosquito, it may not fly away.

After a week or ten days some of the larvae will be found to have changed in shape, and

to look like commas from the reading book, hanging in the water. If you could see one



NYMPHAE OF ANOPHELES AND CULEX.

through a microscope you would find that it was like this.

MOSQUITO.

(*a*) Larva; (*b*) Pupa; (*c*) Perfect Insect.

Within forty-eight hours this pupa will have split his skin or case, and emerged as a real mosquito. So, in the same peg-tumbler you may have eggs, larvae and pupae in the water, and live mosquitoes flying about above it. Also, if you were foolish enough to do it, you could allow your mosquitoes (of the anopheles kind) to bite a person who was suffering from malaria and then to bite you, and you would have malarial fever yourself.

Mosquitoes are among the cruellest and deadliest enemies of mankind. *All your life*, do all you can to prevent them from breeding in water near your house, and teach uneducated people who know nothing about them to do the same.

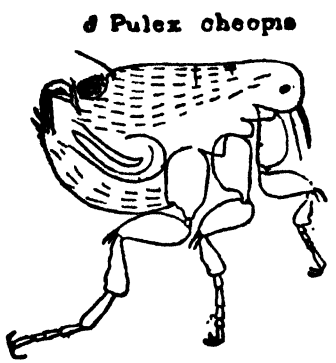
The best means of doing this will appear in the chapter on Malaria.

CHAPTER XIX.

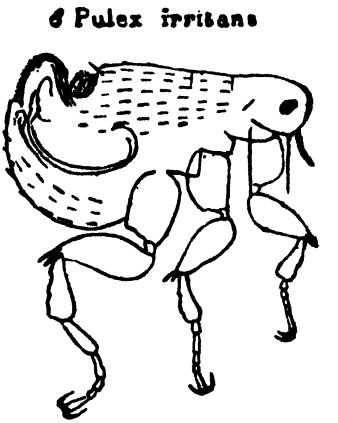
THE RAT AND HIS FLEA.

ANOTHER great enemy of man in this country is the rat, and unless man regards the rat as more sacred than himself he must get rid of it by all means in his power. It is not too much to say that in some cities either man must go or the rat must go. If the rat is not stamped out, then man will be, by plague.

As we shall see later, doctors have clearly proved that plague is a rat disease, and that if there were no rats there would be no plague. Also that the disease is taken from the rat to man by the rat-flea. The rat-flea much prefers to stay with the rat and live upon him, but when the rat dies and his body becomes cold, the flea



RAT FLEA.



HUMAN FLEA.

must go somewhere else for his food, or starve. He goes to another rat if he can, but if all the rats in the house are dead he is obliged to turn to human beings for his food. He goes to the clothing and beds of the people in the house, gets on to their bodies and bites them. As he does so, the germs of the plague disease pass from the flea into the blood of the human being, and in a little while the bitten man has plague.

When you have read the chapter on Plague

you will fully understand this; and there is no educated and enlightened man who does not now admit that plague is due to diseased rats, and is carried from the diseased rats to human beings by means of the rat-flea.

What terrible enemies of the human race rats are, can only be realised by thinking of the millions of people who have died of plague, and of the enormous amount of grief, suffering, loss, and misery caused by this disease.

How can this enemy be fought? On a small scale it can be fought by means of traps, cats, and dogs. If everybody did his best to catch and kill all the rats in his house by setting traps and by keeping a cat, very large numbers would be destroyed. But that is only on a small scale, indeed, compared with what is really necessary to properly fight and overcome the foe.

Rats, we must remember, must have food to eat. They only come into houses where they find food. They eat grain and any cooked food they can find. If all grain were kept in closed vessels into which rats cannot get, and no food were left about the house within reach of rats, not a single rat would be left alive. Any food left over and not eaten should be burnt. It should on no account be thrown where rats can get it.

Well-built houses are required, and cleanly habits on the part of the people. No builder

should be permitted to build houses in large towns, in future, except of solid masonry; and municipalities should prevent over-crowding by taking up land and opening out new suburbs. Meanwhile kill rats.

These things are easier said than done, and still easier is it to show the right path than to have it followed in those places where religion regards the taking of life as a sin.

It seems reasonable, however, to argue that people who are willing to endanger their own lives and the lives of thousands of others rather than kill a diseased rat, might on the other hand do their duty in the prevention of the spread of plague in another way—and be inoculated.

As will be shown later on, it has been proved over and over again that the death-rate is far lower among people who have been inoculated than among those who have not.

The man who will neither agree to the killing of rats nor to inoculation, should remember that there are other people in the world besides himself; and that if he can take no steps to protect his own health he has no right to be a source of danger to others.

Where there are rats there is danger, and danger not only to the people in whose house the rats are, but to thousands and thousands of others.

PART IV.

DISEASES OF THE BODY. THEIR CAUSE AND PREVENTION.

CHAPTER XX.

MALARIA.

ALTHOUGH we hear more about plague, and people dread it more, owing to its terrible suddenness, far more people die of malaria than of plague. Besides the millions who die, millions more are weakened and injured by this fever, although they escape death. The saddest thing about it is that it could be largely prevented, if people would take the trouble to do two things. These are:

1. Have no stagnant water near the house.
2. Take quinine.

A third step can be taken by those who can afford it, and that is:

3. Use mosquito curtains.

(I once heard a civil surgeon say to a malaria patient in his hospital, "Why don't you use mosquito curtains?" He replied, "I cannot

afford them." The doctor said, "You can get a curtain for four rupees. This illness has kept you from work for a fortnight. What have you lost during that time?" The man replied, "About twelve rupees." "Then go and buy a curtain and save eight rupees," said the doctor.)

If you cut your finger blood flows out. There is blood, as we have already seen, in every part of the body. This blood is "the stream of life." We cannot live without it, and we cannot be healthy unless it is pure. You will remember that it consists of liquid, and very tiny specks of solid matter, far too small to see. There are certain living germs which prey upon these tiny specks of living matter, as cats do on mice, or tigers on cattle. But *how* do the germs get inside the blood-pipes? They cannot force their way through the sides as the tiger does through the walls of the cattle-pound.

They are put into the blood by mosquitoes. If you watch a mosquito "biting," as we call it, you will see that he drives a kind of sting right through the skin. This "sting" is a sharp-pointed hollow pipe, and he not only sucks up blood through it, but he sends germs through it into the blood as it flows along the pipes. These germs increase so quickly that there are soon millions of them in the blood, all destroying the

specks of living matter (corpuscles) which are needed to build up the body and keep it strong. Before long the person feels very ill and soon dies, unless he takes quinine. Quinine will save his life, because, while it is harmless to him, it is poison to the malaria germs.

No one would ever get malaria unless he were bitten by a mosquito. Plainly, then, the proper thing to do is to get rid of the mosquito as far as possible, and to prevent those that remain from biting us.

Have you ever seen silkworm eggs, tiny silkworms, the full-grown caterpillar and the moth? If so, you will understand how the mosquito is first an egg, then a creature like a worm, and lastly a fly. But the worms can only live in water, although they *must* have air to breathe. The mother mosquito lays her eggs, as I have told you, on the surface of water, and requires still, quiet water for this purpose. This may be a lake, a pond, a pool, a tank, a well, a cistern or a little water in an old tin pot. It does not matter to the mosquito how large or how small the piece of water may be so long as it is *still.* She will not lay her eggs in a running river or in the sea.

When the eggs are hatched, the young mosquitoes, which now look like tiny worms, swim about in the water, but before long they are quite

different from fish in that they cannot breathe water. They have to keep on coming up to the top to breathe air, just as a whale, a seal, or a frog does, and as a man would do if he were swimming in water. If the young mosquito were kept from reaching the air he would die. He would be drowned just as you would if you were kept too long under water. *Don't let him breathe then.* How can we stop him? We shall see.

When the young mosquito is old enough, he comes out of the water and turns into a fly, as the silkworm turns into a moth. For the rest of his life he sleeps in the daytime and seeks his food at night. Our blood is what the female wants. She does no harm, although she annoys us, until she meets one of the millions of people who have malaria. When she sucks the blood of such a person, she sucks in malaria germs with it. These germs breed in her body. A few days afterwards she bites somebody, and as she does so the germs get into his blood too, and in a few days he gets fever. Thus it is clear that if we can prevent the female mosquito from using water she cannot lay her eggs, and if we can prevent the worm-mosquitoes from breathing they cannot live, and, further, if we protect ourselves with mosquito curtains at night we shall not be bitten.

So the first thing to do is to see that there are no old pots or kerosene tins lying full of water in the compound; and no pools or puddles of water near the house. Wells can be covered and cisterns can have lids.

Secondly, we can prevent the mosquito-worms from breathing in water which cannot be covered.

If kerosene oil is poured into the water it will spread all over the surface, because it is lighter than water, and cover it as cream covers milk. *This will cause the death of every mosquito-worm in the water, because they will be unable to get through the oil to breathe the air.*

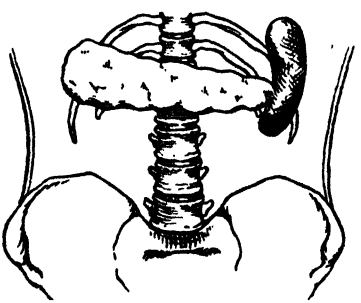
And the people who have already got the malaria germ in their blood must kill it with quinine. Quinine is very cheap indeed, and can be bought at the post offices for less than it costs.

It is useless to take one dose. It must be taken for several days until every malaria germ in the body is killed. The quinine may make us a little deaf for a day or two, and cause noises in our ears, but while it is giving us this very slight trouble it is *killing* the malaria germs, and so saving our lives.

It is a very good plan for a person who has *not* got fever to take a dose of quinine twice a week

during the fever season. Then when a mosquito bites him and puts malaria germs into his blood, they die at once and he never gets fever at all. "Prevention is better than cure."

Hundreds of thousands of people in India have got a swelling on the left side of the abdomen. This is due to the organ called the "spleen" becoming diseased and enlarged through malaria. It is very dangerous to have an enlarged spleen. A blow may rupture it, and that means death.



SPLEEN.

Thousands of people in this country die every year through rupture of the spleen. This diseased and enlarged spleen can be cured by taking quinine. Anyone with an enlarged spleen should take quinine for his own sake, and he should be made to take it for the sake of other people, as he is a constant source of danger. So long as he has a diseased spleen his blood contains malaria germs, and every time a mosquito bites him there is the danger that when the germs

have matured in its body, it may bite somebody else.

So there are five things to remember about malaria:

1. Have no water lying about the compound.
2. Pour kerosene oil on water that cannot be taken away or covered.
3. Use mosquito curtains at night if possible.
4. Take quinine in the malaria season whether you have malaria or not.
5. Go to a doctor if you have an enlarged spleen.

Note that it is a good plan to take a purgative before taking quinine. Castor oil is the best purgative.

CHAPTER XXI.

PLAGUE.

THERE would never be any such thing as plague if men would be careful and be cleanly in their habits. If they live crowded together in small dirty houses, breathe foul air, drink foul water, eat foul food, and make the soil on which they live fouler and fouler every day, they will certainly receive Nature's punishment for breaking Nature's laws. The worst of it is that the innocent suffer with the guilty; and people

who live in a clean and proper way get the disease started by the filthy habits of others. When European towns were dirty and undrained, and the people lived in foul air, horrible smells, and filth, they got the plague. When they drained their towns, ventilated their houses, took care to have pure water, and followed the rules of hygiene, plague quite disappeared, and is entirely unknown in Europe now. Similarly in India, if every house were clean, and every room were light and airy, and all people had cleanly habits, plague would disappear and never be seen again. It is a punishment for dirtiness just as ruin and disease are the punishments for drunkenness.

Plague germs get into the body through the skin, and are generally put there by fleas. The fleas come from rats which have got the disease. Here, to begin with, is room for improvement and cleanliness. Why should there be rats and fleas about a house? They are a sure sign of dirt and carelessness, because they are "vermin," and there are no vermin in clean, well-kept, bright and wholesome places. Rats will not come where there is no food left lying about, and fleas are not found in well-cleaned, disinfected rooms. It is, of course, very difficult for poor people, whose houses have mud floors and walls and thatched roofs, to get rid of fleas; but it is fairly easy to

get rid of rats; and were there no rats there would be no plague.

When once plague has got into a city (by reason of its containing filthy districts) it is very difficult to get rid of it, unless people have the sense to be inoculated. If everyone were inoculated it is possible that none would die of plague, probable that only a very few would die, and certain that there would be an immense decrease in the death-rate.

If there should be a plague epidemic in your neighbourhood at any time *get yourself inoculated;* keep as strong and healthy as you can by means of fresh air, exercise, and rest; do not *over*-work; sleep off the ground; use disinfectants in the house; set rat-traps; and think as little about plague as you can.

It is strange, but true, that those who fear a disease very greatly, and are always thinking about it, worrying over it, and going in terror of their lives, are far more likely to get it than people equally healthy who never give it a thought after taking proper precautions.

There are men who say, "Why take any precautions? If it is written on our foreheads that we shall die of plague, we shall die of plague, and nothing can avert it." And yet we do not find that these men also say, "Why eat food? If it is written on our foreheads that we shall die of

starvation, we shall die of starvation, and nothing can avert it." We do not find these people slow to jump out of the way of an approaching motor-car, on account of what is "written."

Besides, even if they hold such sound and sensible views for their own guidance, what right have they to suppose that other people wish to die horrible deaths, and see those dear to them die? Wise men don't want to die of plague, and those who *do*, have no right to neglect the precautions which will save others as well as themselves. The law will some day punish the man who does things which endanger the lives of wiser and cleaner people, simply because he holds the view, "Plague is the result of filth and bad ways of life. If it is written on my forehead that my habits must be filthy, they must."

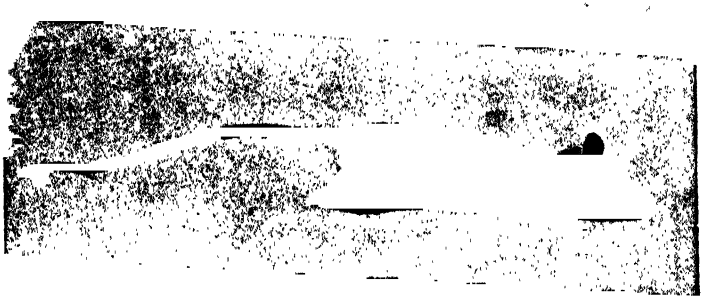
If you meet such ignorant and foolish people at any time, and see them doing things likely to encourage the plague in every way, try and explain something of the following to them.

Plague appeared suddenly in Bombay in 1896. It had been before, but not in the memory of man. It was something historical, like the Great Plague of London of the seventeenth century. It had always attacked men living together in great masses in towns or camps. Armies had been destroyed by it.

It came so suddenly in 1896, and was so little

understood, that people in Bombay who had read terrible stories of the state of London during the Great Plague, saw them enacted before their own eyes. There were huge crowds struggling to get into the railway stations, whole streets of houses standing empty, people lying dead in the streets, whole families lying dead in their houses, fear, grief, and terror everywhere. All business (and most work) was at an end.

Government, as usual, did its utmost, and no labour or money was spared to find out the cause of the disease and the best way to fight it. Medical men worked day and night, and ran the

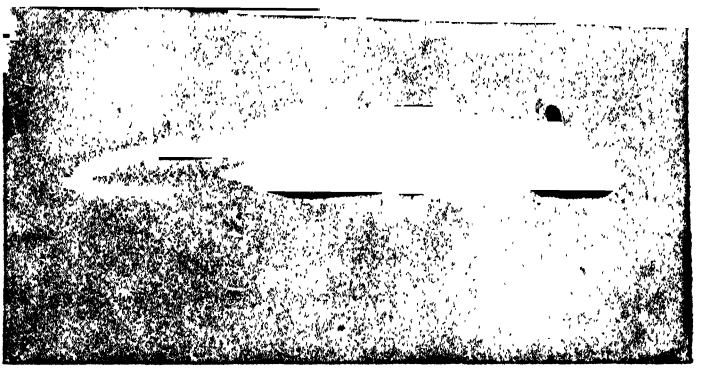


THE HOUSE RAT.

greatest risks in trying to learn all they could about the germs of plague. At first, lakhs of rupees were wasted in doing things which afterwards were known to be useless, and in buying and

using disinfectants which could not get at the real root of the trouble—the rat and his flea.

In course of time the fact that dead rats were always found before the plague broke out in any



THE RIVER RAT.

place led to the idea of the connection of rats with the spread of plague, and experiments were made with the object of finding out exactly what that connection was. At first they failed. It was found that when rats got plague, people in the same place got it, and that when people from the plague-infected area fled to another place, the rats in that place soon began to die of plague.

It was also found that a plague patient could be nursed by others without any fear of their getting the disease *direct* from him, as would be the case if he had small-pox.

If plague could not be caused by germs breathed

in or taken into the body with food and water, but could only be caused by germs entering through the skin ; and if, again, there was some close connection between plague and rats, how could the germs get from the diseased rats through the skins of human beings ? Clearly by means of the rat-flea. It had been noticed that live rats, and rats just dead, were covered with fleas, but that on a rat that had been dead long enough to get cold no fleas were to be found at all. They had gone to other living animals.

Experiments were made with the object of proving that nothing could take the disease germs from a plague-stricken rat to another rat, another animal, or a human being, except fleas.

It was found that healthy rats could actually eat the body of one of their brethren who had died of plague, without becoming infected themselves !

It was also found that healthy guinea-pigs could live and remain healthy on ground upon which infected rats had lived and died, and which was foul with their excreta. In the absence of fleas nothing happened.

Experiments were then made with the rat-fleas themselves. Whenever the fleas from a rat that had just died of plague were allowed to go to healthy rats, the latter took the plague at once. Similarly, when they were allowed to go

to healthy guinea-pigs, the guinea-pigs got the plague at once.

Guinea-pigs hung up in little cages in a big cage containing dead infected rats died if they were hung within jumping-distance for the fleas. Those hung too high for the fleas to jump up to them did not die.

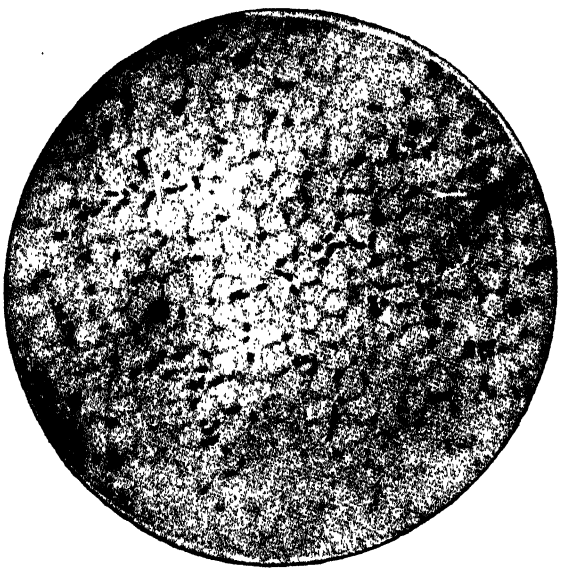
RAT AND GUINEA PIG.

In these and other ways it was proved beyond a doubt that plague could only get from an infected rat to a healthy rat or some other animal by means of rat-fleas.

But rat-fleas are different from the fleas found on human beings. Would rat-fleas ever bite men, because, if not, all these experiments proved nothing with regard to the spread of plague among human beings.

A crowded tenement house in Bombay in which a large number of dead rats had been

found was visited by the medical officers. So great a number of fleas had come from the dead rats that the poor people had been obliged to desert their tiny rooms and sleep on the verandahs. Plague broke out among them, and on a



PLAGUE GERMS IN BLOOD OF RAT. (×850.)

search being made by the doctors it was found that among the fleas, found upon the bodies of all the patients, were a large number of *rat-fleas.*

The rat-flea's natural home is the rat. There he will stay while the rat lives, and he will feed upon the rat's blood. When a rat gets the disease by living in foul and filthy places and eating foul and filthy food, or by being bitten by rat-fleas from another diseased rat, he dies. The fleas

remain on him as long as he is warm and soft. As soon as his body gets cold and hard they can no longer get their food and must go elsewhere or starve. They go to another rat, and as soon as they bite him the germs of the disease, which they have got into their bodies, pass into this rat's body, and before long the germs have so increased and multiplied that his blood is full of them and he soon dies of the plague. Off they go again to another rat, and so on, until all the rats are dead, and the fleas, on leaving them, must go to human beings or starve. We all prefer certain kinds of food, and there are other kinds of food we would never think of touching (unless we were actually starving, and must eat the other food or die, because none of our proper food was to be got). So with the rat-flea. So long as he can find rats and live on rats' blood, he will never think of going to a human being and living on human blood. But when all the rats in the house are dead he has no choice but to take to the food he does not like, human blood, or die of starvation.

What lesson is to be drawn from these facts. Clearly it is, "Destroy all rats and there will soon be no plague." They are the homes of the plague-germs, and the fleas are the distributors or carriers that take the germs about from dead diseased rats to living healthy rats, and, finally,

when there are no rats in the place, to human beings.

A STREET IN BOMBAY. A PARADISE FOR RATS.

When experiment and experience had proved beyond all doubt that the rat was the culprit, a great crusade was started against rats in Bombay, and the municipality spent a great deal of money

on rat-traps and rat-catchers. Both the black rat of the houses and the brown rat of the sewers were caught in hundreds daily. All the rats caught were examined in order that the proportion of infected ones might be known. This was done for a year, and a "curve" was made on a chart showing the result. This curve was found to be wonderfully similar to the curve on the chart showing the number of deaths from plague among the people of Bombay!

Put on the same chart they are seen to follow each other with remarkable regularity, but at an interval of from a week to a fortnight. When very few infected rats are found there are very few human deaths; when many are found there are many deaths. A decrease for a few days in the number of infected rats is followed by a decrease in the death-rate of human beings for the same period. A sudden and great increase in the number of infected rats is followed, a few days later, by a sudden and great increase in the death-rate. Why are the changes in the number of infected rats always followed by a similar change in the death-rate, *after a few days*—(from ten to fifteen as a rule).

It is because it takes several days (1) for the fleas to become hungry after the rats have gone, (2) for the disease germs to increase and multiply in the body of the human being, and (3) for the

disease itself to run its course after the man has been plague-stricken.

Is there no other way of stamping out plague and preventing millions of deaths except by killing rats? If so, there is but little hope of very quick improvement, and parts of some cities will have to be entirely rebuilt before they cease to be perfect, happy homes for rats.

There is a way. It is by *making the human blood unfit for habitation by the plague germs.* There are rivers in which all the fish have died and in which no fish can live, because chemicals have been poured into the water from chemical factories. Our blood can be treated in such a way that plague germs can rarely live in it, and yet the blood can remain perfectly wholesome so far as we are concerned.

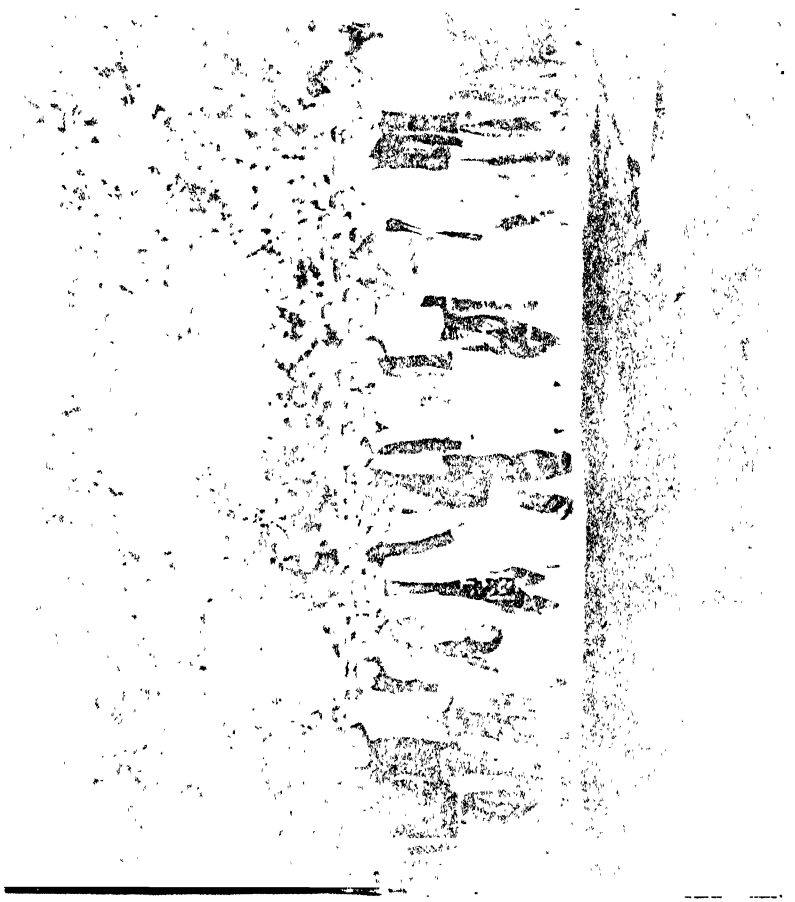
The process is called *inoculation.*

You will hear people, even educated people, speak against inoculation, but that does not alter the fact that the death-rate among inoculated persons is *less than one-sixth of that among those not inoculated.* That is to say that when among one hundred inoculated people ten die, over *sixty* die out of every hundred of the un-inoculated.

The following figures speak for themselves.

Sixty-one people were living in a house at Pilot Bunder, Bombay. Twenty-four of them

were inoculated before plague broke out. Of these twenty-four, one got plague and recovered. Of the remaining thirty-seven, twelve died of



ASSISTANT-SURGEON INOCULATING.

plague. Nought per cent. as against over thirty-two per cent!

At Belgaum eighty-three people, men of the Army Hospital Corps and their wives and

children, were living close to the European Hospital, and were all inoculated with the exception of three. At the end of the plague season it was found that *not one* of the inoculated eighty had had plague at all, whilst *two out of the other three had died of it.* Nought per cent. as against over sixty-six per cent.

At Hubli, out of 3020 railway employees, 1260 were inoculated and 760 refused. Of the former *two* died, and of the latter *twenty-one.* One-sixth per cent. as against nearly three per cent., or eighteen times as much fatality among the uninoculated.

Of the police in Khandesh, 1508 were inoculated, and 230 refused. There was ten times the fatality among the 230 uninoculated that there was among the 1508 who had been inoculated.

At Nagpur, out of the 3779 workers in the Empress Mills, 1116 were inoculated. *Six* of these died of plague. Of the 2663 who were not inoculated, *179* died. About one-half per cent. as against nearly seven per cent., or fourteen times as much fatality among the uninoculated.

At Undhera in Baroda twenty-eight families had cases of plague at one time. Of these twenty-eight families, seventy-one persons had been inoculated and sixty-four had not. Of the seventy-one inoculated people *three* died, of the

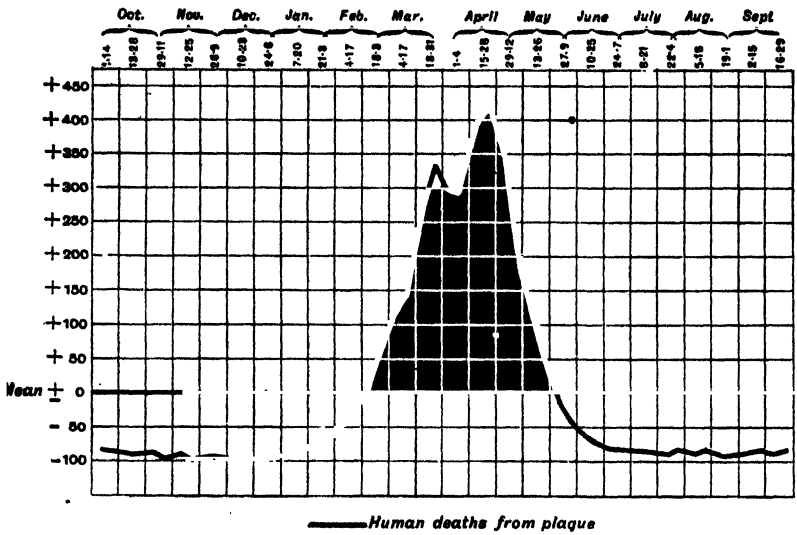


CHART SHOWING THE PROGRESS OF THE PLAGUE IN THE HUMAN RACE.

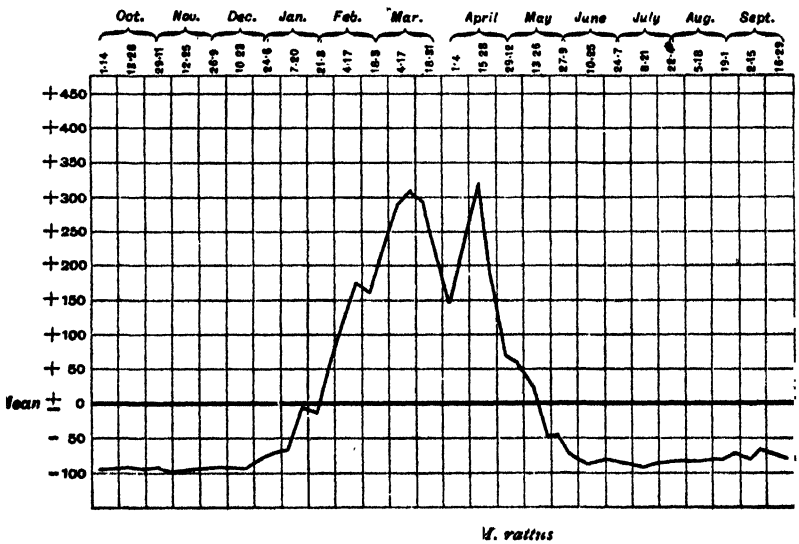


CHART SHOWING THE PROGRESS OF THE PLAGUE IN

sixty-four uninoculated *twenty-six* died. Four per cent. as against forty, or ten times as much fatality among the uninoculated.

Among 3317 inoculated municipal servants in Bombay there were *three* deaths in one plague season, while among 838 others (living in the same quarter) who refused to be inoculated, there were *eighteen* deaths. One-tenth per cent. as against two and a quarter per cent., or twenty-two times as much fatality among the uninoculated.

In Karachi 1245 sweepers were inoculated and *four* of them died. Of *sixty* who refused to be inoculated, *five* died. One-third per cent. as against over eight per cent., or twenty-five times as much fatality among the uninoculated. The figures come from various parts of the Bombay Presidency, but in the Punjaub the records are still more striking. Out of 186,777 people who had been inoculated, 814 died of plague, but out of 639,630 who had not been inoculated, no less than 29,623 died of it.

Since these statistics are plain and simple truths which are beyond all doubt and contradiction, the people who try to prove that inoculation cannot be a good thing have a very hard task before them.

Most sensible people will agree that, so far, we have learnt that the two great steps which can

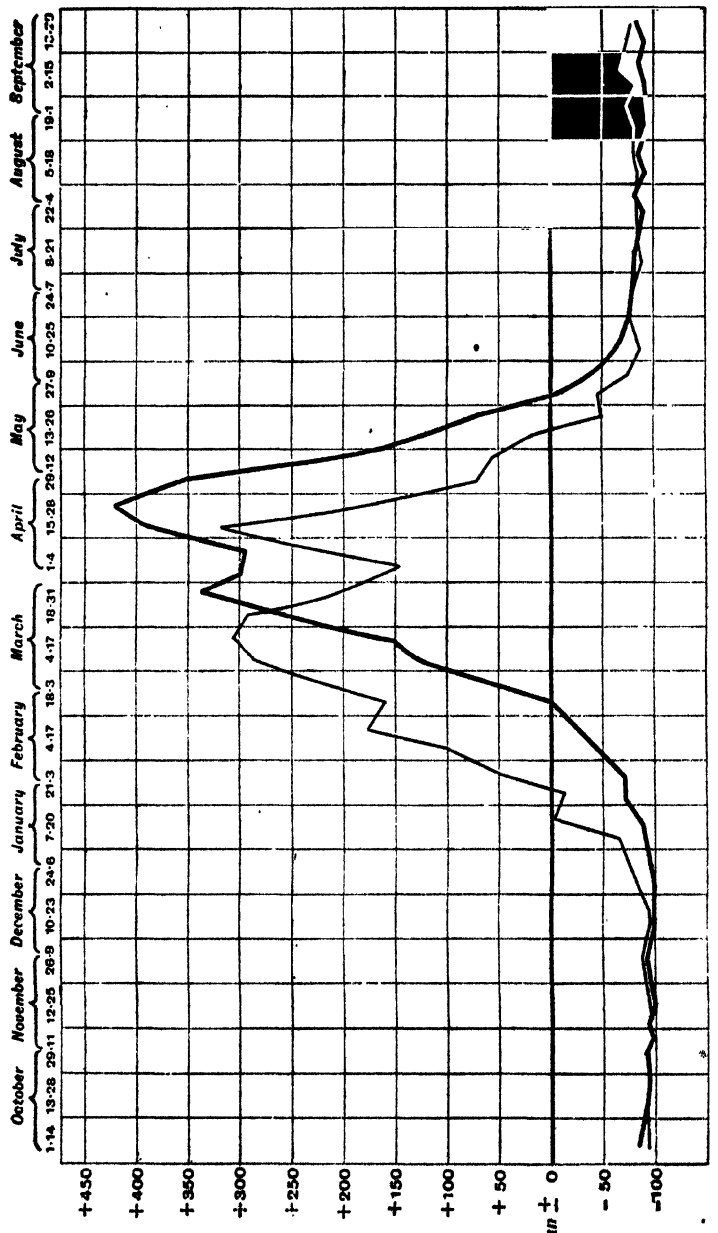


CHART SHOWING THE PROGRESS OF THE PLAGUE IN RATS AND THE HUMAN RACE.

be taken against plague are the destruction of the rats, as they contain the germ; and inoculation, as this renders it very difficult for the germ to live in the human blood.

For your own sake, and as a duty to your fellows, *get inoculated* at the beginning of the next plague-season, and persuade as many others as you can to follow your wise example.

CHAPTER XXII.

INOCULATION.

SUPPOSE you owned a beautiful garden, and it was the most precious possession you had, what would your feelings be if you found that a very large and healthy family of cobras or kraits had got into it, and were gliding along the paths and coiled up under the tree-roots and among the flower-beds? Would you say to a man who came along with an equally large and healthy family of mongooses, and wanted to let them loose in the garden, "No, I don't like the idea of mongooses in my garden. I know the snakes will kill me, but mongooses are not at all pretty?"

If you did, you would be a fool. Perhaps there is no one who is quite foolish enough to do such a thing, but how many people are there

who are foolish enough to say they do not wish to be inoculated against disease?

Suppose there is an epidemic of plague in the town or village where you live. The plague germs are everywhere, and if they get into your blood you will very likely die. A rat that has been living in foul and filthy places, and eating horrible things, has got the plague. A flea bites it and gets the plague germs into its body. The rat dies of the plague, and the flea leaves his dead body. You sit on the ground and the flea jumps on to you and bites you. The germs of the plague disease pass into your blood—and the large and healthy family of snakes has got into the garden! But where are the mongooses? You did not like them—you would not be inoculated, and—you die.

Inoculation is the putting into the body of a poison that forces the body to produce an antidote which kills the disease germs, as the mongooses kill the snakes. The antidote kills them, but it hardly hurts you at all. It hurts you about as much as paying for the mongooses would have hurt the man. It is better to pay and live.

"But," you may ask, "what about the white cells that go about in the blood as sweepers, and whose business it is to catch and kill the disease germs?"

Well, what about the police going about in

the jungle to catch dacoits? Suppose the dacoits are so many and strong that they catch the police instead? What is to be done? Soldiers must be sent to help the police. So, in times of disease, the white cells may be in very urgent need of help, and if there has been no inoculation, and they get no help, the disease germs may increase and multiply, and death from plague is the result.

Inoculation does not make it *certain* that a man will not die of the disease during an epidemic—but the inoculated man and the *un*inoculated man are like a man with a rifle and a man without one, who are each fighting a leopard. Who has the best chance? Nearly always the man with the rifle will win. Nearly always the man without a weapon will be killed.

In England almost every child is vaccinated when it is born, and wise people get themselves re-vaccinated every few years, and always if they go to a place where there is small-pox. In India wise people get themselves inoculated whenever plague breaks out. There are people who say that inoculation cannot be a good thing because it must be harmful to put anything into the blood which Nature did not put there. Certainly it is a great pity, and a great mistake, to put anything into the blood which Nature did not put there. It is a terrible pity that

other people's filthy habits should cause diseases and make it possible for disease-germs to be put into our blood. But since such bad things *are* put into them, is it not a good thing to put in *less bad* things *which will get rid of them*?

Supposing all the people in the world were clean in their habits, and lived in a healthy way in proper homes, took proper food and drink, and wore proper clothes, there would be no disease-germs of plague, small-pox, enteric, cholera, and consumption. Then it *would* be folly to put anything into the blood that Nature did not put there. But so long as there are such disease-germs, and, so long as we may at any time get them into our blood, let us be wise enough to take steps to prevent their giving us the disease when they get there. Filth and disease are not "natural," and we must fight what is not natural *with* what is not natural. A cut with a knife is bad, but certain growths must be cut out of the body with a knife or the body will die. Poison put into the blood is bad, but it must be put there to poison disease-germs or we shall die. Do the people who say that inoculation is bad say that plague and small-pox are not a hundred thousand times worse? In time of danger and evil choose the lesser evil—and be inoculated.

CHAPTER XXIII.

CONSUMPTION.

CONSUMPTION is usually a disease of the lungs, though it may also attack the bowels and other parts. As its name shows, it is a disease which "consumes" or eats away the part attacked. It is common in the West, where plague is unknown, and is found chiefly among the poor who live in damp, unhealthy houses, and whose living-rooms and work-rooms are over-crowded and badly ventilated. One-tenth of the people die of it every year in some countries. It is very common in India in crowded cities.

GERMS OF CONSUMPTION.

Like other germs, the germs of consumption thrive in dark, dirty, airless rooms, and, in such places, people who have got the disease soon give it to those who have not.

Anyone who coughs and spits a good deal should see a doctor and find out whether he has got consumption. The coughing is due to the

fact that the germs grow on the lungs in spots, somewhat as "mould" does on cheese or on bread. Before long the part of the lung on which the spot is growing is eaten away, and the mass of germs breaks down, and there is a hole in the lung. In trying to get rid of the piece of diseased lung, blood, and germs, the person coughs and spits. When he spits, large numbers of germs from his diseased lungs are sent out in the spittle. When the spittle dries up, these germs are blown about in the air, and are breathed in by other people, and so the disease is spread.

A person who has got consumption should not be allowed to sleep in the same room with other people, and he should *never* spit on the floor or on the street. In hospitals the greatest care is taken to see that consumptive patients have a proper vessel into which to spit, and that the spittle is burnt. A disinfectant is also put into the cup to kill the germs. If every consumptive person would spit into a disinfectant (or into a rag and then burn it), and slept in the open air, the spread of this terrible disease would be checked.

Why "in the open air"? For two reasons. If he is in the open air he is not likely to give the disease to others, as he is when sleeping in the same room with them; and, moreover, he is fighting the disease by means of fresh air.

Oxygen kills the germs, and people who are being treated for consumption are now kept in the open air day and night, however cold it may be. They are also sent away from the place in which they live, if it is a damp one. The only hope for a person with consumption is to go to a dry climate and live in the open air.

In some provinces of India consumption causes more deaths than any other disease, more even than are caused by plague, malaria, or cholera. Over 60,000 people die of it every year in Bombay. Moreover, the disease is very rapidly increasing, as the following figures will show. In the Central Provinces the consumption death-rate in the last five years has risen from 8000 to 16,600. In 1902 the consumption death-rate in Madras was 5000, and in 1906 it was 23,000. In Eastern Bengal and Assam the death-rate from consumption is four times what it was five years ago. In Western Bengal it has increased from 5600 to 12,800 in five years. In 1906 over 20,000 people died of consumption in the United Provinces, and over 57,000 in the Punjaub. In Calcutta, at the present time, five men out of every 2000 die of consumption, and seven women out of every 2000. (There are over a million and a quarter people in Calcutta.) In the *city* of Bombay seven people out of every 2000 die of consumption every year.

In all these places where consumption exists, it is found to be worst among Mahommedan women, eleven out of every 2000 dying of it. This is due in part, no doubt, to the purdah system, and lack of fresh air and exercise.

Unfortunately, what is wrongly called "education" has a great deal to do with the spread of consumption. Real education is the training, growth, and development, by exercise, of all the powers of the body, mind, and character. Education in India is too often the ruin of all three, through leading a most unnatural and unwholesome life, while learning by heart the contents of text-books. An enormous number of Indian students get consumption through going to a city, joining a cheap, over-crowded college, and living for years where there is not enough light, not enough air, not enough room, and not enough food. What food there is, is usually badly cooked, unsuitable, and of poor quality. These evils not being sufficient, they spend the day and much of the night huddled over books, work too much, worry too much, sit too much, sleep too little, and eat too little. To many, exercise and real recreation are unknown. And all this when they are growing lads, just at the age when plenty of good food, rest, fresh air and exercise are most necessary. The wonder is *not* that under these circumstances so many fall

victims to consumption and other diseases, but that there are *any* who do not. We expect evil, disease, injury, ruin and deaths from *war*, but why should they go hand in hand with *education* of all things—education, which means training, growth, development, and benefit in every direction?

The consumption germ is one of those that does not live, thrive, and multiply in water or earth, but only in the human body. In spite of the fact that they do not increase and multiply outside the human body, however, the germ can live for a very long time, and await its chance of being breathed into the lungs of some person—where it can begin to thrive and increase. A consumptive person may cough up germs in blood and spittle, and send them out on to the ground in some room or place where there is no sunshine. They will not die, although they will not increase, and as they are blown about with the dust, after the spittle has become dry, they are likely to be breathed in by somebody, sooner or later. They are almost certain to be found in the clothes, bedding, towels and lotah of a consumptive person, and on the floor, walls, and furniture of a house in which a consumptive person lives. The great enemies of the germs are sunshine and fresh air. Fresh air will prevent consumption, and fresh air will cure it, if it has not gone too far. People

who spend their lives indoors are far more likely to get the disease than those who do not, and consumptive people who stay indoors are certain to die of the disease. Fresh air is the finest thing in the world for health, and surely it is the cheapest. It is a cure in consumption, and a great help in all diseases. No patient, from whatever disease he may be, suffering, is the worse for fresh air. If his lungs are weak or diseased there is all the more need for it. In Europe, consumptive patients are cured by the fresh-air treatment, and live out of doors, day and night, even in the depth of winter and when snow is falling. Often patients wake in the morning to find snow all around them, and only kept off their beds by a screen. So long as the body is kept warm, it does not matter how fresh and cold the air is, and the consumptives in the hospitals never go inside a room, but live, have their meals, and sleep, in the garden.

We cannot spend the whole of the day and night in the open air, but we can always have the windows of our rooms open day and night, and get rid of all unnecessary useless "chicks," and other wretched means of shutting out light, air,—and health. We can also go out into the air instead of sitting in a stuffy room, when the choice lies with us.

It is to be remembered also that, speaking broadly, the strong and healthy get stronger and healthier, and the feeble and weakly get more feeble, weaker, and diseased. That is to say—the strong and healthy man is the man in whose blood disease-germs die, and the feeble and weakly man is the man in whose blood they live, thrive, increase, and multiply. A man may be quite healthy too, and all his organs sound, and he may be in a weak state from over-work, worry, or some folly in eating, drinking, or living. This is just as dangerous a state. The strong and healthy man eats well, takes exercise, and goes out in the fresh air. His good, pure, healthy blood contains plenty of oxygen, and plenty of the white corpuscles that kill disease germs. It not only builds up the tissues or flesh of his muscles and organs, but it destroys all germs that get into it. The weak and feeble man eats little, perhaps, although he may be using his brain a good deal (and the active brain requires more feeding and nourishing than any other organ, or any muscle). He is too weak to play games, and he prefers sitting indoors to taking long walks. He thus does nothing to quicken his breathing and get plenty of oxygen into his lungs, and his poor, impure blood can neither build up the tissues of his muscles and organs, nor kill germs that get into it. He breathes in

a germ of the consumption disease, and before long his lungs are being attacked and destroyed.

Try, therefore, to keep healthy by proper exercise, proper food, proper rest and recreation, proper light, and above all—by breathing fresh air night and day.

Signs of consumption are loss of weight, fever that quinine will not reduce, much perspiration at night, continual cough, hoarseness of the voice, and spitting blood. When these are present a doctor should be seen at once.

CHAPTER XXIV.

CHOLERA.

CHOLERA is a most dangerous and deadly disease, and, like most others, is the result of dirt and filth, and can only take a firm hold in dirty, filthy places. It has been introduced into Europe many times, but has never spread far, by reason of the improved sanitation and the careful precautions of the health officers and sanitary authorities.

The chief symptom of the disease is very violent diarrhœa. This becomes so bad that the victim dies of weakness in a few hours. The cholera germ is one of those which get into the body in the drinking water. It frequently

gets into the water through the well and the cesspool being close neighbours. A latrine, cesspool, dung-heap, rubbish-pit, or cesspit is a beautiful home for germs such as the cholera germ, and as liquid manure or filthy rain-water (which has passed through the cesspit or latrine) sinks down into the ground the cholera germs go with it, and, sooner or later, reach the well which ignorant people have allowed to be close to the germ-bed—for that is what such things as cesspits are. If everybody boiled the water they drank there would be no cholera, but as people will not take the trouble to do this, they might at least see that their water comes from a pure source. A few filthy or ignorant people can cause the deaths of thousands by starting a cholera epidemic. At least 75 out of every 100 people who get cholera die of the disease.

The best chance for people who have taken the disease is to get medical help in the very earliest stages. Until the doctor comes the victim should be kept warm and something acid given him to drink, such as vinegar or lime-juice, if there be no chance to get sulphuric, hydrochloric, or acetic acid. If any of these acids be at hand, 10 or 15 drops in water should be given. The patient should be given ice to suck, and when suffering from cramp in the legs, these should be violently rubbed.

The great danger from a cholera patient lies in the excreta and vomited matter. These should be disinfected, burnt, and buried deep in the ground—*not* near a well, tank, or river. After helping a cholera patient one should wash and disinfect one's hands. When there is cholera about it is unwise to eat fruit. Fruit, especially if unripe, may cause diarrhœa, and the person who has got diarrhœa is in a very favourable state for getting cholera. Raw fruit is still further dangerous because all kinds of fruit-sellers' dirty hands have touched it, and it has lain in a basket by the roadside, for dust to settle on it, has been the resting-place of filthy flies, and is almost certain to have disease-germs on it.

In times of cholera epidemic keep the abdomen warm, be very careful to eat good plain food that has been well cooked, drink only boiled water, and don't think about cholera.

CHAPTER XXV.

SMALL-POX.

SMALL-POX is a terrible disease, of which hundreds of thousands of people die annually, and it is a *preventable* disease. Do you wish to make *sure* that you can escape being killed, blinded, or dis-

figured for life by small-pox? If so, be *vaccinated*, and you will almost certainly be safe.

Small-pox attacks people of all classes and all races, but the people of Africa and of the East seem to suffer more severely than those of Europe.

It begins with headache, shivering, pain in the legs and back, vomiting, fever and, sometimes, fits.

A "rash" (of pimples and spots) appears on the face and neck, then on the body, and lastly on the arms and legs. The rash turns to the "pocks," or sores, from which the disease gets its name.

Very frequently the patient dies from high fever, lung disease, or weakness. Often those who recover are deaf and blind. Formerly all who recovered were horribly marked all over the face with "pits," left when the scabs of the pocks or sores fell off.

Small-pox is one of the most infectious of all diseases, and yet it is now almost extinct in England. This is owing to compulsory vaccination in childhood, and to the fact that the people are wise enough to get vaccinated every time there appears to be any likelihood of a small-pox epidemic.

The germ is found in the breath of the patient and in the scabs of the pocks. If a person who has not been vaccinated breathes the air of a room in which a small-pox patient has been, or

touches the body, clothing, or bedding of one, he will almost certainly take the disease.

If all people were vaccinated at birth, and then again at the age of twelve years; and if all cases of small-pox were at once notified to the authorities so that the patient could be isolated and properly cared for, small-pox would soon disappear.

In an English city a quarter of a century ago there was an epidemic of small-pox. Out of *every* 1000 adult people 3 took the disease who had been vaccinated twice, 19 who had been vaccinated once, and *94* who had not been vaccinated at all. Of the vaccinated people who took the disease hardly any died at all, but the majority of the unvaccinated people died. Of every 1000 children 5 who had been vaccinated took the disease, and 101 who had not been vaccinated. Very few indeed of the vaccinated patients died, but a great proportion of the unvaccinated died.

Facts are very stubborn things.

A distinguished writer has said :

"The loftiest end to be reached is its complete removal from all civilised countries, and indeed from the face of the earth by universal vaccination and revaccination. The day is not far distant when the man, woman, and child unprotected by vaccination will properly be regarded as *an enemy of the human race and treated accordingly.*

Evidence of the most satisfactory character as to successful vaccination should be imperatively required of all applicants for admission to schools, academies, colleges, charitable institutions, public libraries, art galleries, and places of labour legislatures, political, religious, and deliberative bodies; of every purchaser of a ticket for purpose of travel; and of every voter. In addition there should be in every district a systematic and periodical inspection of all persons registered in the census by persons qualified and competent to perform compulsory vaccination. This is the scientific treatment of small-pox."

CHAPTER XXVI.

VACCINATION.

VACCINATION is nothing more nor less than causing small-pox in a very mild and perfectly harmless form. One *seldom* has small-pox more than *once*, and to have been vaccinated is as good as to have had small-pox. That is to say, it gives practically the same "immunity" or safety.

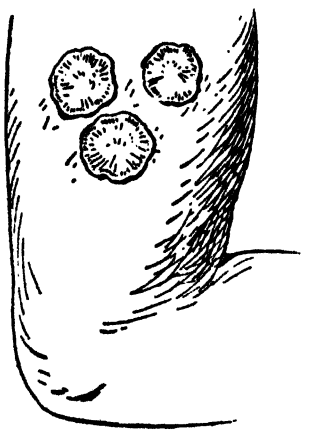
Like inoculation against plague, vaccination against small-pox makes the blood uninhabitable for the germ. If you have been recently vaccinated and get a small-pox germ into your blood,

it dies there as a fish would die in oil or acid, and nothing happens.

The operation is painless, harmless, and free.

Dr. Reynolds, M.D., F.R.C.P., a writer on Hygiene, says:

"The little operation is performed by making a few slight scratches on the arm, and then spreading on them a small amount of clear fluid called vaccine lymph, which is taken from the little blebs or vesicles on the arm of a child who has been similarly vaccinated seven days before, or the lymph may be taken from the vesicles of a vaccinated calf, or the so-called calf lymph. At least three separate marks should be made on the arm, or better still, four, as one or two marks only do not sufficiently protect from true small-pox. The operation is practically painless, and if carefully done, is absolutely safe, and in healthy children no bad results should follow. About three days after the arm has been vaccinated small lumps or papules begin to grow on the places which become also slightly red. These then show some clear fluid in them, and become vesicles, which are well developed on



VACCINATION MARKS.

the eighth day. After this the clear fluid turns to matter or pus, then a scab forms, which ultimately, about the fourteenth day, falls off and leaves the well-known "vaccination mark." During this process the place should be protected from the air and from the friction of the clothes by a piece of clean linen, spread with some simple ointment, such as vaseline, and over this a proper guard to prevent injury. This primary vaccination will protect against small-pox almost absolutely for about twelve years, and partially for the rest of life, that is, if small-pox is taken, it will only be of a very mild kind, and not cause death. Every one should, however, be re-vaccinated about the age of twelve years, and then they are almost absolutely protected for the whole of life. If an adult who has not been re-vaccinated for several years happens to be exposed to a small-pox case he should be vaccinated at once, or at any rate before three days have elapsed, and then even if he has been infected with small-pox, he will only have a very mild attack.

It is impossible here to give a history of vaccination, or to deal with the objections and *false statements of a few foolish people who call themselves anti-vaccinators.* It will be sufficient to mention that since the introduction of compulsory vaccination into England the death-rate

from small-pox has enormously decreased, and that in Germany, where both primary vaccination *and re-vaccination at the age of twelve years are compulsory, small-pox is practically unknown.*"

Dr. Banks, M.D. (a health officer of Calcutta), another writer on Hygiene, says:

"Re-vaccination at the age of puberty has practically the effect of abolishing small-pox.

The following suggestions should be carefully observed:

1. As a rule every child should have four good pocks.

2. Re-vaccination should be done every six or seven years. A person should never pass the time of puberty without re-vaccination.

3. Re-vaccination should be done during epidemics of small-pox without regard to the length of time that has elapsed since primary vaccination.

4. Every child, even the newly born, should be vaccinated if small-pox is prevalent. The younger the child the greater is its chance of taking the disease.

5. Every child should be vaccinated before it is five months old whether small-pox is epidemic or not.

6. If for any reason it is suspected that a person is about to develop small-pox, that person should be vaccinated at once. By doing so the

disease may be averted, or what might otherwise have been a bad attack may turn out a comparatively mild one. It is well known that vaccination will overtake and destroy the small-pox infection even when the small-pox infection has had a start of two or three days. After all, however, small-pox may appear if the vaccination is done too late.

7. If small-pox breaks out in a house all the other members of the family should be immediately vaccinated."

It has been already mentioned that cows suffer from a disease called "cow-pox." This disease resembles small-pox in the human subject in so far as it passes through similar stages. There are, however, few if any of the grave symptoms which attend human small-pox. The disease in the cow can only produce pocks when the lymph is applied directly, whereas it is well-known that small-pox may be contracted at a great distance through the air or infected articles of clothing, etc. It is to cow-pox, as has already been stated, that we are indebted for lymph suitable for human purposes. This lymph is of two kinds, viz. "bovine," or the so-called "calf lymph," and humanised lymph.

Calf lymph is the virus of cow-pox which has passed through a successive series of calves, becoming thus more fit for human use.

Humanised lymph is that which is taken from a human being, as in arm-to-arm vaccination. The original supply, however, was calf lymph, the supply having been kept up in the human subject instead of the calf. This constitutes the difference between the two.

Lanoline lymph or lymph preserved in lanoline has of recent years been introduced into India, and from careful experiments conducted in the Animal Vaccination Depôt at Darjeeling has been found to be a most successful method of storage and preservation, and when carefully used proves most successful in vaccination operations.

Vaccination direct from the calf, however, is the most suitable method from every point of view. The system of vaccination direct from the calf is to be worked in the following manner as described by Major Dyson in his report on the working of the Vaccination Department in Bengal during the three years 1890-91, 1891-92, 1892-93:

"A calf is to be procured through the village headman (as a rule for nothing, though eight annas to one rupee per calf may sometimes have to be paid) and is inoculated with lanoline lymph obtained from one of the depôts, on its abdomen, which must of course be first washed with soap and water and then shaved by the vaccinator.

From this calf all the village children are vaccinated, as well as a calf from each of the neighbouring villages, which are brought in for the purpose and returned to their owners immediately after inoculation. When the lymph is ripe on these calves, which is usually on the sixth day after inoculation, the vaccinators proceed to the village and vaccinate from the calves all the children of those villages, as well as fresh calves from other villages. In this way animal vaccination is spread throughout the district, and the evils of arm-to-arm vaccination are avoided. No harm is done to the calf, which requires no particular care during the period the lymph is ripening on it."

In Bengal in 1892 there were 3844 deaths from small-pox amongst children under one year of age, or 17·18 per cent. of all the deaths from small-pox during the year.

In the same year there were 6973 deaths amongst children from one to six years, or 31·18 per cent. of all the deaths from small-pox, and 3937 amongst children from six to twelve years, or 17·60 per cent. of all the deaths from small-pox.

The total number of deaths at all ages from small-pox during the year 1892 was 22,359. Therefore 15,000 children under twelve years of age died from small-pox whose lives might have been saved if they had been properly protected against that disease by vaccination.

PART V.

ACCIDENTS AND INJURIES TO THE BODY.

CHAPTER XXVII.

BLEEDING.

If you ever have the chance to attend a course of lectures on First Aid, and to obtain a "St. John's Ambulance" or "First Aid to the Injured" Certificate, you should most certainly take that chance. A man who knows exactly what to do in cases of accident and injury is a blessing to himself and others. How much better to be able to do the right thing quickly and well, than to be able only to stand and gape like a fool, while the injured person dies for want of a little simple help.

Hundreds and hundreds of people have died from loss of blood, poisoning, snake-bite, drowning, and other mishaps, when all that was required to save their lives was such aid as any person with a little sense and knowledge could have given. Hundreds and hundreds of times

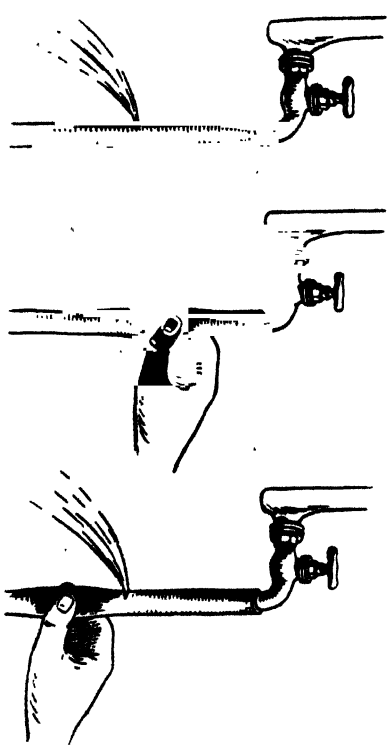
the doctor has had to say "Too late" when fetched to the scene of some accident—when he would not have been too late had a single onlooker known what to do to stop bleeding, to prevent spread of poison, to start the lungs working again, or to take other simple precautions.

Perhaps the commonest cases in which "first aid"—that is, immediate help before the doctor can arrive—is required, are cases of bleeding owing to the cutting of some large artery or vein.

If an artery has been cut, the blood is of a very bright red colour, and flows out in spurts or jerks.

These facts are due to the freshness and purity of the arterial blood, which has come straight from the heart, and has done no work yet; and to the nearness to the heart, which causes each beat or "pump" to be felt all along the arteries. As the blood is flowing *from* the heart, it is clear that the bleeding can only be stopped by some obstacle between the heart and the cut. In other words, the artery must be pressed and closed on the side of the cut *nearer* to the heart. Pressure of the artery on the further side of the cut could have no effect whatever in stopping the bleeding.

If you have a rubber pipe fastened to a tap, and let water flow along the pipe, and then make a cut in the pipe, you can only stop the water from spurting through the cut by pinching the pipe on the side of the cut nearer the tap. If you pinch the pipe beyond the cut, on the side further from the tap, the water will only spurt out all the more.



If, therefore, you see that a boy has severely cut his wrist, and that very bright blood is flowing out in jerks and spurts (once for each beat of the heart), what is the right thing to do? Stare at him while he bleeds to death before the doctor comes? No. Seize his arm and press the wrist *above* the cut—on the side nearer the heart. Press as hard as you can, holding the arm straight up in the air, and call for a piece of string, tape, linen, calico, leather, rag—or anything else that you can tie, as a bandage, very tightly round the arm. If there

is none whom you can send for something for a bandage, you must press on the artery with one hand, and get hold of your handkerchief, tie, belt, bootlace, braces, or some such article, and use that. When you have tied it as tightly as possible, you can make it still tighter, if necessary, by thrusting a pencil, pen-holder, ruler, or stick under it, and then giving the stick, or whatever it is, a twist round. The bandage *must* be tight enough to stop the bleeding.

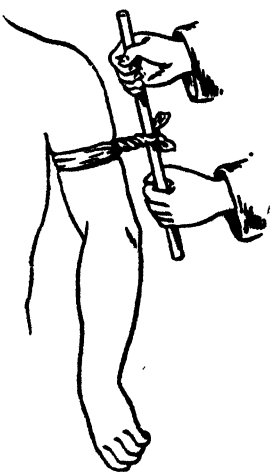
The best place for putting pressure on an artery is where it lies on or near a bone. A slight pressure will catch the artery between the thumb and the bone, or between the bandage and the bone, and squeeze it shut at once.

In the arm there is such a place on the inner side, about four inches above the elbow. In the leg there is such a place on the inner side, slightly to the front, about six inches above the knee.

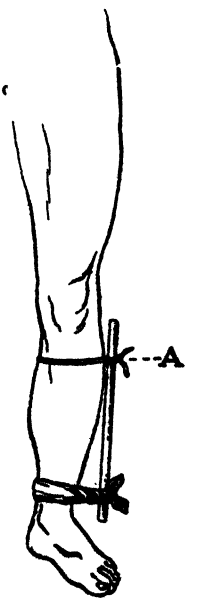
If, on the other hand, a vein has been cut, the blood will be much darker in colour, and will pour out in a perfectly steady stream, without any spurts and jerks at all. This is because the blood is on its way back to the heart full of impurities, having done its work; and because the beats or "pumps" of the heart cannot be felt in the veins so far from the heart, and with millions of tiny hair-like blood-vessels

(called capillaries) between the arteries and the veins.

As the blood in this case is flowing *towards* the heart, it is clear that an obstacle must be placed on the further side of the cut, to stop the



HOW TO APPLY A KNOTTED HANDKERCHIEF AS A TOURNIQUET ABOVE A WOUND IN AN ARTERY.



FIXING A TOURNIQUET IN POSITION TO STOP ARTERIAL BLEEDING IN A WOUND IN THE FOOT.

flow of blood before it reaches the cut. Do as you did in the case of the artery, only put the bandage on the *other* side of the cut.

If blood is flowing from a stab or cut on the neck or trunk, where you cannot put a bandage, the best plan is to simply shut the cut with your

thumb and fingers, and hold it shut until the doctor comes.

In the Boer War a man was shot in the neck, and his blood was flowing like water out of a tap. He would have bled to death in a few minutes, but another wounded man (who had been shot in the leg and had bandaged his own wound) closed the hole with his thumb and fingers, and held it shut. He remained sitting by the other man for over four hours, and for four hours he held the sides of the wound together, and prevented the flow of blood. When the men of the medical corps found him, they had to bring a doctor from the field-hospital to the other man, instead of taking the man to the field-hospital. The doctor arranged a pad and bandage before he could be removed, and said that the man who was shot in the neck certainly owed his life to the other man. Nothing could have saved him but finger-pressure until the doctor came with proper instruments and bandages.

There is a belief that the placing of a mass of cobwebs on the bleeding spot will stop the flow of blood. No doubt this helps to form a "clot," and so to stop the bleeding, but cobwebs are dirty, and it is more likely that they will cause blood-poisoning than do any good at all.

If you cut your hand with anything, be very careful to thoroughly clean the cut and then cover

it up. A scratch with a pin may prove fatal if dirt and germs get into the blood.

Soap is a good disinfectant in itself. Permanganate of potash is invaluable, but only enough crystals should be put in the water to colour it without making it opaque. If the solution is too strong it burns. If carbolic lotion is used, one drop of the lotion should go in forty drops of water; and if corrosive sublimate one drop in a thousand.

If the edges of a cut are wide apart they should be held together and strips of strong sticking-plaster put across to keep the cut shut up, but the whole cut should not be covered by the plaster. There must be spaces left for any discharge.

The wound should be then covered up with cotton-wool, lint, calico, or linen, soaked with a disinfecting lotion or with some vaseline or ointment. The whole should then be kept in place with a bandage and the hand kept quite still.

In any wound the steps are: cleansing; closing; disinfecting; protecting from the air, dirt, germs and flies; rest. New dressing is required daily while there is any discharge.

CHAPTER XXVIII.

POISONING.

THERE is a wide-spread belief that if a person has swallowed poison he must at once be given an emetic (that is, something which causes vomiting) or made to vomit in some other way.

This is a mistake. In the case of certain kinds of poison no emetic should on any account be given, or vomiting caused in any way—or the harm and danger will be greatly increased. Such poisons are those which burn and corrode, and are called *corrosive* poisons. Some poisons are quite agreeable and pleasant to take, but corrosive poisons burn the lips, mouth, food-pipe and stomach, and cause terrible agony. Some of these corrosive poisons are acids such as sulphuric acid (vitriol), nitric acid, hydrochloric acid, oxalic acid and carbolic acid. Some of them are alkalis such as washing-soda, ammonia, caustic potash, and caustic soda.

No emetic should be given to a person who has swallowed one of these corrosive poisons, whether acid or alkali.

In the case of an *acid*, chalk, or a lump of plaster from the wall will give relief. These are best given crushed up in milk. Magnesia is also

good. Afterwards olive oil should be given, or ghee.

In the case of an *alkali*, lime juice or vinegar and water will give relief. Olive oil or ghee should be given later.

It is when other *non-corrosive* poisons have been swallowed that emetics and vomiting are required. Such poisons are opium, alcohol, cocaine, phosphorus (from matches), corrosive sublimate, or "bad" food (tinned fish, tinned meat, bad fish, shell fish, poisonous berries, roots or leaves).

An emetic can be made by putting a little mustard or salt into hot water. The patient must drink until he is sick. Tickling the back of the throat with a feather or with the finger will often help.

Opium-poisoning is one of the commonest in India. It causes unconsciousness and a rapid weak pulse, while the face becomes pale and the pupils of the eyes small. The patient must be roused up by means of shaking, and by sprinkling cold water on him. An emetic must be given and he must be walked about and not allowed to fall asleep. He should not even be allowed to sit down until he has quite recovered. It may be necessary to keep him moving for hours, and in this case he will require nourishing and stimulating food.

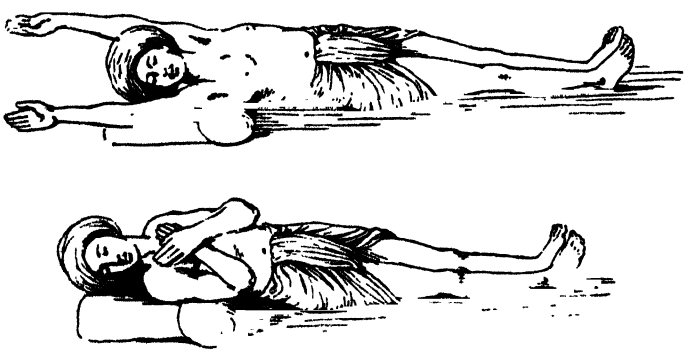
If it is found impossible to rouse and awaken

him, "artificial respiration"—that is, forced breathing—must be tried, as in the case of a person who has been drowned and appears to be dead.

CHAPTER XXIX.

DROWNING.

WHEN anyone who cannot swim has fallen into a tank, well, river, or other water, and been brought out apparently lifeless, there is always a



chance of saving him, or her, if artificial respiration is tried—provided the drowned person has not been in the water too long. Hundreds of people have been pulled out of the water and then allowed to die, because none of the bystanders knew how to start them breathing again. In the case of a drowned person, the muscles of the diaphragm and ribs have ceased to

act, and therefore no air is flowing in and out of the lungs. As the diaphragm and rib-muscles are not working to pump air in and out (natural respiration), it must be pumped in some other way. This pumping is called "artificial respiration," and is carried out by means of the arms.

If you ever see a boy taken out of the water and apparently dead, set to work at once in the following way:

Put him on his back and push something under his back and neck, so that his head is thrown slightly backwards and his chest forwards. A pillow, cushion, log, satchel, or anything similar will do.

Keep the mouth open, and prevent the tongue from closing the throat, by pulling it forwards. Then seize the arms just above the elbows and pull them slowly up above the head (so as to raise the ribs and expand the chest), and air will *enter* the lungs. Next drive the air from the lungs again by taking the arms back to the front of the chest and pressing them hard on the chest (so as to send the air *out*). Keep on doing these raising, lowering, and pressing movements at the rate of eighteen or twenty times a minute, until the patient begins to breathe on his own account —which may not be for an hour or more. Meanwhile send for dry clothing, and get someone to remove the wet clothing and dry the body. As

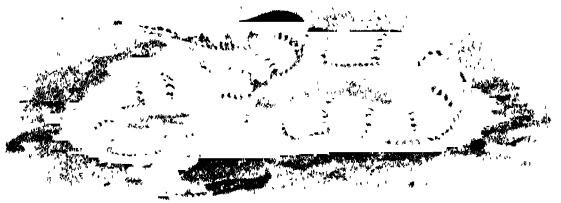
soon as possible the patient should be warmly wrapped up and made to drink hot tea or hot spirits and water.

CHAPTER XXX.

SNAKE-BITE.

A GOOD many people die of sheer fright after being bitten by a harmless snake, so it is always a good plan to take it for granted that the snake was harmless, while taking all precautions as though it were most poisonous. If the patient can be persuaded that he has been bitten by a very inoffensive and harmless snake he will have a better chance. Men have died of fright after being pricked by a thorn. Quickness is of the utmost importance in the case of snake-bite, as what has to be done is to prevent the poison from getting well into the blood and being carried all over the body. First suck the wound as hard as you can. (No injury will follow if your mouth is not cut, cracked, or sore, and if you spit out what you have sucked.) Next, bind the arm, leg, finger, hand, toe or foot as tightly as possible, both above and below the bite, and

SNAKE'S HEAD AND POISON FANG.



KRAIT. LENGTH 2′ 6″, CIRCUM. $1\frac{3}{4}$″.

RUSSELL'S VIPER. LENGTH 3′ 8″, CIRCUM. 5″.

COBRA. LENGTH 5′, CIRCUM. $5\frac{1}{2}$″.

then cut the flesh freely with a knife, or if possible a razor, and press permanganate of potash into the cuts. Do not be afraid to cut several times. The cuts should be deep, close together and parallel, so ≡ and should go *along*, and not across, the limb. Cover the place right over with the permanganate of potash, crush it in with the hand, and drip drops of water on to it. Every house and every school, in places where snakes are found, should keep a supply of permanganate of potash and a lancet. If no permanganate of potash can be got, the bitten part should be burnt freely with a red-hot iron. Nitric acid, if available, would do. If a red-hot iron or nitric is used, permanganate of potash should be obtained and used as soon as possible. Remember that if the man has been bitten by a krait, cobra, viper, or some other deadly serpent, he will certainly die *soon* unless something is done for him, and do not be afraid to cut him if you have the permanganate or to burn him if you can get a red-hot iron. If you have neither, bind the limb, suck as hard as you can, and make the place bleed.

CHAPTER XXXI.

BROKEN BONES.

As a rule the bones of growing children are not actually broken into two separate pieces when "a broken arm" or "a broken leg" is the result of some accident.

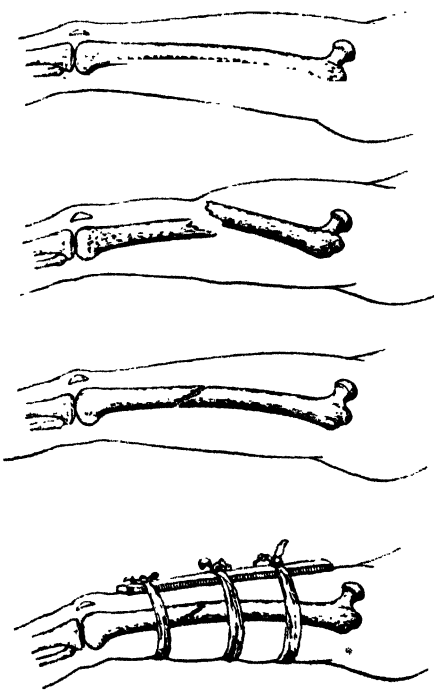
If you break a green and living stick you find that it snaps but that the two pieces hold together. This is just what usually happens in the case of young bones. If a bone is actually broken, however, and in two pieces, the pieces may remain inside the unbroken skin of the limb, or they may actually stick through the skin. We call the former case one of "simple" fracture of the limb, and the latter one of "compound" fracture.

When a bone is broken right through, the fact is plain even though the skin is not cut. The limb is bent in an unnatural way; there is, as it were, a new joint in the middle of it, and the broken ends can be both felt and heard grating together if the limb is moved.

When the broken ends are sticking through the skin, in a compound fracture, there is great danger that germs in the air will get into the bone and cause disease, if not death. In both cases a doctor is wanted at once, but while he

comes something may be done for the patient. Still more must be done if it is necessary to remove him before he can get medical care.

If the case be only one of simple fracture at first, it may easily become one of compound fracture if the patient is moved before the broken limb has been so fixed and bound as to keep the broken halves of the bone perfectly still and firm.



In either case, whether a simple or a compound fracture has occurred, a support called a *splint* is required. A splint can be made with the help of sticks, laths, umbrellas, broom handles, bats, walking-sticks, or anything of the sort that can be used to place along the sides of the limb, and then bound tight so that the bones cannot move. The best things are straight flat pieces of wood that can be laid flat along the broken leg or arm, and then bound round with bandages so that the

limb is in a kind of cage, which is a firm, strong, and steady support to it, and allows of no movement whatever. When the broken limb has been put in splints, the patient should be removed, if this is *necessary* before a doctor can attend him, with very great care. A very good plan is to interlace a cord between two poles as shown in the picture, and lay blankets on it. If this cannot be done, a door, gate, or shutter could be used.

In the case of a compound fracture, the wound should be washed with clean water, and, if possible, some disinfecting lotion. It should then be covered from the air with a clean handkerchief or bandage of some kind, before the splint is made.

CHAPTER XXXII.

BURNS AND SCALDS.

In the case of a burn the clothing should be cut away, with scissors, from the injured part, and should never be pulled off. Air must be kept from the burn, so cover it as quickly as possible. The best thing for covering burns or scalds is

carron oil (which is a mixture of olive oil and lime water) and lint or rag. A spoonful of bicarbonate of soda in a seer of warm milk forms a good dressing for burns and scalds. Clean rags, lint, or cotton wool soaked in either of these should be laid lightly on the burn. If neither of these liquids can be had, flour should be dusted over the burn (if the skin is not broken), and, if this is not available, soap will be found to give some relief.

REMEMBER THE FLAMES GO

Remember that flames go *upwards*, so if ever you see a child or other person whose clothes are on fire, knock the person down. The flames will then go up *from* the body instead of up *to* it. Wrap a carpet, dhurri, rug, sack, cloak, overcoat, blanket, or anything of the sort round the burning clothing. Fire needs air or it cannot burn. Earth and sand are better than water for putting out flames. If a person's clothes catch fire, the worst possible thing for him or her to do is to rush about and run out into the air. If there is no one to help you if you are on fire, lie down and roll on the burning part if you cannot get

anything to wrap round you and cannot jump into water.

About burns and scalds, Dr. Banks says: "Burns are caused by dry heat, such as a hot iron. Scalds are caused by moist heat, such as steam or boiling water. Injuries of this kind are very

THE WAY TO PUT OUT THE FLAMES.

dangerous, more especially in the case of old persons and children. The larger and deeper the injury the greater the danger. Death from shock often follows severe burns and scalds. The patients sometimes die from diseases of internal organs following such injuries.

"*Treatment.* First, remove the object that may be causing the burn or scald, or remove the patient. If the clothes are on fire the patient should be made to lie down, and covered with a

blanket or other thick covering, to put out the flames. Water is also useful, and in the case of oil flames, sand.

"The burn or scald should be immediately covered up with cotton, wool, or a thick layer of rags dipped in carron oil to keep out the air. Carron oil is made of equal parts of linseed oil and lime water. If no linseed oil is at hand olive oil may be used instead. The wool or rags will stick to the burned or scalded part unless kept well soaked with the oil. Oil is also useful in helping to remove any of the clothing that may be sticking to the part. After the first two days or so, carbolic oil will be found useful in treating the affected part. If the patient suffers from faintness, stimulants should be given and the feet kept warm."

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