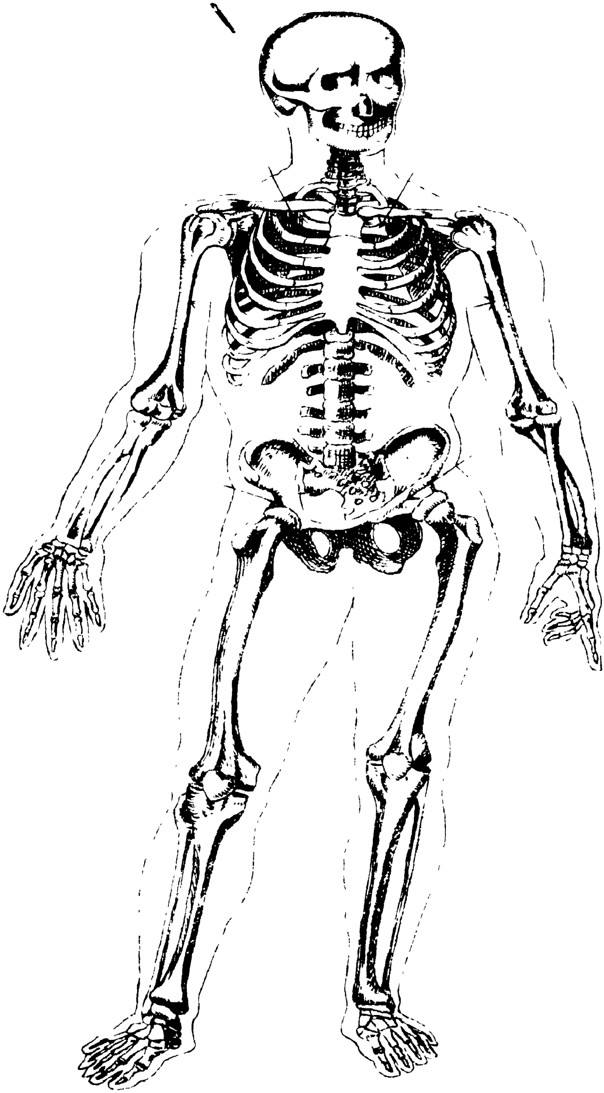
HYGIENE
PERSONAL AND DOMESTIC.



PERSONAL AND DOMESTIC HYGIENE

FOR THE

SCHOOL AND HOME

BY

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'*Nature never says one thing, and Wisdom another.*'

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PREFACE.

In offering this little book to the Public of India it is hoped that a long-felt want may be supplied. The subject of Health is so all-important, not only to every individual, but to every nation, and is so intimately connected with the welfare and happiness of everyone living, that no apology is needed for endeavouring to place the very necessary knowledge of all things pertaining to our Domestic Health within the easy comprehension of all. Doctors and sanitarians are responsible for enforcing the Laws of Public or State Hygiene, but their work can never be anything but an up-hill task—especially in a hot climate like India—unless *every* member of *every* household, recognises his own responsibility in Domestic Hygiene.

E. M. HENDLEY.

August, 1893.

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Elementary Physiology.

N. B.—Yaggy's "*Anatomical Study*"—Patented 1886,—is recommended for use in teaching this section.

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ELEMENTARY PHYSIOLOGY.

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CHAPTER I.

PHYSIOLOGY—ANATOMY—THE SKELETON—LONG, FLAT AND IRREGULAR BONES—THE SKULL—THE SPINE—THE PELVIS—JOINTS—MOVEMENTS OF JOINTS—MUSCLES.

Introduction.—*Before we can possibly understand* why so much importance is attached to the Laws of Health, and why we ought all to have a knowledge of them, as much for our own welfare as for that of others, we must learn something about how beautifully and wonderfully we are made, and how it is often very simple to prevent ourselves getting ill or even weak.

There are many things we know about ourselves without being taught, as for instance, that our bodies consist of a head, trunk and limbs, that we have bones and flesh and blood, and a skin which covers the whole of our body; but there are others which must be learned, if we are to understand how it is that the food we eat is changed into blood and flesh and bone and nerve and muscle, or that the air we breathe into our lungs changes and purifies the blood of our whole body.

Physiology.—This knowledge is called Physiology, and Physiology therefore means the study of the working or functions of the different parts or organs of our body.

Anatomy.—The study of the way these different parts or organs are put together is called Anatomy, and to be able to understand the Laws of Health we must learn a little about both, that is, how our bodies are made, and how the different parts work.

Bones.—The Skeleton.—First of all we must learn somethiug about our bones, and the way they are joined together, to form the Skeleton, (Fig. 1 *Front.*), which is the frame-work and support of our flesh.

We have 200 bones in our body, and they are of many varying shapes and sizes according to their uses. There are long bones and flat bones and irregular bones, and they are all designed so as to be as light and strong as possible.

Long bones.—Thus the long bones which we find in our arms and legs are not solid pieces of hard bone, but are made up of a circle of hard, compact bone outside, a second circle which is soft spongy bone inside, and within these two a hollow which is filled with marrow, like the white substance one can see in the hollow of meat bones.

Flat bones.—And again the flat bones which are in our head and face are not flat solid pieces of hard bone, but they are made up of two plates of solid hard bone with sponge-like bone between them.

The Skull.—Twenty-two of these flat bones form the skull, which is a very strong and yet light structure containing the brain and our senses of seeing, hearing, smelling and tasting. Without the brain we could not think or reason, and without our other senses we could neither enjoy life ourselves, nor work for the good of others. It is therefore not surprising that the skull is very strongly made, and that it should be round or arched at the top instead of flat, because an arch is the strongest of all shapes, each part supporting the other by pressing against it. If the skull were not so strong, people could not carry such heavy weights as they do on their heads.

In the skull of a baby it is easy to see how these bones join and fit into each other, for they are not quite hard and well joined together until a child is seven years old. The reason is that a baby's brain has to grow, and the bones have to grow too, to cover the brain as it gets larger. Every one should therefore be careful not to press or hit a child's head, as they may harm the brain.

The Spine.—Irregular bones.—The skull which, as we have seen, is made up of flat bones, rests upon a column made up of the irregular, or third kind of bones. This column is made up of 33 bones called the Vertebræ, which form what is called the spine, or spinal column.

These bones are also very strong, not only because they are the backbone, or support of the back, but because they have to protect the spinal cord, which is nerve matter, very much like the brain. To prevent the bones jarring our nerves when they move, there is a wonderful little pad of gristle between each of these vertebræ, and in two of the vertebræ in the neck there is still something more to remember—for there we find one bone with a spike of bone shooting up from it and passing through a hole in the vertebræ just above—a very simple contrivance, but one that enables us to turn our head from side to side.

The Pelvis.—Another kind of irregular bone is seen in the haunch bones which join the backbone and form what is called the Pelvis—that strong basin of bone which is at the lower part of our body, and which rests on our thigh bones, protecting and supporting all the organs in the belly or abdomen.

The Ribs.—Again another kind of long or curved bone is seen in the ribs which are fastened to the spine at the back and to the straight breast bone in front. Their work is to protect our lungs and heart and to help us in breathing.

Joints.—When two or more bones meet together they form what is called a joint. Now just as there are three kinds of bones, there are three kinds of joints :—

(1). the fixed ;
(2). the mixed ;
(3). the movable.

We have fixed joints, that is joints that do not move, in the skull bones.

We have mixed joints, or joints which cannot move very much, in the spine, and between the collar bones and the breast bones.

Movable joints.—And lastly we have movable joints in our fingers and toes, our hands and arms and legs. The movable are *really the true joints, and they consist of two bones which fit one into another and are bound together by strong ligaments or binders.* All these true joints are alike in one thing—they all have a soft piece of gristle or cartilage over the top of each bone, and all have a little bag of fluid between the two bones that meet. The fluid bag is like oil to the joint, as well as like an air cushion between, and the bag and the gristle together prevent the bones from jarring. But these joints are not alike in the way they move. In all true joints the bones *glide*, or move smoothly one over the other, and in the case of the wrist and ankle bones this is all they can do, but the elbow joint, the knee joint and the finger joints can all move like hinges, that is, they move at an angle, and these are called hinge-joints.

Pivot joints.—In some other joints, as for instance between the first and second vertebræ, and the two bones of the lower arm between the elbow and the wrist, one bone turns round upon another and these are called Pivot-joints.

Ball and Socket joints.—In others, one bone with a round head fits into another with a hollow or socket, like a ball into a cup. These are called Ball and Socket joints, and we can move them more than any other kind of joint. Our shoulder and our hip joints are joints of this kind, and as we know we can swing our arms round in a circle, straight out from the shoulder, besides bending them different ways.

The Muscles.—Now we know how our joints are bound together, and all the different ways they can move, we have to learn about our muscles, which make us able to move our bones and our joints. Our bones cannot move by themselves, they only move when the muscles fastened into them grow shorter or longer according to what our brain tells them.

Now what are these muscles? They are simply bundles of strong fibres, or threads of flesh, bound round with a tough membrane or skin.

Tendons.—The ends of this strong, tough membrane of the muscles are generally fixed into bones, and we call them tendons or sinews. Now muscle is very elastic, and when we wish, we can make it shorter or longer, just as we can stretch a piece of elastic in our hands.

When we want to draw up our arm, our nerves, which we shall learn about afterwards, carry a message from our brain to the nerves round the muscles of the arms, and the muscles immediately contract, that is, grow thicker and shorter, and so bend the joint.

Voluntary Muscles.—Involuntary Muscles.—All muscles that are attached to our bones are under the control of our will, and so are called voluntary muscles; but there are others which continually contract and relax without our thinking about them, and these are called involuntary muscles. All the muscles of the stomach, the heart, and the lungs, and several other parts of us, are involuntary, but these we shall learn about later on.

CHAPTER II.

NUTRITION—THE ORGANS OF DIGESTION—MUCOUS MEMBRANE—THE STOMACH—GASTRIC JUICE—CHYME—THE DUODENUM—BILE AND PANCREATIC JUICE—CHYLE—VILLI—LACTEALS—RECEPTACLE OF THE CHYLE—LARGE INTESTINES—UNDIGESTED FOOD.

Nutrition.—We have now to learn about Nutrition and the organs of Digestion, that is how our body is nourished, and all that happens to our food after we have eaten it. It is easy to imagine that there must be a great many changes required, before a dish of rice, or a roast fowl, or a piece of bread and butter, or in fact anything we eat, becomes changed into the blood which pours into every part of the body, giving flesh where it is needed, repairing muscles and nerves and bones, carrying away all that is not wanted, or used up, and generally keeping us alive.

The Mouth.—The Teeth.—The Saliva.—Mucous membrane.—These changes that the food undergoes are very wonderful, and also very interesting. In the first place a great change is made when food goes into the mouth. There, as we know, are our teeth to masticate it with, our tongues and the insides of the cheeks, to roll it from side to side until the teeth have bitten it well up, and some fluid which is called Saliva or Spittle. *This Saliva comes from six little glands lying along each side* of the mouth. These glands, the same as those in our stomach, and other parts of our bodies, are simply little depressions or hollows in the mucous membrane, and the mucous membrane itself is the fine pink skin that lines all the inside of our mouths, and in fact of all our bodies. Membrane means fine lining or tissue, and the lining skin of our bodies is called "mucous," because it is always giving out a kind of moisture which is called "mucus."

First change in our food.—Starch becomes sugar.—Babies' digestion.—The Saliva coming from the mucous membrane of the mouth causes the first great chemical change *in our food,* since *it instantly* changes *all starch into sugar. There is a great deal of starch in most of* our foods, in bread, in rice, in *chapatties*, in potatoes, and in all puddings, or cakes made with flour, and although when it is cooked, it becomes a kind of sticky fluid, still it is not perfectly fluid enough to pass through the walls of the food canal into our blood. But sugar can easily pass through into the blood, so we can understand that the Saliva is very important, because it changes all starch into sugar for us. Babies, we must not forget, do not have Saliva until they begin to cut their teeth, when we see they begin to dribble, so that if rice, or arrowroot, or bread, or *chapatties*, or cornflour is given to a very young baby, it has nothing in its mouth to change the starch into sugar, and so its food cannot pass through into its blood, and the child therefore gets no nourishment from its food.

It is very wonderful to think that directly food goes into the mouth, the Salivary glands begin to pour out their useful fluid, and that when they begin their work they stimulate the stomach to pour out its particular fluid, which we call gastric juice. In this way when the food is finished with in the mouth, and we swallow it, it goes down the gullet into the stomach, and there finds further changes in store for it.

The Gullet.—The gullet which is between the wind-pipe and the backbone, is a soft tube with muscles which press the food on and down. It is these muscles which enable a juggler to drink a glass of water when standing on his head, and these also which enable horses and other

animals to eat and drink with their heads down, for they have a gullet like ours.

The Stomach.—The food is not changed in the gullet it merely passes to the stomach, which is a kind of elongated bag with two openings, one for the food to enter from the gullet, and one for the food to pass on into the intestinal canal or bowels. The stomach is placed just below the Diaphragm and to the left of the body.

The Diaphragm.—The Peritoneum.—The diaphragm is a strong muscle stretching right across our bodies. It helps us in breathing, and it also divides the chest which contains the heart and lungs, (Fig. 2), from the abdomen, which contains the stomach, liver, kidneys, bowels, &c. And here in the abdomen, just as between our joints, we find a bag with fluid in it, to prevent our organs pressing or jarring one against the other, when we take exercise or move about. This bag which is called the Peritoneum, is fastened to the Diaphragm and to the walls of the abdomen on all sides, and dips in and out between the Stomach and Liver, the Pancreas, the Spleen, the Kidneys and all the folds of the Intestines.

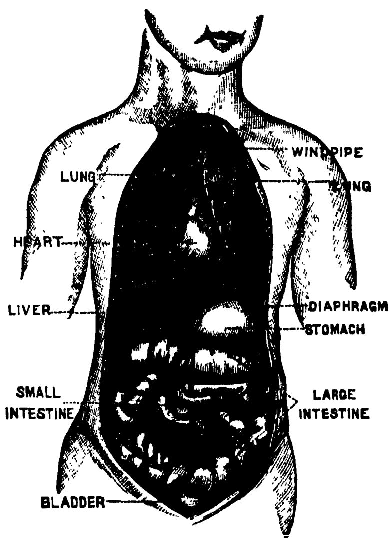

FIG. 2.

Coats of the Stomach.—Now we have to learn how the stomach is made, and how it works on our food. The stomach then, as we said, is a kind of elongated bag, but it is a bag with three coats, an outer, middle and inner, and each coat is made up of a different kind of muscle.

(1) The outside coat is a muscle with downward fibres for shortening the stomach.

(2) The middle coat has circular fibres for narrowing it.

(3) The inner one has oblique fibres for drawing the sides of the stomach over the food.

The work of the Stomach.—Chyme.—The stomach therefore, is like a big muscle which is able to work all ways at once. When food goes into it, it contracts all its muscles, and so moves the food up and down, and from side to side. At the same time the gastric juice pours out from the mucous membrane lining the stomach, and helps to dissolve the food, until all the solid part of it is like a smooth, thin paste, or like *congee*, that is until it has become Chyme. Three things help to make this change.

(1). The contractions of the stomach.

(2). Its heat.

(3). The gastric juice which is a very powerful acid fluid, strong enough to dissolve metals, such as iron or silver, and therefore strong enough, as one can imagine, to break up all the solid parts of our food, such as fish, meat, or the gluten of wheat and the white of egg.

However, although the stomach does a great deal to dissolve the food, it does not finish the work of digestion, because it cannot change the fat or oily part of our food, so that it will mix with water, or can be made into blood. Now we shall see how this is done.

The Duodenum.—When food has become chyme in the stomach, the entrance into the intestines which is closed by a muscle whilst the stomach is at work, opens and allows the chyme to go into what is called the duodenum, a part of the intestinal canal so called because it is twelve inches long. Into this duodenum flow two fluids, one from the pancreas, or sweet bread, called pancreatic juice, the other from the liver, called bile.

The Pancreatic juice.—The pancreatic juice is very much like Saliva, and its work is chiefly to finish dissolving any starch that may still remain unchanged into sugar, but it also does two other things. It helps to split up or divide the fats in our food, and to digest any of the solid parts of our meat or food which have not been broken up by the gastric juice.

The Bile.—Fats in food changed.—Chyle.—The bile is very like a strong soap, and its work is to make the fat or oily part of our food mix with water. We know that if we pour some oil into a glass of water, the oil will float but will not mix. But if we put soda, or strong soap, in with the oil and water, they will soon mix. Now in the bile there is a kind of soda, to change the fats we have eaten into a soapy substance which will easily mix with water. This, we must remember, is the third great change our food undergoes during digestion, and after it, it is no longer called Chyme but Chyle. Now we have traced the chyle, or milky white substance into which our food has been turned, to the first part of the intestines, we must see what becomes of it.

The Small Intestines.—The Villi.—Lacteals.—Receptacle of the Chyle.—The small intestines which are four times the length of the body are not simply smooth tubes inside and out, but on the contrary are lined with a mucous membrane puckered up into an immense number of folds, and every fold has hundreds of little projections, like the pile of velvet. These little projections, called Villi, absorb or take in the food or chyle as it goes squeezing by them through the whole *length of the intestines. From the villi, the chyle passes to quantities of little tubes called "Lacteals," or "Lymphatics,"* which carry the milky fluid to the back of the intestine, to what are called the Mesenteric glands. And in these glands another wonderful thing happens, for about half the chyle gradually changes into little round bodies called corpuscles, which float along with the chyle until both are emptied into a canal or tube, which lies close to the spine, just below the diaphragm, and which is called the "Receptacle of the Chyle." A tube about the size of a goose quill then carries it up to a vein in the neck, and from this vein the food, which has now become blood, is carried into the heart.

We now know how the food we eat is changed into chyme and chyle, and afterwards blood, but we must not think that *all* our food becomes blood. It is only that part which is really digested, that is, becomes a milky fluid that is taken up by the villi,—all the rest passes on all through the small intestines until it comes to the large intestine, where a valve of muscle closes on it and prevents it coming back.

The Large Intestine.—The Rectum.—The large intestine contracts and expands just in the same way as the small intestines, or the gullet, and in this way pushes the undigested and waste substances of the food on until they reach the rectum, which is the end of the food canal, and is closed by a strong voluntary muscle. This muscle only relaxes at will, when it is necessary to get rid of the waste matters, or in other words the solid excreta from our bodies.

CHAPTER III.

CIRCULATION OF THE BLOOD—THE HEART—PERICARDIUM—AURICLES—VENTRICLES—AORTA AND LARGER CIRCULATION—VALVES—CAPILLARIES—VEINS—RIGHT AURICLE—PULMONARY ARTERY AND CIRCULATION—PURIFYING OF THE BLOOD IN THE LUNGS—THE BLOOD—THE SPLEEN—MALARIAL FEVER—COAGULATION.

Now that we have learnt how our food becomes changed into blood, and how the new blood after every meal we eat is carried to the heart, we must see how it is distributed all over the body.

The Circulation.—In the first place then it goes into the heart, and from the heart it goes into tubes called arteries, which carry it away from the heart, next it goes into very fine vessels called capillaries, because they are as fine or finer than hairs, and from the capillaries it passes into tubes called veins, which carry it back to the heart. This is what is called the circulation or going round of the blood. Now what is the heart and what does it do with the blood ?

The Heart.—The Pericardium.—The Septum.—Auricles.—Ventricles.—The heart is a very powerful pumping machine which is placed in the chest, rather to the left side of the line of the breast bone, and about the same size as the closed fist of its

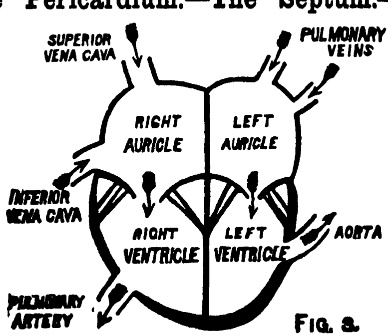

FIG. 2.

owner. Thus a baby's heart is as big as a baby's fist, and a man's heart as big as a man's fist. *All round the heart is a bag of membrane called the Pericardium, which contains* fluid and protects the heart, just as the *peritoneum* protects all the organs in the abdomen. The heart is divided into two distinct halves, by a partition going from top to bottom, called the Septum, which entirely separates the blood on either side of the heart and prevents it mixing. (Fig 3). Each half of the heart is again divided into two chambers, the upper ones called auricles because they have little *ear-like* appendages, and the lower ones called ventricles, and blood can go from the left auricle into the left ventricle, or from the right auricle into the right ventricle, which is just underneath, but cannot go back from a ventricle to an auricle until it has circulated through arteries, capillaries and veins, and undergone many changes.

Circulation from the Left Auricle.—Bicuspid Valve.—Now the heart is really an involuntary muscle, which acts day and night until we die, and it is always full of blood, though the blood is being constantly changed. Let us begin with the left side of the heart, and imagine we see the left auricle full of blood. In an instant that blood has passed through into the left ventricle, and the small tooth-shaped valve, called the Bicuspid, or Mitral valve, which hangs from a fibrous ring in the opening, has closed over it. Then what happens? These valves, which are like little doors, are held closely shut by small cords like catgut, that fasten them to the wall of the ventricle, and at the same time the ventricle, which has a strong muscular wall, presses the blood on all sides. We know that it cannot get back, then where does it go? It goes forwards into the largest tube for carrying blood that there is in the body.

The Aorta.—Semilunar Valves.—The Pulse.—This is called the Aorta, and starts in a big curve upwards from *the heart, like a great hook. Directly the blood goes* through, three little valves shaped like half-moons, called semilunar valves, close like doors upon it, and the same thing happens as in the heart, for the Aorta, which has very elastic strong walls, expands for a moment, and then suddenly contracts, thus driving the blood along, for as we have said the little valves have closed, and prevent its going back to the heart. Each time the left ventricle pumps blood into the aorta it sends about 2 *chittacks*, or four wine-glassfuls, and as the aorta is always full, one can easily realise that as its walls are constantly expanding and contracting it presses the blood on in little wavy jerks or throbs—and it is exactly these throbs or beats which a doctor feels when he presses his fingers to anyone's wrist to "feel their pulse."

Branches from the Aorta.—Now we must find out where the blood in the Aorta goes to. Soon after it has passed the curve three branches or arteries are waiting to be fed with blood.

(*a*) Goes to the right and soon divides into two branches, so as to give one to the right arm and one to the right side of the head.

(*b*) Goes to the left side of the head.

(*c*) Goes to the left arm.

The work of these three branches it is easy to see, is to carry blood to all the upper part of the body—the head and face, the neck, arms and shoulders.

Branches to Organs.—Arteries.—Capillaries.—Now the Aorta after giving off these branches and thus getting rid of some of its contents, does not stop. Its work is not yet done, and if one follows it, one sees that it goes down the body close to the left side of the spine, that on its way it again gives off branches to the stomach, the liver, the kidneys and other organs, and when it has given off enough for the supply of all the inside of the body, it divides into two great arteries, thus sending one to each leg. Now if we trace any one of these big arteries, no matter whether it goes to the head, or the arm, or the stomach, we find the same thing always happening—that is the big artery continually dividing up into branches, and these branches again into smaller branches, until the artery ends by spreading out like a tree with hundreds of feathery branches. Then all these little branches divide and divide, and get smaller and finer, until they end as capillaries. These capillaries are finer than a hair, and when we put them under a microscope we see they are only the $\frac{1}{3000}$ of an inch across. As the blood gets down into the finer arteries, it gradually grows slower and slower and loses its wave-like movement, until in the capillaries, and afterwards in the veins, it flows at an even rate.

Perhaps some one is wondering by this time what is the use of all these capillaries, and why the arteries should take all their blood to them.

Work in the Capillaries.—Loss of red Colour.—Oxygen.—Carbonic Acid Gas.—The reason is that when the blood gets to these very, very fine tubes, their walls are so thin that the blood can pass through them, repairing a piece of muscle in one place, a piece of nerve in another, adding new blood to something else, so that it may grow larger, and at the same time sweeping away all that is worn out, or old, or has done its work and must be got rid of. All this is done as the blood flows through the capillaries, and it makes a great change in the colour of the blood. When it started from the left auricle, and in fact all the time it was travelling through the arteries, it was a bright red colour, but when it has done its work in the capillaries it is so full of waste materials and things which have to be got rid of from the body in order to keep us fresh and well and clean inside, that it is a dark inky colour. This change in colour is caused by the blood not only being full of waste materials, but by its having lost a pure gas called Oxygen, and received in exchange an impure one called Carbonic Acid gas, which is poisonous to us when we get much of it.

Now we have to see how the blood gets pure and clean again.

The Veins.—Valves of Veins.—First then from the capillaries it goes into the veins, and the veins take it all back to the heart. We all know how blue our veins look under our skin, and now we know that it is because the blood in them is inky and not red. There are one or two things to remember about veins.

One is that every big artery, and every little branch of an artery, has a special vein running alongside to take back the blood from its capillaries.

Another is that all veins are fitted with little valves which let the blood go past towards the heart, but which close so as to prevent it going backwards. When people get what are called "varicose" veins, it means that these little valves have got weak and cannot do their work properly.

And a third is, that all the veins in the body gradually unite and unite into bigger veins, until they form two only, one of which brings all the blood from the legs and lower part of the body, whilst the other brings all the blood from the head, neck and arms and upper part of the body.

The Right Auricle.—Tricuspid Valves.—These two veins then empty their blood into the right auricle, and from there it starts on a new journey, but this time it only goes through the lungs and not over the whole body. From the right auricle it passes through into the right ventricle, and a valve—this time with three points and so called tricuspid—prevents it going back, just as the bicuspid valve did on the left side of the heart.

Pulmonary Circulation.—The right ventricle contracts and the blood is forced into the Pulmonary, or lung artery, which, we must remember, is the only artery in the body that carries impure blood.

Pulmonary Artery.—Lung capillaries. Change in the colour of the blood.—Pulmonary Veins.—Left auricle.—The Pulmonary artery has three little half moon valves like the Aorta, and divides first into two branches, one for each lung. These branches divide up in the lungs like all other arteries, until they end in capillaries. And in these, as in the capillaries all over the body, a wonderful work goes on, though it is of a different kind. These capillaries, we must understand, wind about in a close network all over the tiny air sacs which make up our lungs, and directly the impure blood in these capillaries comes into contact with the fine walls of the air sacs it makes a marvellous exchange—it throws away the poisonous carbonic acid and takes in all the pure oxygen it can. The oxygen has just come from the fresh air we have breathed into our lungs, so it at once changes the colour of our blood back to bright red, fresh and clean and clear, and it flows swiftly along, away from the capillaries, and so into the pulmonary or lung veins, the only veins remember that carry bright red blood. And when these veins carry the blood back to empty it into the heart they take it to the left auricle which as you know we started from, and from this of course it starts on another circulation.

Now that we have learnt all about the way the blood travels or circulates in our

Blood.—Corpuscles.—Blood then is a pale straw colored fluid with millions of little *bodies called corpuscles* floating about in it. These corpuscles are of two *kinds*, red and white, but there are many more red than white, and so they give the blood its color.

The Spleen.—Some of these corpuscles, we remember, were formed in the mesenteric glands of the intestines after every meal we eat, but it is only a few that are formed there. Most of those in our blood are manufactured in the spleen. The spleen which is the largest of what are called the "ductless" glands, that is glands which have no tube leading from them, is found between the stomach and the ninth, tenth and eleventh ribs. It is really a great blood gland which swells out after every meal, when it is supposed to be busy at its important work of manufacturing white corpuscles for the blood. But besides being the birth-place and nursery of most of the white corpuscles of the blood, it is the graveyard, or destroyer of some of the red corpuscles. This is perhaps the reason why the spleen becomes enlarged when people suffer from malarial fever or ague.

Malarial poison.—Its influence on the Blood.— Malarial poison in the blood often causes a very serious and painful enlargement of the spleen. Now it is the little red corpuscles in the blood which are attacked by malarial poison. When any one has malarial fever, a small speck or germ which has come in, either through the air or the water, grows in these red corpuscles and gradually draws all the colour away from them. The beautiful red colour disappears and black takes its place and the little corpuscle at the same time changes its shape very much like the moon. Its roundness changes into a crescent, and in the crescent is the black colour, which is really the life-blood of the victim. Quinine and strychnia, or arsenic, which *destroy malarial poison, also make the spleen contract or grow smaller. From knowing this we may remember that* it is very unwise to neglect fever. If medicine to cure it is taken in time the spleen will not get enlarged.

White corpuscles.—We said that there were two kinds of corpuscles, the red and the white. Now what are they each like? The white corpuscles are much larger than the red, and are not round but all kinds of irregular shapes, with one or more smaller bodies inside them. There are only about three or four of these corpuscles to every 1,000 of the red, and the reason of this is that they are continually disappearing, for they are always either dying in the blood or giving birth to red corpuscles.

Red corpuscles.—The red corpuscles themselves are very tiny disc-shaped bodies rounded at the edges, a little thinner through in the middle than the outside, and very elastic. They are so tiny that 3,200 would lie along an inch, and there are so many of them that it would take over a thousand years, counting a hundred a minute, night and day, to count the number in one cubic inch of blood.

Coagulation of the blood.—There is one more thing to remember about the blood, that is that though it is always liquid (like water) when in our blood vessels, it forms a thick clot directly it runs out of its proper tubes. This is called the "coagulation" of the blood, and is a thing we may see any day when a finger is cut. The blood, we may notice, after coming out fast for a little while, begins to look thicker, and at last forms a solid plug over the place and so stops the bleeding.

CHAPTER IV.

RESPIRATION—THE WINDPIPE—CILIA—BRONCHI—AIR-CELLS—PLEURA—DIAPHRAGM—RIB MUSCLES—INSPIRATION—EXPIRATION—EXPIRED AIR—CARBONIC ACID GAS—WATERY VAPOUR—FOUL ORGANIC MATTER.

Respiration.—In the last chapter we learnt that when our blood travelled through our lungs it was changed from its inky colour to a bright red. This change takes place every time we breathe in air, so now we must learn all about our respiration or breathing. Now how does the air we breathe through our nose and mouth get to our lungs, which are packed away in our chest, with rib bones and muscles keeping them out of sight? There must of course be a tube from the mouth to the lungs, and there is one which we can feel, running down the front part of the neck.

The Windpipe.—Epiglottis.—This is called the windpipe, that is the pipe for carrying the wind or air. At the top of it there is a little door called the Epiglottis which is always open to let air go through except when food is going down the throat. Sometimes when people eat quickly, or speak when they are eating, a little food gets under the epiglottis and then they cough because the windpipe refuses to let it go down.

The Windpipe.—Cilia.—The windpipe, if we look inside it, is not like the other pipes or tubes we have learnt about, for it is not muscular or elastic but it is made up of a lot of little gristle rings shaped like a C fastened together at the back by a membrane, which is part of the wall of the gullet. These little rings are to keep the tube always open so that whether we are asleep or awake, air can go into the lungs. These rings and the *whole of the windpipe are of course lined inside with a mucous membrane, and if this mucous membrane is put* under a microscope, it is seen to be thickly grown over with fine little hairs, called cilia, which are constantly moving upwards—their work is to sweep away all dust or particles of grit, and send them on up to the nose where they are got rid of.

The Larynx.—The Bronchi.—Air cells.—The Pleura.—There is still something else to remember in the windpipe, and that is the voice box, or larynx, which has chords stretched across it. It is by the air vibrating through these chords that we are able to speak. Now the windpipe is not very long, for directly it gets to the root of the neck it divides up into branches and sends one to each lung. Each branch, or bronchus, as it is called, then divides into smaller branches, always getting finer and finer, just like the arteries, until at last they end in very, very fine little tubes, each of which has a bunch of tiny little bladders, called air cells at its tip. These air cells really make what is called the lung, and over their fine little walls run the minute capillaries carrying the blood which has to be cleansed by the fresh air. The lungs are very delicate organs, as can be imagined, so we find they are protected like the heart by a bag containing fluid.

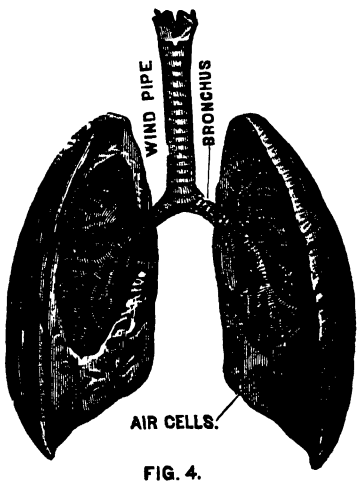

FIG. 4.

This bag goes all over the lungs, between them and the rib bones, and is called the Pleura.

Inspiration.—Rib muscles.—Now how does the air get down into all these little air cells? We know that the chest is like a closed box; the diaphragm, which separates the chest from the abdomen, is the floor, the neck is the top, and the ribs are the sides. Now the *diaphragm is an arched muscle, and when that contracts* the chest is made longer. Between the ribs also are oblique muscles, like crossed elastic bars, which pull the rib bones up, and when they contract they make the chest wider on all sides, that is, a vacuum or empty space is made inside the chest. Then, what happens? As the inside of the chest is thus enlarged, air is drawn in through the nose, down the windpipe and the bronchi, and by rushing into the air cells fills up the space the chest has just made for it.

Expiration.—But notice, directly after the air has gone down, the diaphragm and rib muscles all relax, because the air outside of us presses on them, and as they relax, the chest becomes smaller, and the little air sacs are squeezed down so that they drive the air out of the lungs again.

Pause.—Change in the blood in the Lungs.—Then there is a short pause, and then the breathing in, or inspiration, and the breathing out or expiration begin again. But although we feel how quickly the air goes in and comes out of our lungs, there is still time for that marvellous change to be made in the blood which the air touches. The blood, as we know, gets rid of all its impure carbonic acid gas and goes away red and clear. Now, where does this carbonic acid go to? It goes into the air which we breathe out, and so leaves the body altogether. And the air which comes in fresh and pure goes out impure, that is, the blood has made an exchange with the air. It has given up the carbonic acid gas which it no longer requires, and taken in the pure gas oxygen which we shall afterwards learn more about.

Breathing purifies the blood.—At present the chief things we have to remember, are, that in breathing we purify our blood, keep up the heat of our bodies, and get rid of carbonic acid gas and certain other waste substances.

Waste matters in expired air.—We cannot see these waste substances, it is true, any more than we can see the air around, but we get rid of them all the same, and if we breathe the same air over and over again, as people sometimes do in their sleeping rooms, or any room that has the doors and windows shut, we breathe in poison which has really come from our own bodies.

The waste matters we get rid of by our lungs are three :—

Carbonic Acid Gas,
Watery Vapour,
Organic Matter.

Carbonic Acid gas.—The first, carbonic acid, is a gas that is produced when oxygen comes into contact with carbon. Carbon is a thing that we all know, though perhaps not by that name.

Carbon.—Animal Heat.—Charcoal is carbon, and a diamond is also carbon, in fact a diamond is the purest kind of carbon. Carbon, or charcoal is a thing that is in almost all the tissues of our body, and in almost all our foods, so that it is being continually taken into the body and has to be continually got rid of. When carbon and oxygen come together, the process of burning, or oxidation, as it is called in chemistry, takes place, and carbonic acid gas is formed. When carbon and oxygen unite very rapidly, both light and heat are produced, as when a fire burns, but in our living bodies they unite more slowly and only heat is formed. We can now understand that it is by the oxygen we breathe in, mixing with the carbon in our blood, that the heat of our bodies, or what is called Animal Heat, is produced.

In health the heat of the body is 98·4° Fahrenheit, and the air that we breathe out is 98·4° too. When the heat of our blood gets higher than this, we have fever, and every degree higher it is, the more dangerous does it become. Both fever and bad headaches often come from breathing the same air over and over again.

Watery Vapour.—The second, the Watery Vapour from our breath can only be seen when the weather is cold enough to condense it, or when by breathing on a glass or piece of polished silver a mist is seen to form on the surface. Six grains of this watery vapour are given off every minute by our lungs, which make about half a pint, or five *chittacks*, during 25 hours.

Organic matters.—The third, the foul organic matter is the most dangerous thing of all to breathe over again. It is the foul organic matter which makes a room smell stuffy and close. It sticks to the walls, the ceilings, the *durries*, curtains and everything in a room, and can only be got rid of by keeping everything very clean.

CHAPTER V.

THE LIVER AND THE EXCRETORY ORGANS—FUNCTIONS OF THE LIVER—ITS STRUCTURE—THE PORTAL CIRCULATION—BILE—GLYCOGEN—EXCRETIONS BY THE LUNGS—THE SKIN AND ITS GLANDS—THE KIDNEYS—URETERS—BLADDER—CORPUSCLES OF THE KIDNEYS—EXCRETIONS BY THE KIDNEYS.

When we learnt how food was changed into blood, it was said that after it left the stomach a fluid called bile came into the duodenum from the liver.

The Liver.—Work of the Liver.—Now the liver, which is placed just underneath the Diaphragm, on the right side of the abdomen, is the largest organ in the body, and it is also one of the most important. It has not only to manufacture and pour out bile to aid the digestion of our food, but it has two or three other different kinds of work to perform as well. One of the chief of these is to prevent poisonous substances, which may form in the intestines during digestion, from passing straight into the blood, or in other words, to act as a kind of door-keeper, or porter to the circulation. Another is to form and store up Glycogen, or Liver starch, which gives us some of our animal heat and muscular strength. And the last is to destroy the poisonous properties of peptones, that is things formed whilst digestion is going on, and to change them into glycogen.

Knowing now what important and varied work the liver is called upon to do every day, we shall not be astonished to find that it is not at all simply made, and that it has a special kind of circulation of the blood in it, which we do not find anywhere else in the body.

Structure of the Liver.—Circulation in the Liver.—The Portal Vein.—The Liver is called a mixed organ, because it not only takes substances out of the blood like a gland, but supplies it with others. If we examine it to see how it is able to do so many different kinds of work, we see that it is made up of masses called lobules, and these lobules are made up of cells. Everywhere between these lobules and cells there is a net-work of blood vessels, and the blood which feeds them comes from two sources. It comes from an artery which is a branch direct from the Aorta, and is called the liver artery, and it also comes from a vein called the Portal Vein, which brings all the blood from the stomach, spleen, pancreas and intestines. This vein is a very important one to remember.

1st.—Because it divides up into branches, and ends in capillaries like an artery.

2nd.—Because it takes all the blood that is formed after each meal in the stomach and intestines to the liver, before it can go into the general circulation.

If we notice the circulation in the liver still more closely, we shall see that the liver artery and this portal vein enter the liver side by side; that they divide up between the lobules and cells of the liver still running side by side; and that they end in the *same set* of capillaries. Afterwards they run together, like all other capillaries, and form a large vein which, when it has left the liver, empties its blood into the great vein coming from all the lower parts of the body, which, as we know, goes into the right auricle of the heart.

Portal Circulation.—The circulation in the liver is called the Portal Circulation, and now we understand it, we see how it is that the liver is able to act as a door-keeper to the general circulation, and how it can destroy poisons which are formed whilst our food is digesting, before they get carried to the blood going direct to our heart, and from there all over our bodies.

Glycogen.—But the liver does more than take out these poisonous matters from the blood of the portal vein as it is flowing through its lobules and cells. It changes these poisonous matters, as well as any sugar there is in the food we have digested, into the liver-starch, called glycogen, which it either turns into fat, to warm and nourish our body, or stores up for use at some other time.

Bile.—And besides this, it separates bile from this newly made blood. Bile, we already know, is a kind of very strong soap, or soda, which digests the fats in our food, and helps to prevent our food decaying in our bodies as it passes through the intestines.

Gall bladder.—The bile, after it is separated from the blood, goes into the bile duct, which leads to the duodenum; but before it leaves the liver the duct has to pass the gall bladder which opens on to it, and if there is much bile going along the duct, some of it flows into the gall bladder and is, like the Glycogen, stored up for use at some other time.

Biliousness.—When too much is formed and stored every day, people get what is called "bilious," that is the bile does not only go into the intestines, but it gets back into the blood, and then causes headache and sickness.

Over-eating or drinking, especially in hot climates, soon upsets the liver, but we cannot be surprised at this, now we know what a great deal of work the liver always has to do to keep us in health.

The Excretory Organs.—From the liver, which we *have seen is a mixed organ, taking substances from and adding others to the blood, we now pass to the Excretory* Organs, *whose chief work it is to take away the waste* substances from the blood. There are three that do this:—

(1). The Lungs. (2). The Skin. (3). The Kidneys.

The Lungs.—The lungs we already understand, and we know that they separate waste carbon from the blood in the form of carbonic acid gas. Carbon is contained in nearly all our food, and so is constantly being added to the body, and has continually to be got rid of when it has given the heat required from it. The lungs get rid of nearly ¼ of a *seer* of carbon every 24 hours, and besides that, they get rid of about half a pint of water, and also a certain quantity of other waste matter. But, of course, it was never intended that the lungs should be able to get rid of all the waste of the body, and so we find the skin and the kidneys helping.

The Skin.—Sweat Glands.—Excretions from the skin.—If we could see a piece of skin under the microscope, we should find it full of wonderful little openings called pores, each of which leads down to a tiny twisted ball of fine tubing. This tubing is called a sweat gland, and millions and millions of them are embedded in the underneath layer of our skin, with millions of little capillaries twining round and about them. Now day and night, whilst the blood is running through the capillaries in the skin, these little sweat glands are busy separating all the waste carbonic acid, water, and foul organic matter that they can get from the blood, and carrying it away in their tubes or ducts to the surface of the skin. About nine *chittacks* are got rid of every day like this, without our knowing anything about it, so it is called "insensible perspiration," but when we walk, or run, or take any exercise, *then these little sweat glands work so fast that we can actually feel or see the water on our skins, and* we call that perspiration, or sweat.

Sebaceous Glands.—Hair Glands.—There are still some other glands in the skin. They are called sebaceous glands; and their work is to separate fat and oily matter from the blood, to keep the skin supple, and to nourish the little hair glands close to them, which are also in the skin and from which our hair grows.

The Kidneys.—Ureters.—Bladder.—Now that we know that both in the lungs and the skin waste matters are got rid of as the blood is running through the capillaries, we shall not be surprised to find that the work in the kidneys is done in much the same way—but that as the waste matter to be got rid of is mostly water, a different kind of apparatus is needed. We each have two kidneys for the purpose. They are placed in the abdomen, one on each side of the spine about the waist, and when they have separated out the water or urine from the blood, they pour it into tubes called ureters, which carry it down to the bladder, a strong bag in which the urine goes on collecting until it is necessary to expel it.

Composition of the Kidney.—Now the kidney is built up of a number of tiny tubes, which begin in small bags or corpuscles in the large outer rim of the kidney, and end or open out into the beginning of the tube which leaves the kidney—the ureter—which is shaped like a funnel.

Corpuscles of the Kidneys.—These tiny tubes are like sweat glands, carrying off the water as it is separated from the blood; but they are much larger than sweat glands, as they have harder work to do, and they are different in another way. For instead of the capillaries twisting round the glands as in the skin, the capillaries in the kidney find their way right into the small bags or corpuscles—in fact as they divide up from the artery they push the delicate lining of the end of the tubes inwards, thus forming the little bags in which they do their work.

Circulation in the Kidneys.—Excretions from the Kidneys.—Again, the capillaries when they leave the little corpuscles do not unite into veins which take the blood away from the kidney at once, but they unite into veins which divide again into capillaries like the portal vein, and this second set of capillaries winds about outside all the length of the little tubes before they join into veins which leave the kidney. All the time the blood is running through the capillaries, it is busy getting rid of water it no longer wants, and other things such as urea and uric acid, which would do a great deal of harm if not got rid of. This liquid waste matter, known as urine, passes through the walls of the capillaries into the tubes which carry it safely away to the ureters and thus to the bladder from which we get rid of it as occasion requires.

CHAPTER VI.

THE NERVES AND SENSES—SYMPATHETIC SYSTEM—ORGANS IT CONTROLS—CEREBRO-SPINAL SYSTEM—MOTOR AND SENSORY NERVES—SPECIAL SENSES—TOUCH—TASTE—SMELL—HEARING AND THE EAR—SIGHT AND THE EYE.

Now we come to the question :—How are all these different organs kept working, and what is it that controls them, so that they work regularly and well, and balance each other ?

This is done by the nerves or nervous system.

Nerves.—Nerves are quite different to anything we have learnt about so far, for they are simply like soft white threads which are found in every part of us, and carry messages to and from the brain, like telegraph wires to and from a telegraph office.

The Sympathetic system.—Now there are different kinds of nerves for different kinds of messages. There are those which belong to what is called the Sympathetic System, whose work it is to see after our breathing, the circulation of our blood, the digestion of our food, and the regular working of all our organs.

The Cerebro-Spinal system.—And there are others which belong to what is called the Cerebro-Spinal system, that is the Brain and Spinal Cord, whose work is of a higher kind. They have to do with our voluntary muscles and with our senses, as well as all we say, or think, or feel, or do.

Work of the Sympathetic Nerves.—Ganglia.—Now it is the nerves of the Sympathetic System that see to the regular working of all our different organs. These nerves start from little centres, called Ganglia, which are found in front of the spinal column, and they go all over us—to all the glands in our body and to all our involuntary muscles.

Control of the Involuntary Muscles.—For instance they carry a message to the salivary glands to tell them food is coming, and that they must pour out their saliva; they tell the heart how much blood is to be pumped from it every time it contracts; they tell the lungs and the muscles connected with our breathing when they should contract and when expand—in fact they see after everything that has to work night and day whether we are asleep or awake, and whether we are thinking about it or not.

Temperature of the body.—And one very important thing there is which these sympathetic nerves do, and which we must remember, that is, they control the circulation in the skin, and through the skin, the heat or temperature of the body. On a cold day when it is necessary to keep all the warmth within, they make the small vessels in the skin contract so that very little fluid or heat is lost from the body. Whereas on a hot day, as the body wants to get rid of its heat, the nerves cause the vessels in the skin to relax, so that perspiration runs out freely and the superfluous heat escapes. It is for this reason that chills are so dangerous because if the skin gets chilled, the heat cannot escape, and so gets driven in when it is not required and may make us ill.

These sympathetic nerves we see, act without any effort or will on our part, and so are very different from the higher kinds of nerves which are controlled by our will.

The Brain.—Motor and Sensory Nerves.—The seat of the will is in the brain, and these higher nerves come direct from the brain and spinal cord, which is like a continuation of the brain. These nerves are of two kinds, some are to carry messages from the brain, others to carry sensations to the brain. When we stretch out our hand to feel whether anything is hot or cold we use both kinds of these. First we use the nerves which carry the message from the brain to our muscles, that we wish to move our hand and arm in a particular direction to touch something; next when we have touched it, we use the other nerves to carry the idea of what it feels like to the brain. The first are called "Motor" nerves, because they carry out the brain's orders with regard to all motions or movements—the others are called "Sensory," because they carry sensations to the brain.

Nerves from the Brain.—Spinal nerves.—These nerves, as we said, all come out from the brain or spinal cord—the nerves which go to our eyes, ears, nose and tongue, and which are sensory nerves, that is, they carry the sensation of all we see, hear, smell or taste, all come direct from the brain, and the nerves which move the muscles of our eyelids and eyeballs also come from the brain; but the nerves which move the big muscles of our arms and hands or legs all come from the spinal cord, that is indirectly from the brain. Now we can understand why it is that when any one hurts their spine by an accident, they can neither move, or feel below the part, for in such accidents the spinal cord is injured, and so can neither carry orders from the brain to the muscles which move the limbs, or carry back sensations to it, just as when a telegraph wire is cut no messages can be sent out or come in through it.

There is not much more to remember about our motor nerves except that they enable us to move all our voluntary muscles, but there is a great deal more to learn about our sensory nerves. We have five senses, as we know; Sight—Hearing—Smell—Taste and Touch.

Special Senses.—The idea of Light and of all we can see, reaches our brain through two nerves which are hidden away in the eyes;—the idea of Sound and all we can hear, through two nerves which are hidden away in the inner part of the ears;—the idea of Smell through a pair of nerves embedded in the inner part of the nose;—of Taste through a pair of nerves ending in the little papillæ or projections on the skin of the tongue;—whilst Touch is not a sense which belongs to any one part but to the skin in all parts of our body.

Let us first understand what it is that makes us able to feel things, and then we shall more easily be able to understand our other senses.

Touch.—If we could see a piece of our skin under the microscope, we should see besides all the little sweat glands, oil glands, hair glands and capillaries, thousands of tiny little projections underneath the outer skin, and in each of these projections or papillæ, the tiny ends of the sensory fibres of the spinal nerves—the sensory fibres being the nerves of touch embedded in the lower layer of the skin, so as to be out of harm's way.

If we think about it we know our nerves of touch cannot be in our outer skin, for if we rub or scratch the surface, it gives us no pain—we merely feel the rub or scratch—but if we prick ourselves we feel a smart of pain because the little nerves themselves have been reached.

Now if we took the skin from several different parts of the body we should see many more of these sensory fibres in some parts, as in the tips of our fingers than in others.

Sensitiveness of the finger tips.—It is because there are so many in our finger tips that we can feel things better with our fingers than with any other part of our body—and this is the reason why blind people can be taught to read by distinguishing different shapes of raised letters with their fingers. In some blind people the sensitiveness of the finger-tips becomes so great that they can even tell different colored materials.

Sensitiveness of other parts.—To show how much better we can feel with our finger-tips, and therefore how many nerves there must be in them, we have only to take a pair of scissors and place them with their points about a tenth or twelfth of an inch apart on the tip of a finger. Any one will be able to tell there are two points; but place them half an inch apart on the cheek and they feel like one point, or place them even $2\frac{1}{2}$ inches apart on the skin of the back and they still seem like one point only.

Taste.—Just as we have the sense of Touch through nerves ending in the little papillæ of the skin, so we have the sense of Taste through nerves ending in the papillæ of the Tongue. Any one can see these papillæ on their own tongue, but the ends of the nerves going to them would have to be seen under a microscope. These nerve fibres for the tongue all come from two special nerves of Taste direct from the brain, and when we eat anything they tell the brain whether it is nice or what it tastes like.

Smell.—The sense of smell is very like both Taste and Touch, for the two nerves of smell which come from the brain divide up into hundreds of little branches in the upper part of the nose and are embedded in the mucous membrane lining it. Smell is one of the most useful senses because it often warns us of a danger to health before our eyes have discovered it.

Hearing.—And now we have to learn about a more complicated sense, the sense of Hearing, or how it is that sounds made in the air outside reach the brain.

We all know that we hear with our ears, and that *there is an opening from our ears which goes right into the head. That much it is easy to see, but that does not tell us how we hear. We must know all about the ear inside our heads and how the nerve of hearing is* reached as well.

Sound.—But first we must remember these facts about sound:—

(1) That Sound consists of pulses or waves in the air.
(2) That water carries sound much more quickly than air.

In our ears we find all that is necessary for collecting these waves of sound into one wave, and besides that we find the nerves of sound floating in water so that, the different sounds we hear may reach the brain quickly.

The Outer Ear.—The outer ear we notice is all curled and twisted, and this leads to a tube or passage which also winds a little, and has a great many hairs and a good deal of wax in it to prevent insects and dust from getting in.

The Drum.—The Bones.—The Oval Window.—The Labyrinth.—The Rock.—Nerves of Hearing.—At the end of this passage is a fine, almost transparent membrane, or skin stretched on a bony rim like the parchment of a drum. This is called the drum of the ear, and behind this are three bones connected with tiny joints. The first is like a hammer, the second like an anvil and the third like a stirrup. The hammer bone is fastened to the drum, and the stirrup bone to another little skin further in, called the Oval Window, which covers the opening to a still more wonderful part of the ear. This inner ear is something like a wind instrument of music, all spirals or twists. One part of it is called the Labyrinth because of its twists and turns, and another is called the Shell because it is like a snail's shell,—and it is all protected by or rather cut out of the hardest bone in the body called the Rock. *Inside these labyrinth and shell*-like passages we find a liquid, like water, and floating in the water a little bag also filled with fluid. If this little bag is put under the microscope it is seen to be covered with what look like fine little threads. These threads are really nerves to carry sound, which go on joining together until they make one big nerve which we call the nerve of hearing. We have a nerve of hearing, for each ear of course, coming from each side of the brain.

How Sounds are carried to the Brain.—Now we have to see how all these different parts enable us to hear. The waves of sound are first collected by the outer ear and come in by the passage until they strike the drum. Directly the drum moves, it pushes the three little bones inside. They tremble or vibrate one after each other and so knock against the little oval window which sets the liquid inside shaking; and when that shakes, all the little nerves covering the bag floating in it vibrate too, and their vibrations travel on through all the little nerves to the big nerve of hearing, and so to the brain. Then the brain has to listen and think what the sound means—whether it is music, or crying, or laughing, or speaking, or the song of a bird or the neigh of a horse. It is very strange to think that sound has to pass through liquid to reach our nerves and the brain.

Hearing in the lower Animals.—Some of the lower animals only have a nerve and a little bag of watery fluid for their ears, and yet they can hear very well. So that a nerve and a bag of fluid which can be reached by the waves of sound are all that is needed to hear. Our hearing is more complicated because we are reasoning beings, and are intended for higher purposes than animals.

The Eyes.—Just as in the ear we find everything that is best fitted to carry the waves of sound to the brain, so in the eye we find everything that is necessary for bringing the rays of light to a point where the nerve of sight becomes affected by them, and conveys the sensation to the brain. And just as in the ear we found winding passages leading to a watery fluid so in the eye we find lenses like the lenses of a telescope, with watery fluid between them. This is very wonderful, for it shows that rays of light as well as waves of sound travel through watery fluid before they reach the brain.

Position of the Eye.—Protection for the Eyes.—Now the first thing to notice about the eye is that it is lodged in a strong, deep, bony hollow resting on a bed of fat—that it has eyebrows above it to prevent sweat running down into the eyes—that it has eyelids above and below to wipe it constantly, and to close it in sleep, or when harm is near—that each eyelid has a row of eyelashes to protect the eye from dust or grit flying in from the air—that each eyeball has a fluid constantly moistening it, washing away all specks of grit and keeping it bright—and that there is a tiny hole in the inner corner of the lower eyelid, which is the opening to a little tube for carrying off this fluid when done with, down to the nose.

The Tear Gland.—This fluid is chiefly secreted by a large gland called the Tear gland placed above and to the outer side of the eyeball.

Tears.—Ordinarily, it runs off gradually down the little tube to the nose, but when we are sorry, or hurt, so much fluid is poured out that it cannot all run down the tube, and so it overflows and makes tears.

Muscles of the Eyeballs.—If we look behind and round the eyeball we see in addition muscles to move the eyes in different directions, and besides that, the great nerve of sight piercing the two outer coats of the eye and entering the eyeball where it spreads out.

Now how does light reach this great nerve of sight?

The Eye a series of Lenses.—It reaches it through a series of lenses which collect the rays into a focus and throw a picture on to the back of the dark interior of *the eyeball. A lens is any clear glass-like body, so shaped that rays of light passing through it are made to* change their direction, and to make objects at a certain distance either larger or smaller. In a telescope we have several lenses so formed as to bring far away things near, and in a microscope we have a number of lenses so formed as to enlarge very tiny things. Now the eye is really a number of lenses similar to these.

The Cornea.—The Iris.—The Pupil.—The Crystalline Lens.—In the front standing out from the white of the eye we see a clear raised piece like a watch glass. This is called the Cornea, and is really the first lens of the Eye. Behind it is a flat piece, the Iris or curtain of the eye, with the black hole in the middle which we call the Pupil. The Iris is not a lens but is a colored, movable curtain, closing up slightly to shade the eye when the light is too strong, and enlarging the opening in the centre when there is but little light,—besides that it cuts off all rays of light coming sideways, which would otherwise confuse our sight. Behind the Iris again is another lens, which is called the Crystalline or Accommodating lens. It is the most important of all because it enables us to see things far off or near. It is the only lens with a muscle attached to it—a little muscle which is inside the eye and which contracts or expands the lens according as we want it rounder or flatter for seeing things distinctly at different distances.

Aqueous Humour.—Vitreous Humour.—The Retina.—In between the Crystalline Lens and the Cornea is a little fluid called the Aqueous Humour, and this again acts as a lens; whilst some thicker fluid called the Vitreous Humour behind the Crystalline Lens, which fills all the hollow of the eyeball, forms still another lens. All these lenses together collect the rays of light coming *from all directions around us and thus throw a picture of* whatever is before us, on the nerves of sight at the back of the eye. These nerves are a network of tiny, tiny branches of the large nerve of sight coming from the brain, and they spread out to form a coat of the eye called the Retina. Behind the retina again is a coat of pigment or colouring matter which not only carries blood to the retina, but besides that does a useful work in absorbing superfluous light, which, if reflected back, would confuse our sight.

The Rods and Cones.—The retina is a wonderful little piece of our body to study, to see how marvellously and beautifully we are made. The rays of light, carrying the pictures we are looking at, after being focussed by the lenses, strike on the retina as we know, but it is through a layer of cells like fine mosaic work, called Rods and Cones, that they are borne along the nerve fibres to the brain.

The Optic Nerve.—Thus these nerve fibres are like all others of our sense nerves, because they are not directly sensitive to that which stimulates them. It is only through the layer of Rods and Cones that they are sensitive to light, just as it is through the outer layer of the skin that the nerves in the underneath skin are sensitive to touch.

Smallness of the Retina compared with all we can see.—Again, although the retina is such a small surface, about half an inch across, or the size of a four-anna piece, yet it is on it, that miles and miles of landscape and sky and all things both small and great, are pictured and carried to the brain, with the size and colour of each different thing accurately shown.

A truly wonderful little organ, the eye—with its lenses and nerves of sight—must be, when we think, how small it is compared with all we can see.

SECTION II.

HYGIENE.

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CHAPTER I.

HYGIENE—CHOICE OF A HOUSE—SITUATION—JHEELS OR MARSH-LAND—GROUND WATER AND DAMP HOUSES—PRECAUTIONS IN MARSHY SITUATIONS—DRAINAGE—THE BLUE GUM TREE—FLOORS—WALLS—ROOFS—DRAINS.

Hygiene.—We have learnt a good deal about our bodies which have to be kept healthy, and now therefore we pass on to the study of our surroundings—our houses, the disposal of refuse matters,—the air we breathe—the water we drink—the food we eat, and the personal habits which will help to keep us well and strong. The study of all this, that is, of all that has to do with health, is called Hygiene or Sanitation, and both words mean simply "Health," or the "Laws of Health."

The study of Hygiene has nothing to do with medicine—it will not teach us how to doctor ourselves, or cure diseases, but it will teach us how to prevent diseases, and how to preserve or take care of our health.

Our houses.—One of the first most important things for our health, if we look around us, is the house we live in. Of course it is not every one who is fortunate enough to be able to choose the house, or even the place they have *to live in. We are sometimes obliged to live in places which* we know are unhealthy, and in houses which are badly built. All the same it is very useful to know what a good house should be like, where it should be built, and how it can best be supplied with fresh air. If we know that, we can do a great deal to improve even an unhealthy house, whilst if we can choose at all in the matter, we shall know how to choose what is best for our health in every way.

A house, if we think about it, is a very important thing. It is our shelter against heat and cold and rain, and a great part of our time is spent in it, either sleeping, eating, or working.

Air and Water.—We ought therefore to be careful that we get as good a house as we can, that we keep it clean and dry and fresh and sweet-smelling—and that we have fresh air and good water around us. The worst enemies to our health are foul air and foul water; and even if we cannot always be sure we have good water, still we can do a great deal towards helping to keep the water around us good and fit to drink, whilst as regards fresh air, it just depends entirely upon ourselves and the people we live with. There is plenty of fresh air and pure water around us everywhere, and it is our own fault if we do not get them.

There is a great deal, however, to study about both, so we will leave them to another chapter whilst we see what a good house should be.

Situation.—First we must remember it must be in a good site or situation. A good site is one that is dry, or can be easily drained, that is, where water will not lodge. A house on flat ground, or on a terrace cut in a hill-side or slope, is in a good situation, but a house in a hollow or low-lying marshy place is in a bad situation. There is no worse place for a house than marshy or badly drained ground.

Jheels.—Cholera and the Plague.—*We call* any place a marsh or jheel where water cannot get away naturally, because of a stiff, closely-bound soil underneath which will not allow the water to pass through. A jheel may be made by the water overflowing from a river, or by the flow of a river being blocked by the solid matters it brings down with it—but the result is always the same—stagnant water, a great deal of vegetation, and a pestilential smell in the air, owing to the heat and the decaying matters in the stagnant water. Some of the worst diseases known have started from such places. Lower Egypt, once the home of Moses, who gave us all those excellent sanitary laws we find in the Old Testament, used to be most fertile, prosperous and healthy; but afterwards when drainage was neglected it became simply an unhealthy marsh or swamp— and from the marshes at the mouth of the Nile started the disease called the Oriental Plague, which killed millions of people a few hundred years ago. Cholera, we know, commenced in the jheels of the Ganges, and although we do not always get such bad diseases as cholera or the plague from living in marshy places, still many people have bad fever and ague and get very weak from them.

Damp houses.—Ground water.—Wells.—But it is not only houses in marshy places that are damp—a house which is too near a tank, or the bank of a river, is in a bad situation, just the same as a house which is built in a place where the *ground water* is very near the surface. Ground water comes from that great underground sea or lake which exists everywhere beneath the ground, but at different depths in different places. This is the water which we find in wells, and by the depth of wells we can tell how far the ground water is below the surface. In some places a well has to be cut a great depth before water is found, and in others only a few feet. A house or village should never be built anywhere if the ground water is nearer than five feet to the surface. But even five feet is too near for health, and a place is safer to live in, the lower the ground water is. In India, and in all countries where wells are dug, it is always easy to tell how far off the ground water is, by finding out how deep the wells are in any place.

Supposing, however, some of us cannot help living where the ground water is too high, or near a marsh or jheel.

Supposing a forest has to be cut down, or a railway made through a bad marshy country—what are we to do?

Precautions in marshy places.—We should take these precautions. Have our house or tent on the highest piece of ground we can get.

Never sleep on the ground, because people sleeping on the ground are always more likely to get fever or ague than those who sleep off the ground, even if it is only in a hammock. Never open the windows or doors facing the marsh if the wind is blowing over it, but open the windows and doors on the further side of the house or tent.

Eat well cooked, wholesome food and never drink water from the marsh, if it can be helped. If there is no other water to be had, first boil and then filter the marsh water.

Make the best arrangements possible for carrying off the ordinary water and flood water in the rains, both close to the house and as far around as can be managed—and fill up all hollow places where water can lodge.

Next—if the stay in a marshy place is to be a long one, plant trees and shrubs between the house and the jheel. Some plants and trees are well known for their power to dry and cleanse the soil, and these are the proper ones to plant.

The Blue Gum tree.—Among them the Blue Gum Tree of Australia, known as the Eucalyptus, is very valuable, and it has already been planted in some parts of India with great success—another which is very easy to grow is the ordinary sunflower.

A good site.—A good site for a house is, as we have learned, one that is dry—but it is also one where fresh air can blow freely round it, and where high trees on perhaps two sides of it can protect it a little from the burning heat of the sun's rays. It is also one which is not too near a stable, or place where any refuse is thrown. In bazaars or villages it is a good thing to have the houses wide apart, so as to get as much open space as possible in order that light and fresh air can come into every house.

Building materials.—A house to be thoroughly healthy must not only be in a good situation but it must be well built. It must be built so as to keep both heat and damp out, and so as to let plenty of fresh air in. In this country, houses are built chiefly of stone—or bricks, either *pucca* (fire-burnt,) or *kachcha* (sun-burnt)—or mud. Of course stone or *pucca* brick is the best, but any house can be made healthy to live in if four things are remembered, *viz*:—

(1). **Floors.**—To make and keep the floor dry—first to have a plinth, that is, to raise the floor above the level of the surrounding ground—secondly, to have where possible a layer of asphalte or chunam underneath the boards of real floor, or to make some arrangement to prevent the water rising up from underneath. It is a very good thing to have an open space below the floor where the air can circulate, as it keeps a house both dry and sweet-smelling. This can always be made if a little money is spent.

(2). **Walls.**—To see that no wet can get in through the walls, and that the foundations are carried down four or more feet. Where the walls are of sun-dried (*kachcha*) bricks the clay covering them should be carefully renewed from time to time. These bricks are like sponges for sucking up moisture, so that if they are not kept well covered, walls made of them become very damp. Tar is an excellent thing to cover such walls with inside. It can be washed down now and again and does not want constant renewing.

(3). **Roofs.**—To see that the roof is a good one to keep the house cool, and that it has plenty of good drains to take the rain away. A thatched, sloping roof with a deep thatch over the verandah will keep a house the coolest. A slate roof makes a house hot— but a corrugated iron one, such as one sometimes meets with in India, and which is admired because it is "European," is excessively hot and unsuitable. If corrugated iron has been brought, and the best has to be made of a bad job, a good plan is to make an inner roof of wood, and fill in the space between that and the corrugated iron with saw-dust or some other non-conducting material.

(4). **Drains.**—To see that the drains, both from the roof and round the house, are good and take off all the water right away from either one's own or one's neighbour's house. Drains should always be made of brick or some hard material, so that the water cannot soak through into the ground, and should always slope downwards so that the water runs away quickly. They must also always be kept clean and open. If any earth slips into them it must be dug out.

Dirty water from the house or the cook house must never be thrown on to the ground, or into a drain near a house, but should be put into a *gurra* or old kerosine oil tin and taken away by the *mehter*. If water is thrown down close to a house, it will soak into the ground and make all the house damp, as water soaks up into the walls as well as down into the ground.

CHAPTER II.

SANITATION AND CLEANLINESS—DISPOSAL OF REFUSE—CONSERVANCY—VENTILATION—LATRINES—REFUSE TRENCHES—HOUSE REFUSE—CLEANLINESS OF HOUSE AND ROOMS—LEEPING—COW DUNG—DISPOSAL OF THE DEAD.

Sanitation and Cleanliness.—We said in the last chapter that we should always keep a house clean and dry, fresh and sweet-smelling, and we learned how to keep it dry by having good drains, good roofs, floors and walls. We have now to learn how to keep it clean inside and out, and always to have it fresh and sweet-smelling.

Disposal of refuse.—This can only be done by having a good system for getting rid of all refuse or waste things—of every thing that has to be thrown away every day, that is, everything that smells, or that would smell if left to decay.

Neglect of the Laws of Health.—If refuse is not got rid of, it gets into the water we drink, or the air we breathe, and we may get typhoid fever, or cholera, or diarrhœa, or diphtheria, or inflammation of the eyes, or if we do not grow actually ill we become weak and soon get tired over our work without knowing why we should feel so. Now all the most horrible diseases, cholera, smallpox, typhoid and typhus fever began from people living in dirt and not obeying the Laws of Health. Only a very few people who live in clean, well kept houses ever suffer from them; and when they catch them it is because other people have been dirty, or have not known what harm they might do, by being careless about dirt and waste matters. When we know how many people have these diseases, and that they are all caused by not taking proper care in getting rid of refuse and dirt, we ought for the sake of our own health as well as for that of others to do all in our power to see that the system and arrangements in our own house, or in our own village or town is the best that can be.

Now these waste matters which are dangerous to health if not properly got rid of, are of several kinds—some are from our own bodies, whilst some are from our houses and cook-houses—and like everything else in the world around us they are solid, liquid or gaseous (like gas.)

Conservancy.—The getting rid of the solid and liquid waste matters is called Conservancy.

Ventilation.—The getting rid of the gas-like waste matters is called Ventilation.

Now, if we remember all that we learned in the Physiology lessons, we shall know that all three kinds of waste matters, or excreta as they should properly be called, are thrown off from our bodies every day. Our bowels carry away and get rid of the solid excreta—our kidneys with a little assistance from our skins and our lungs get rid of the liquid waste matters and our lungs get rid of the gas-like waste matters.

The question is, what should be done with all these waste matters which are no longer of any use to ourselves, and which unfortunately give rise to bad smells and disease if left in or near our houses?

Balance in Nature.—The answer is they should be returned to the earth. What is poison to us is food to the earth, and what is no longer of use to us is of use to the earth. This is a very wonderful thing, and it is a truth which is the same all through nature. We shall see a little later on, how the waste gas we breathe out is the very gas that plants require to breathe to keep them alive, and how the gas which we breathe in and which gives us life and health comes in the same gas which is breathed out by the plants.

Waste.—It is this balance which keeps all nature fresh and sweet-smelling, and prevents there being such a thing as *waste* in the world. The things we call waste matters are waste to us, because *we* no longer can use them, but they are not waste if properly got rid of, that is, if they are returned to the earth where science teaches us they will be useful.

Bad Conservancy.—There are of course both good and bad ways of returning refuse to the earth. The bad ways unfortunately are generally the easiest, and save trouble to the people themselves; but one must remember, though they may save trouble at the time, they may give *a lot of trouble and pain in the end by causing sickness and death. It is a bad way of returning refuse to the earth, for people to get rid of either the solid or liquid excreta from their bodies by the side of a road, or a hedge,* or on the bank of a river or tank, or on the top of a house. If many people do this it causes a bad, unhealthy smell all round, and when the wind blows, the dry, solid matter is sometimes carried long distances, perhaps into the water we drink, but certainly into the air we breathe, and thus may lead to disease.

Latrines.—Glazed gumlas.—The only safe and decent plan is to use latrines, that is places which are, or might be built, either in every compound to a house, or in several convenient places near a town, a village or a bazaar. A latrine should be built of *pucca* brick and have a sloping, overlapping roof raised on supports about a foot above the top of the walls so that there is a large open space on all sides at the top where the bad air can escape. Small openings, if made on a level with the plinth, will give quite enough space for fresh air to enter by, and with these openings the smell inside can never become very bad even in a public latrine. Glazed *gumlas* are the best to receive the excreta because neither the liquid nor solid matter can soak into a glazed surface.

Dry earth.—A big box or tin of dry earth should also be placed in each latrine, and everybody using the place should be asked to sprinkle some dry earth over the contents of the *gumla* before leaving.

Refuse trenches.—Dry earth disinfects such matters and prevents a smell which otherwise would last until the sweeper came to empty the *gumlas.* The *gumlas* should be taken away at least once or twice every day, and emptied into a shallow trench of one foot broad by one foot deep, dug on land that will be cultivated.

Where there are no latrines, every headman of a *village, or every owner of a house should see that trenches for the same purpose are dug some little distance from where any one is living. Along the side of a hedge,* or near the shelter of some trees, is a good place, because it can be made private, and each trench should be a foot deep and a foot broad. A little dry earth can then be sprinkled each time after it is used, and the whole covered in with dry earth when it is nearly full.

Rich crops.—It must be remembered that all excreta, whether from man or from animals, if given back to the earth in the away described, makes the earth give richer crops, and therefore gives man more food as well as better health. Sugar cane and Indian corn give especially rich crops when planted on such ground.

Minor refuse.—In the same way all the refuse from our houses or cook-houses should be got rid of by returning it to the earth. All dirty water, all mangoe or plaintain skins, all scraps of vegetables, the skins of potatoes, all scraps of meat or old bones, all sweepings from the house, or the compound, in fact everything that has to be thrown away from our houses every day, should be thrown into a *gurra* or an old oil tin by the side of the house, and the *gurra* or tin should be taken away and emptied once or twice every day into the same trench as the excreta.

Trenches.—All these trenches should be dug some distance from the house, or village and should never be more than a foot broad and a foot deep. A large deep pit dug near a house is very bad, because the smell from the refuse will come into the house. Wherever there is a bad smell, remember, there is a danger to health. A bad smell in, or near a house, shows there is something wrong in the way we get rid of refuse, just the same as a pain in our bodies shows there is something wrong with our health.

Cleanliness of house.—So far we have only learnt how to get rid of the worst kinds of refuse, but if our home is to be thoroughly clean and sweet-smelling we must learn how to be clean in little matters as well as great. Every day each room should be well swept, and everything in it dusted with a *jharan.*

And not only each living room but the cook-house and the *bottle-khana* must be kept quite clean also. *Degchies* and milk pans and everything to do with food should be cleaned with boiling water and scrubbed so clean that a white pocket handkerchief will not show a mark from them. Cold water is no good, as it will not take grease away. All shelves or *doolies*, that meat, food or dishes are kept in, should also be thoroughly dusted every day.

Rooms.—Once every week again, every room should have an extra cleaning—*durries* and mats should be shaken and put out in the sun—all *phulkaries*, curtains and hangings should be well shaken, or beaten with a soft feather brush, and all the windows cleaned.

Leeping.—Where there are only mud walls and floors these should be fresh coated with clay water now and again, but both walls and floors must always be scraped quite clean before either whitewashing or leeping.

They must be scraped clean first, because no amount of whitewash will take away the dirt underneath it, any more than clean clothes will take away the dirt off one's body. Scraping walls and floors before whitewashing or leeping is like having a good bath with soap aud hot water before putting on clean things.

Cow-dung.—It is not a good thing to do this leeping as it is called, too often, especially in damp weather as it makes a house damp. And it is a very bad thing to mix it with Cow Dung. Cow Dung is decaying matter and does not make a house cleaner or sweeter. Still it is a thing that natives of India believe is sacred, and so they think they cannot have too much of it about them. They make it into cakes to use as fuel, and plaster it all over the walls of their houses and villages whilst drying. This is a bad thing for two reasons. The smell from it makes the air unhealthy all round,—whilst burning it instead of letting it return to the earth as all waste matters should, makes the earth poorer, and so less good grain grows than where the cow dung is dug into the earth.

Disposal of the Dead.—There is still one more thing to remember, if we wish to have all our surroundings in life as healthy and clean as possible, and that is how best to dispose of dead bodies whether they are of men or animals. In a hot country like India it is very dangerous to leave any dead body long without disposing of it. Directly anybody or anything is dead, whether it is a man or animal or a plant, decay begins to set in, and when anything decays it gives off a great deal of poisonous gas and poisonous matters to the air.

Burning.—Burying.—Burning a dead body is really the best way of all to prevent these poisonous gases mixing with the air we breathe, or the water we drink, and thus harming those who are still alive—but all people do not like to burn their dead, they prefer to bury them. If they are properly buried in a deep grave, at least five or six feet underground with plenty of earth over them, this will not hurt living people, unless the grave is made on the bank of a river or near a well—or too near a house, or on ground where water will drain through into a well or river.

Dangers from dead bodies.—But neither burning or burying are properly done in many places. Very often a body is burnt a little way from a house, and before it has all crumbled to ashes, the remains are thrown into a river or stream. Now until a body has all been burnt to ashes there is always decaying matter left which will give off poisonous gases directly the burning stops—so that it is very dangerous to health to throw half burnt bodies into any kind of water.

But it is still more dangerous to throw a dead body into a river or canal without taking the trouble to burn it. The water soon helps it to decay, it is true; but whilst it is decaying, a great many people may get poisoned, or ill in other ways, from drinking the water from that place.

Dead animals.—And it is just as dangerous to health to leave dead animals unburied, or to throw their dead bodies into rivers or streams. If they are left unburied, vultures or other animals may come and pick the decaying flesh off their bones; but this may not always happen, and in fact often does not happen, until the dead body has poisoned all the air around, and the vultures know by the smell that a dead body is there.

CHAPTER III.

AIR AND VENTILATION—COMPOSITION OF AIR—HOW AIR IS CHANGED BY BREATHING—CLOSE ROOMS—VENTILATION IN SICK ROOMS— BREATHING OF ANIMALS—LAMPS, CANDLES, &C. —VENTILATION OF HOUSES.

Gaseous excreta.—In the last chapter we learnt about proper Conservancy, that is to say, how to get rid of two of the excreta from our bodies—the solid and the liquid—but we did not learn anything about Ventilation, or the way to get rid of the gas-like waste matters.

Dirty water.—Dirty air.—The gas-like waste matters are all thrown off into the air we breathe, and perhaps because we cannot see them we think nothing about them, and do not take much trouble about getting rid of them. When we know a little more about the air we breathe, however, we shall all no doubt think it quite as dirty to sit in a shut up room, breathing into our lungs all the waste matters, that have been breathed out of eight or ten other people's lungs, as we should to wash our faces or hands before eating, in a tub of water in which eight or ten people had been washing all the dirt off their bodies. In the case of water we can see when it is not clean, and we need not use it unless we like—but in the case of air, we cannot see, we can only smell that it is dirty when it contains a *great deal* of poisonous matter—and by the time we have smelt it we have breathed it with all its waste matters into our lungs.

Now what is this air which is so important to us, made of, and how does our breathing affect it ?

Composition of air.—Air is a mixture of gases, and when pure is made up chiefly of two gases :—

Oxygen	...	about 21 parts	in 100.
Nitrogen	...	„ 79 „	

These two gases are really a little less than this because there are small qantities of the following substances :—

Carbonic acid gas 4 parts, in 10,000 or very, very little.

Watery vapour—varying with the temperature.

Ammonia—extremely little.

Ozone—varies according to the place.

Oxygen.—(1). *Oxygen*, the first named, is the most important to us and to all animals. Nothing can live without it. Fire cannot burn without it, nor can the heat of our bodies be kept up without it. It is this gas, as we learnt in the first lessons on breathing and the circulation of our blood, which makes our blood bright red and gives us strength and energy to work. It has no color, or taste or smell itself, and yet it is a very strong gas—too strong to be breathed alone.

Nitrogen.—(2). *Nitrogen* is the gas that dilutes oxygen, and is necessary to weaken the strength of the oxygen in the air, just as water is mixed with spirits or wine, when they are too strong to be drunk alone.

Carbonic Acid Gas.—(3). *Carbonic Acid* is the gas that is produced when oxygen comes into contact with carbon. It is the gas, we remember, which comes out of our lungs every time we breathe, and it is formed, we know, by the oxygen in the fresh air we have taken in, uniting with the carbon in our blood. This gas also forms wherever a fire or a lamp or candle burns.

There is very little as we saw in pure air, but in any place where many people are breathing, or many lights are burning, a great deal of it is formed, and it then becomes one of the gaseous waste matters, which we know must be got rid of by ventilation.

Watery vapour.—Moisture.—(4). *Watery Vapour*, or moisture, the fourth substance in the air is not a thing we can always see, we only see it when the temperature gets cool enough to make it show ; yet all the water around us, is constantly giving off vapour into the air. If we put some water in a saucer out of doors we see how it dries up or goes away—that is, it goes into the air around although we cannot see it. Moisture is, like all the other things in the air, absolutely necessary for life. Neither plants nor animals could live in a perfectly dry air as all the moisture in them would soon be drawn out by the thirsty air around. The amount of watery vapour varies very much in the air, when there is much we call the air "moist," when there is very little we call the air "dry."

Ammonia.—(5). *Ammonia* is a substance that comes from decaying things, both animal and vegetable. Where much of it can be smelt it shows the conservancy arrangements are bad. Ammonia is a bad thing for us, but a good thing for plants and crops, and helps their growth.

Ozone.—(6). *Ozone* is a very strong, pure gas—a kind of intensely strong oxygen, often called "Nature's Disinfectant" or the "Scavenger of the atmosphere." It is only found where the air is very pure and good ; such as on the top of mountains, or over the sea, or where there is much green vegetation as in a forest. It is never found in places where men or animals are crowded together.

Organic matters.—(7). *Organic and suspended matters* are small solid particles of such things as fine sand, dried mud, iron rust, charcoal, tiny pieces of wood, of insects or spider's webs, of hairs, of seeds of plants, &c. There are always quantities of these floating about in the air, but they are so tiny that we cannot see them with our naked eye except in a sunbeam or strong light. We can see them very well, however, under a microscope, and see what kind of thing each tiny particle is. Many of these minute things in the air do us no harm at all, but others which are dead or decaying particles of organic matter are very dangerous to us.

Effect of breathing upon air.—Now we have learnt what good air is made up of, we have to learn how we alter it by our breathing. We know that when we breathe we always take oxygen out of the air and give back poisonous carbonic acid, but we do not know how much oxygen we use up in this way. With each breath we take we use up about a $\frac{1}{4}$ of the oxygen that goes to our lungs and we increase the carbonic acid and the organic matters in the air about 100 times. That sounds a great deal; but when we think that the whole of our blood comes in contact with the air we breathe once every minute, or sixty times every hour, we can better realise how much oxygen we must always be taking out of the air, and how many waste substances we are always giving off into it.

Closed rooms.—Yet what do we see people continually doing? They shut up all the windows and doors in their rooms, they stop up every little hole or corner where the fresh air can come in, and then they go to sleep all crowded together, often with their head and face smothered up in a blanket. Very often such people wake up with a bad headache—which has simply come from breathing the air they themselves have poisoned.

Or again, they light a fire and cook their food with the doors all shut up in the cold weather. Women and children, who spend most of their time indoors, suffer very much from breathing bad air in this country, and they not only suffer when they are in-doors, but when they go out travelling they are still no better off.

Travelling in doolies.—High born native ladies, and all *purdah* women are shut up in *doolies* when travelling —and as every one knows they are often ill for days after a long journey. It is a very cruel custom to shut anyone up like this, but perhaps when people understand the laws of health, and know that these poor ladies are ill because their blood has been poisoned by the air they have breathed over and over again, their relatives may let them have the necessary fresh air both when travelling and when at home.

Fresh air required.—We each require a great deal of fresh air every hour if we are to keep well—the exact quantity is 3,000 cubic feet every hour, so if we are in a small room or small space (like a *doolie*) we ought to let fresh air in every minute to get all that.

Fresh air in sickness.—Now we understand how even when we are well we are always wanting a fresh supply of air, as our breathing is constantly changing the air around us, we can believe that in sickness it is doubly necessary to us. It is not only the poisonous carbonic acid which we have to dread, but it is the amount of foul organic matters. It will be remembered that we said there were always some organic matters in the air we breathed, which we could not see, and which as a rule did us no harm. Some people, it is true, get hay fever or hay asthma, from the little hairs or pollen constantly flying off hay, or off trees of the mountain pine and fir kind, floating in the air around.

Nature's protection.—But this is a danger which we cannot help, and which will not kill us; and as a matter of fact there is seldom anything in the air out of doors to do us harm, because nature is constantly protecting us by mixing all poisonous matter, with pure air. The chief dangers out of doors come either from bad conservancy, or from not getting rid of other refuse properly.

Trades which make the air impure.—Butchers ought not to be allowed to kill animals and dispose of the blood and refuse as they please, nor should other people, such as tanners and dyers, who make the air impure by the nature of their work, be allowed to carry on their trades in the public streets.

But after all, as we said, our worst dangers are indoors, and those we can prevent.

Dangers indoors.—The peculiar little scales which cover our skin, and which we can see in the scurf of the head, or when the hands get rough or chapped, are constantly floating off into the air around us; and in a sick room there are not only these but there are pus cells, *i. e.*, small circular particles which come from the pus, or matter in wounds or sore places—there are particles from the spit or cough of people in lung diseases, and there are other things which it is very horrible to think of breathing into our lungs. And they are not only horrible to think of, but they may, and very often do cause diseases.

Pus cells from sores may cause inflammation of the eyes, or a dangerous inflammation of the skin called erisypelas, or some kind of blood poisoning.

The particles from the spit from lung diseases may give healthy people who breathe them in, the same diseases—and the skin scales from people ill with the small-pox, scarlet fever, measles or typhus, may give other people these illnesses.

Diffusion of air.—But remember that unless we shut up our rooms, and so prevent fresh air coming in, nature is always trying to help us to get rid of the poison by diffusing it, or spreading it over a larger space, in other words diluting it with fresh air. Air is always moving and always helping us in this way, and the way we have to help Nature in return is by "ventilating," that is, giving plenty of room for the fresh air to come into our houses.

Breathing of animals.—But before we learn how we can ventilate our houses properly, we must know that it is not only ourselves who use up the oxygen of the air. All animals, cows, goats, sheep, dogs and horses breathe in the same way that we do, and require as much fresh air.

They ought never to be allowed to live in a house, or even in the downstairs part of a house, where people are living above, for not only do they make the air impure by their breathing, but they make it still more poisonous by all the solid and liquid excreta from their bodies dropping on the floor.

Lamps, candles, &c.—And besides animals, everything that burns in a room—all lamps, candles, or charcoal, or wood fires take the oxygen out of the air and give carbonic acid gas back just as we do. Nothing we learnt, can burn without oxygen—it is only when oxygen and carbon come together that things burn, and then we know carbonic acid gas is formed. Coal-gas which is fortunately not very common in this country, does the most harm when it is alight, as each jet destroys as much air as four people—that is, 12,000 cubic feet per hour. One good oil lamp destroys as much as one person, and two hard candles produce as much carbonic acid and use up as much oxygen as one person. Softer candles which melt quickly and make a disagreeable smell, destroy more air than hard candles, because they throw off more soot or carbon into it. When we are thinking how much fresh air is needed in a room for each person, we must not forget to reckon each lamp or candle. Nor must we forget that it is a very bad thing to burn a fire in a room where there is no opening or chimney for the foul air and smoke to escape by. Charcoal in an open *gurra* or pan, is the very worst kind of fire because a most poisonous gas is formed when charcoal burns—and many people have been killed by going to sleep in a closed room with charcoal burning.

Ventilation.—This brings us to the best way to ventilate rooms. Many rooms have no proper ventilators, but all have windows or doors, and if we are not rich enough to put in ventilators, we can still manage to keep the air of a room fresh by always having one window or the door open, day and night, *all* the time we are sitting or asleep in it. Then when we go out we can get perfectly fresh air into all parts of a room by opening the windows and doors on all sides and letting the wind blow through. If there is no wind, and not much movement in the air, it is a good plan to flap a door to and fro so as to make a draught and move the air about in a room. But we must always be careful the air comes from outside and not from another room. A door which only opens into another room which is shut up, is no ventilation at all.

Day and night ventilation.—We said that a door or window in every room ought to be open day and night—and this is very necessary for everyone is much longer in the same room by night than by day. We breathe nearly as fast when we are asleep as when we are awake, and we change the air in exactly the same way, so that we must have fresh air quite as much by night as by day. Some people think night air is bad because it is cold, but cold air does no harm if we are warmly covered, whilst the same air breathed over and over again does a great deal of harm.

Hot and cold air.—Besides windows and doors and fire places which all help to let in fresh air, we ought, if possible, to have ventilators or openings both low down and high up in every room. Hot air is always lighter than cold air, and air is always moving because the hot air is constantly chasing the cold air, rushing in as it were, so as to make it all one temperature. Now the air we breathe out is always 98·4° that is generally, or except in the very hottest weather, hotter than the air outside, and therefore it is lighter. This air we breathe out then rises up in a room, and the cold air sinks to the bottom, so when we want to ventilate a room we have to make openings near the floor for the fresh air to come in by, and openings near the ceiling for the hot, foul air to go out by. These can be made in different ways either by openings in the windows, the floors, or the walls.

Ventilators in windows.—In windows either slits may be made in the panes of glass—or the panes may be "louvred" that is strips of glass may be placed lying one over the other and fixed on to a frame, which can be opened or shut; or, again, whole panes of glass may be taken out and replaced by wire gauze.

Ventilators in floors.—In floors, or rather in a line with the floor, openings may be made by taking out one or two bricks, fixing a grating on the outside and having a tube or funnel running upwards about four or five feet inside the room. This tube is a good plan because no draught comes. But if there is only an opening in the wall the air blows straight in, and makes a draught in cold weather.

Ventilators in walls.—One of the best forms of ventilation is by lifting up the ridge of the roof.

Another is by leaving a space between the roof and the wall. But if neither of these can be managed, openings can be made near the ceiling by taking out bricks as before explained, but no tube is necessary.

If in cold weather the air blows down upon people sitting in a room it is a good thing to have a board sloping out and up, and closed at the sides. The cold air then goes up first and falls gradually, getting warmer as it comes lower down into the room.

Ventilation we must remember is letting in fresh air continuously and without draughts, so if there is ever a draught from a ventilator it shows it is not well arranged.

How to have fresh air always.—A good way to know whether a room is properly ventilated or not, is to go into it from the fresh air out of doors. If there is a close, stuffy smell, it shows the air is not fresh enough, for good air has no smell. Generally speaking we shall be sure to have fresh air in our houses if we carry out all that has already been advised and if, in addition, we are careful as regards a few other things.

(1). That verandahs should not be blocked up, as they not only prevent fresh air coming into a house, but prevent the walls drying in damp weather.

(2). That no room or house should be overcrowded either by people, by animals, or by furniture.

(3). That openings for fresh air should not be stuffed up even in cold weather.

(4). That dark rooms are unhealthy and that the more light there is in a room the better the air will be.

(5). That if the air surrounding a house is impure, either from a jheel being close to it, or from any other cause which we cannot help, it is a great safeguard to sleep under Mosquito curtains, as the air gets "filtered" so to speak. But the curtains must never be too close to the sleeper.

Lastly we must remember there is no excuse for not having fresh air in our houses. There is plenty around us, and nature is always keeping the balance even.

Breathing of Plants.—The carbonic acid we breathe out is taken up by all plants and vegetables—they separate the carbon from the oxygen and return the oxygen to the air. In this way they are constantly manufacturing what we want and we are as constantly manufacturing what they want.

CHAPTER IV.

WATER—COMPOSITION OF WATER—WATER IN THE HUMAN BODY —SOURCES OF WATER—RIVERS—STREAMS—TANKS—DIRTY HABITS—RULES TO KEEP WATER PURE—WELLS—RULES FOR KEEPING WELLS PURE — CLEANING WELLS — BOILING AND FILTERING DRINKING WATER—DRINKING WATER FOR ANIMALS.

Now that we have learnt all about the necessity of fresh air and the way to obtain it in our homes, we have to learn about the other great necessity of health we spoke of in the chapter on Houses—that is good water.

Water.—Water is like air in some ways. It is made up of two gases chiefly, and contains a few salts when it is pure, and when it is impure it has carbonic acid gas and dead organic matters in it just as air has.

Oxygen and Hydrogen.—The two gases which combine to form water are called Oxygen and Hydrogen. Oxygen we already know about, but Hydrogen we do not. Hydrogen is the lightest of all gases and it is the one balloons are generally filled with to make them float up in the air. Oxygen forms the greater part of water for in nine seers of water there are always eight seers of Oxygen to one seer of Hydrogen.

Water in our bodies.—Now we all have a great deal of water in our bodies, more than anyone would think, considering that our bodies are solid.

But if a man weighs 75 seers, about 56 seers, or as much as two thirds of that, is water. And if we remember what we learnt in the Physiology lessons, we know that every day we get rid of some of this water from our lungs and skin and kidneys and that every day as much has to be replaced or we should lose weight.

Water in Foods.—We replace it by the water we drink and by the water we take in with our other foods. All foods, except the driest, contain a great deal of water—one seer of meat has about $\frac{3}{4}$ of a seer of water, whilst a seer of flour has two chittacks of water.

In this way we take in a great deal of water with our foods, but we still have to drink a great deal besides to make up for all that we lose daily, and it is how to get the purest, cleanest water we can, to drink or to cook our food with, that we have now to learn.

Cholera.—Cholera which is truly called the "child of dirt," is one of the worst diseases we get from bad water, but there is always plenty of pure water around, just as there is plenty of pure air, if we do not ourselves spoil it and make it impure.

Source of pure water.—Rain.—Now where does this pure water come from and how is it made impure? Pure water comes from the clouds. All the time the sun is shining during the day, its heat is sucking up moisture from all the water on the earth. It sucks it up as vapour which we cannot see until a lot of it collects and forms a cloud. Now clouds according to their temperature can only hold a certain amount of vapour. When they get too heavy they fall and the moisture that falls from them is called Rain. Rain we know falls on the earth and soaks into it—some of it goes back into the rivers and tanks from which the sun drew the moisture up, and some soaks down into the earth until it meets with some clay or rock that will not let it pass through, but holds it as if it were in a basin. And it is this basin we reach when we dig a Well.

Wells.—Most of the water we use comes from rivers and streams, canals, wells or tanks. In large cities water is often brought from a river or a reservoir in pipes which supply every street or house, and that is a good way to get pure water if the river or reservoir is kept clean

Dirty habits.—But it is difficult to keep any water clean where people have dirty habits, and the first thing to remember is, to keep all the rules given before for keeping houses and compounds and the air around us clean and sweet-smelling, for the same things make both air and water impure.

Breaking any of the rules of cleanliness is bad enough if a river or stream is large and the water is flowing quickly, but if it is a small stream with the water moving slowly, it soon becomes a dangerous place for all the dirt diseases to start from.

Tank water.—Where drinking or washing water is got from tanks it is doubly necessary for all the people around to be clean in their habits because water in a tank is stagnant or still, and there is no motion in the water to carry off any dirt or impurity. Yet what dirty things we may see done every day either in or near every tank in India.

Banks of tanks.—People use the banks as latrines, quite forgetting that all the foul matter from their bodies will soak through the ground and be washed into the water they drink—others wash all the dirt and perspiration of their bodies, brush their teeth, rinse their mouths and spit into the tanks, others again scrub their dirty, greasy, cooking pots, or wash and water their cattle, while others wash the grain and fruit they are about to sell or eat, and the filthy clothes they have just taken off their dirty bodies, and which simply stink with the dirt of weeks or months.

These are all very dirty habits, and it is only by people knowing all the harm that is done by them, and the diseases that spring up in this way that we can ever hope to get a cleaner and more healthy state of affairs.

Diseases from drinking bad water.—The diseases that come from drinking dirty water of this sort are some of the worst we can have—cholera, dysentery, diarrhœa, typhoid fever, and some kinds of worms, and these come chiefly through drinking in by our mouths the foul excreta from other people's bowels. Can anything be more horrible to think of? And can anything be more true than calling cholera and these other diseases "dirt diseases."

Rules to keep water pure.—They are dirt diseases, but they are also preventable diseases. Clean habits will stop them if only every one will be clean, and remember the following rules with regard to all water in rivers and streams, canals and tanks:—

(1). Not to throw any kind of refuse or dirt into water, but to get rid of it into a proper trench.

(2). Not to throw dead bodies, or the ashes of dead bodies that are burnt on the banks, into any water.

(3). Not to wash clothes, or to bathe in the same place where drinking water comes from.

(4). To have separate tanks for bathing people and washing cattle.

(5). To keep the bathing tank as clean as possible, and not to think that any dirty water will do to wash oneself, or one's clothes in.

(6). To keep one or two tanks with the purest and cleanest water for drinking water.

(7). Where drinking water is taken from a river, or stream, to make a small well or hollow in the sand at the side of the stream, four or five feet deep—so as to form a natural filter. The water will pass through into it, and on its way will get rid of a lot of its impurities.

(8). Never to drink water from a jheel, because it very often gives people intermittent fever or ague.

(9). Not to use the bank of a river, a canal, or any stream as a latrine.

(10). To make sure there are no latrines or refuse trenches near.

(11). To be sure no drains or *nullahs* from houses, or crowded streets near, empty into the tank.

(12). Not to steep hemp or jute or other similar things in water anywhere near a town or village, for when they rot they make both the air and the water impure.

Well water.—All that has been said about keeping rivers, streams and tanks clean, is equally true as regards wells. A great deal of drinking water in India is taken from wells, and although people cannot bathe in them, or wash their clothes in them, still they do many things which make the well water dirty.

How wells get dirty.—They draw up water from it in dirty *chatties*, or pails tied to filthy ropes, and as they raise it up they spill some of the water over their feet on to the ground around, and it soaks through from there into the well again. Or again they draw up water and bathe, or wash their clothes close to the mouth of the well, so that the ground all round gets wet, and the dirty water from their bodies or clothes soaks back again in the same way.

Cattle troughs.—Sometimes they build troughs round the well for cattle to drink from ; but these are often both cracked and dirty, and through the crack all manner of dirty matters fall back into the water. At the same time the droppings from the cattle fall on to the wet ground all round and soak through the earth into the well.

Rules for keeping wells pure.—Now what ought to be done to keep all well water pure and fit for drinking ?

(1). Every well should be sunk in a good soil and not near any refuse pit.

(2). It should be at least thirty feet deep where possible, so that the water in it is not taken from the surface close around.

(3). The upper part should be built round with a good wall and there should be a masonry platform a few feet all round the mouth.

(4). The top of every well, private or public, should have a wooden cover with small openings for ventilation, so that no leaves or dust can fall or be blown in. Living plants or fish, we must remember, do good to water, but dead leaves or dead things of any kind do a great deal of harm.

(5). Every well should have a pump to draw up the water with, where possible.

(6). If there is no pump, clean *chatties* and clean ropes should always be used.

(7). *Lotas* or *chatties* used by people themselves should not be let down into a well. A clean iron bucket kept for the purpose is the best.

(8). There should be no holes where water can lodge near to a well. If there are any they should be filled in.

Cleaning wells.—Wells should be thoroughly cleaned twice a year, but before cleaning a well it is always necessary to let a lighted *chiragh* or candle down. If the light burns it shows the air is pure, and that there is enough oxygen in it for a man to breathe. But if the light does not burn well, or goes out at the bottom, no one should go down, because it shows there is a quantity of carbonic acid gas in the air. And wherever the carbonic acid gas is enough to put out a light, it is enough to kill a man.

Carbonic acid gas in wells.—It sometimes happens that this poisonous carbonic acid gas is let loose in the air by cleaning the well, or by disturbing the decaying matter at the bottom—but if this is the case, it shows the well has not been cleaned for a long while. So if it is known that a well has been left dirty for a long while, it is always safest to keep a light burning in it if men are going down it.

Drinking water.—Perfect cleanliness all round is the best remedy against bad water; but as we can never be sure there is perfect cleanliness anywhere, we should always both boil and filter all the water we drink, and not only all the water we drink as plain water, but all the water to which spirit or wine is added, or the water with which we make tea, coffee, cocoa, &c., as well as what is most important, all water from which soda water is made.

Effect of boiling water.—By boiling water we kill any living things or fever germs there may be in it—only it must be really boiled to do this. If it does not bubble and steam it is under boiling point and worse than no good, for heat makes the germs grow up to a certain point. It is only when boiling point, 212° Fahr. is reached that we can be sure all living things in the water are killed.

Filtering water.—If we filter water after boiling it, we take out all the sediment or impurities there may still remain in it, for the water is made to pass through some material that will not allow organic matters to go through. Filters are made of different materials, sometimes of sand and gravel—sometimes of charcoal.

Both vegetable and animal charcoal have been tried but the vegetable charcoal does not make a perfect filtering material.

Good and bad filters.—Animal charcoal is good if we are certain it has been well burned, and if we take it out and put fresh in, about every three months. Any material that has been thoroughly well burned makes a good filter, because it is not likely to become a breeding place for any kind of vegetable or animal life—but such a thing as a piece of sponge for a filter is worse than no good, for it soon becomes alive with all kinds of living creatures. Filters that cannot be taken to pieces to have their materials renewed or cleaned, are after a time worse than useless, and very likely to prove dangerous by becoming breeding places for germs.

The best filters.—The best kinds of filters to buy are :—(1). the spongy iron ; (2). The silicated carbon ; (3). The animal charcoal ; and of the different kinds of animal charcoal filters, the "Syphon" is the best.

But those who are too poor to buy a regular filter can make a very good one for themselves in this way.

Cheap filter for a poor man.—Get a glazed *gurra*, and make a hole about the size of a two anna piece in the bottom. Cover the hole with a piece of zinc gauze, or clean flannel, which must be changed from time to time—then get some rather fine gravel, enough to fill the *gurra* to about three inches—wash it well and put it in as a first layer.

Then get the same quantity of white sand—wash it well and lay it in on the top of the gravel about three inches deep—and next buy 2lbs. of animal charcoal, and wash that well by putting it into a jug or basin and pouring boiling water on to it. Let it stand until the charcoal settles, and then pour the water off and put fresh boiling water on three or four times. When the charcoal is well washed in this way, press it well down on the sand till it is about four inches deep. From time to time all the charcoal and sand will want washing, or fresh putting in, but if the charcoal only gets stopped up or a little dirty, take a good thick layer off the top, boil it two or three times, and then spread it out to dry in the sun, or before a fire before putting it back.

How to keep filtered water.—Water filtered in this way will be quite pure to drink if it is filtered fresh every day, and if it is kept in a glazed jar or *gurra* with a lid to it. Water either for drinking, or for cooking, should always be kept in a closed *gurra*, where neither dust nor other things can fall into it, and once every day all the water should be emptied out, and the inside of the *gurra* wiped dry with a clean cloth before fresh is put in.

Drinking water for animals.—Besides getting pure drinking water for ourselves, we should not forget that all animals, cows and horses, goats, sheep and dogs all want clean, pure water as much as we do. If they had clean drinking water given them in clean pails or *gurras* they would not suffer from worm diseases which make them thin and miserable looking—and they would not only be able to do more work but would fetch higher prices when sold. In England all animals are well taken care of, and have good drinking water, and clean places to live in, so they always look fat and well, and can do a lot of hard work.

Test for good water.—A very good rough test to tell whether water is pure or impure, is to drop some permanganate of potash into it. Half a teaspoonful in four or five seers of water is quite enough for the purpose. If the water turns purple it is pure. If it turns a dirty yellow it is impure, and therefore not fit for either man or animals to drink.

CHPTER V.

FOOD—COMPOSITION OF THE HUMAN BODY—SALTS AND PHOSPHATES—GROUPS OF FOOD—TABLES OF NITROGENOUS AND CARBONACEOUS FOODS—WATER AND SALTS IN DIFFERENT FOODS—NECESSITY OF MINERAL SALTS FOR HEALTH—VALUE OF RICE—A GOOD MIXED DIET—SWEETS—MILK—VEGETABLES ANIMAL FOOD—COOKING FOOD—FRESHNESS OF FOOD.

When we learnt how the food we eat is disgested or turned into blood, which feeds all our flesh, bones, and nerves, we learnt something about the chemistry of our bodies, but by no means all.

The chemistry of our food and our bodies alike.—We shall now see that our food, as we might expect, is made up of exactly the same chemical compounds as our body.

Our body, we said, in the last chapter, was more than half water—really two-thirds water—and water as we know is a compound of oxygen and hydrogen.

Elements.—Now oxygen and hydrogen are " elements," that is substances which will not divide up into anything else—and in the same way carbon and nitrogen are elements, because they are simply themselves. There are altogether sixty-two elements which have been discovered, and everything in the world—earth—fire—air—water—trees—plants—animals as well as we ourselves, and the food we eat, are made up of some of these mixed or combined together into what are called compounds.

Elements in our bodies.—Our bodies, however, are only made up of sixteen of these elements, and seven of these are metals. We have not yet learnt anything about the metals in our bodies, but we do know something about the other elements. We remember, we have oxygen, hydrogen, carbon and nitrogen in our bodies, and that these are the chief elements in us, just as in fact they are in everything in the world.

All the others are in very small quantities. Their names are—Phosphorus—Sulphur—Chlorine—Fluorine—Silicon — Calcium — Potassium —Sodium—Magnesium—Iron—Manganese and Copper.

The last seven are all metals, and iron which is amongst them is found everywhere in the body, and is necessary for the coloring matter of the blood. Iron and other mineral matters are always found in the ashes of a body after it has been burnt,

Combination of Elements—All the first four elements, Phosphorus, Sulphur, Chlorine and Fluorine, are generally found combined with the metal elements,—Calcium, Potassium, Sodium or Magnesia—and form mineral salts, which are met with in all our tissues and all the liquids of our body, our blood, saliva, gastric juice, bile, pancreatic juice, and perspiration.

Salt—One combination of these is easily remembered, that is, the gas Chlorine and the metal Sodium, which unite and form common salt, or as it is called in Chemistry, chloride of sodium. Common salt is always found in our blood, and the gastric juice of the stomach is partly formed from chlorine, whilst bile is partly formed from sodium, and both the gas and the metal are separated inside us, from the salt we eat.

Phosphates.—Of the others, phosphorus is one of the chief, because it combines with oxygen and calcium to make phosphate of lime, and again with magnesium making phosphate of magnesia. Both of these phosphates are found in all our tissues, but mostly in our bones and teeth.

We get these phosphates chiefly from wheat, barley, rice, oats, &c., and they get it from water. When rain falls it dissolves phosphate of lime from the earth and so it becomes soaked up by these plants and enclosed in their grains as they grow. This is truly a very wonderful provision of nature, for both the plants need it for their growth, and we need it for ours.

Silicon, the last of the non-metallic elements, combines with oxygen, and is found in the hair, the nails and bones.

Principal Elements.—In order to be able to understand how food nourishes us, it is necessary to know all this, but chiefly to remember that our bodies are, generally speaking, made up of the first four elements, together with several kinds of mineral salts.

The two first of the elements, Oxygen and Hydrogen, form the water in our bodies; the next, Carbon, unites with Oxygen and burns, and the fourth Nitrogen combines with other things to form bone, blood, muscle and flesh.

The two last are especially necessary to remember, because foods are divided into two great classes according to the amount of Carbon and Nitrogen each contain.

Carbonaceous foods.— Those which contain most carbon are called *carbonaceous*, or heat-giving foods, because the carbon in them becomes united with the oxygen in our body and burns, or in other words, helps to supply our animal heat.

Nitrogenous foods.—Those which contain most nitrogen are called *nitrogenous*, or flesh-forming foods, because most of our flesh and bone is formed from nitrogenous compounds.

Salts, or Mineral foods.—The above are the two great classes, but there is also a third class of necessary food, and that is divided into two groups, the first being *water*, the second *salts*, or mineral matter.

Waste and Repair.—There are two reasons why we eat food:—The first, to repair the waste of the body which is continually going on. The second, to supply animal heat.

Every day and every minute of our lives we are continually using up part of our body—or, as we know, throwing out waste substances from our blood which are got rid of by our lungs, skin, kidneys and bowels. Every time we move a muscle, or think, or speak, or walk, or breathe, some of this waste takes place and has to be got rid of. But it also has to be replaced, or our bodies instead of growing larger and stronger as we grow older, would grow less and less. And it is by the air we breathe, the water we drink, and the food we eat, that this waste is replaced, and fresh fuel for keeping up the animal heat supplied. Now there is only one food which has all the elements in it which are required to supply both these necessities, and that is milk, the food we have first as babies, and which gives all we want to make us grow strong and fat in the first few years of our lives.

Milk—the perfect food.—What then is milk made up of? If a seer of cow's milk is analysed, that is, divided up, it is found to contain about $13\frac{3}{4}$ *chittacks* of water—about $\frac{3}{4}$ of a *chittack* of sugar—about $\frac{1}{2}$ a *chittack* of butter, $\frac{3}{4}$ of a *chittack* of caseine—about $\frac{1}{4}$ of a *chittack* of salts, and a little iron.

In the water and salts we get the necessary proportion of water and mineral food—in the sugar and butter we get the necessary carbonaceous, or heat-giving food, and in the caseine we get the necessary nitrogenous, or flesh-forming food.

Now we have to learn which, amongst all the many foods we eat, are nitrogenous and which carbonaceous.

Albumen.—Nitrogenous, sometimes also called albuminous foods, are those which contain a lot of albumen, fibrine or caseine, that is solid or stringy matter.

The white of egg is albumen, the fibres, or flesh, or meat is fibrine, and the solid part of milk, or cheese is caseine, and this is the part in which the nitrogen is found.

Carbonaceous foods, on the other hand, are those which contain a lot of starch, sugar or fat, that is, substances which are nearly all pure carbon.

List of chief Nitrogenous foods.—The chief nitrogenous foods are :—

Animal.	*Vegetable.*
Meat.	Bread.
Fish.	Flour (all kinds).
Fowls, ducks, &c.	Barley.
Eggs.	Oatmeal.
Milk.	Rice (very weak).
Cheese.	Lentils.
	Maize.
	Rye.
	Millet.

All the above contain Oxygen, Hydrogen, Carbon and Nitrogen.

Chief Carbonaceous foods.—The chief carbonaceous foods are :—

Animal.	*Vegetable.*
Butter and ghee.	Sugar.
Suet.	Treacle.
Oil.	Olive Oil.
Fat.	Starch (which is in flour and all vegetables).
Dripping.	

We see from these lists that there are many different kinds of both animal and vegetable food in both classes, but although they all sound equally good, some are really a great deal stronger and better for us than others.

Proportion of Nitrogen in different foods.—Here is a list of some nitrogenous foods in the order of their richness :—

	Nitrogen.	
Cheese	29 parts in 100.	
Cooked meat	27	,,
Dry Peas, Lentils Gram	22 to 24	,,
Oatmeal	16	,,
Millet	16	,,
Eggs	14	,,
Fish	14	,,
Maize	9	,,
Bread and flour	10	,,
Rice	7	,,
Barley meal	6	,,
Figs and Dates	6	,,
Milk	4	,,
Bananas	4	,,

Proportion of Carbon or Fat in different foods.— Here follows a list of Carbonaceous foods according to their richness :—

Sugar, Treacle, Butter, ghee, Suet or Fat	Have about 90 parts in 100, of pure Sugar or Fat.

And the following are principally Starch :—

Sago, tapioca, arrowroot, cornflour	83 parts in 100.	
Pearl Barley	76	,,
Rice	76	,,
Fine flour (*maida*)	74	,,
Wheat	71	,,
Rye	71	,,

Dates and Figs	*66 (starch and sugar.)*
Maize	*64 parts in 100.*
Oatmeal	63 ,,
Millet without husks	61 ,,
Peas	51 ,,
Haricot beans and Lentils (*dhal*)	49 ,,
Bananas	20 ,,
Sweet Potatoes	16 ,,
Potatoes	15 ,,
Parsnips	3 ,,

Proportion of Carbon and Nitrogen compared.—If we compare these two lists, the thing that must first strike us is the fact, that the flesh-forming foods have much less nitrogen than the heat-giving have of carbon—Dry Peas for instance, which come high up in the first list have only 22½ parts in every 100—that is, nitrogen forms less than one quarter of their whole weight. Cooked meat again has a little over a quarter of its whole weight nitrogen. But if we turn to the carbonaceous list we see that sugar, butter, and fat consist nearly entirely of carbon, whilst sago, tapioca, arrowroot, cornflour, pearl barley, rice and *maida* have ¾ or more of their whole weight starch or carbon—and even many of those lower in the list have more than ½ their weight carbon.

Amount of Carbonaceous food eaten.—Now this is very instructive, for it shows that we are always eating far more heat-giving food than flesh-forming. If we could see all the calculations made by clever men as to the daily loss and gain of our bodies, we should see that we want a great deal more carbon to burn in our bodies than nitrogen to supply the waste in our muscles and tissues, so that it is quite right to eat more carbonaceous than nitrogenous food.

Effects of too rich living.—*However we must not eat too much carbonaceous food, that is, more than we require to keep up our animal heat, for if so, the superfluous* carbon stays in our bodies, and forms fat in all parts of us—in our organs and between our muscles—whilst if we eat too much nitrogenous food, blood is formed too freely, our organs do not require it all, and they become congested, and so get diseased. This means we must never overload the stomach with any kind of food—although if we are doing hard work, or taking a lot of exercise, a good deal more can be taken than if we are doing next to nothing, as we require it to produce force and repair muscles.

Now that we know how much nitrogen and carbon we get in a good many of our ordinary foods we must see what they are made up of besides, and this is not difficult to remember, as it is mostly water and mineral salts which, as we know, form the third class of necessary foods.

Proportion of Water and Salts in several foods.—All foods contain water and mineral salts, though some have much more than others, as may be seen from this list :—

The food—	*Water* in 100 parts	*Mineral salts* in 100 parts.
Vegetables and Fruits, such as Onions, Lettuce, Cabbage, Carrots, Rhubarb, Apples and Parsnips.	Between 80 and 95 parts.	1 part or less.
Milk	86	0·8
Sweet Potatoes	76 to 79	1·0
Potatoes	75	1·0
Fowls and lean meat	73	2·0

The food—	*Water* in 100 parts	*Mineral salts* in 100 parts.
Bananas	73	0·8
Eggs	72	1·5
Bread	40	1 or less
Cheese	34	nearly 5
Dates	20	1·0
Figs	17	2·0
Rice	15	0·5 (½)
Flour (wheat)	14	1 to 6
Peas	14	3·0
Haricot beans	14	2.9
Maize meal	14	2·0
Barley meal	14	1.1
Butter	10	1·0
Oatmeal	5	21.0

Wet and dry foods.—From this we see that most green fresh vegetables are very wet foods, as they are nearly all water. Next, that potatoes, fish, fowls, meat, eggs and bananas have about ¾ of their weight made up of water, whilst rice, peas, beans, (*dhal*) barley, wheat or maize, dates, figs, &c., have only between an eighth and a fifth of their weight water, and are therefore very dry foods. This shows us that rice, *dhal* and all dry foods are cheaper for a poor person to buy, because as they have only a small quantity of water in them they must have a great deal of solid carbon and nitrogen.

Again, if we look at the amount of mineral matter in different foods, we see that flour, cheese, oatmeal, peas, beans, meat and figs contain a great deal of mineral matter, that is 1 to 2 or more parts in every 100—whilst rice contains only ·5 or ½ a part in every 100.

These mineral matters, or different kinds of salts, are all very important to us. We require a great deal of one kind

—common salt—and we get some of it in a great many of our foods, but not nearly enough, so that we always eat it separately as well, if we wish to remain in health. People who live only on vegetable food require a great deal more than those who mix animal and vegetable foods, because there is very little common salt in any kind of vegetable.

Necessity of salt.—Salt is the only solid mineral, we must remember, that we add knowingly to our food, and we do this because we require so much more of it than of any of the other salts. Some people perhaps look upon it only as a relish to food, but it is really one of the first necessities, and no one's blood can be healthy without plenty of it. When people are in good health they can taste that their blood is salt, if they prick their finger and try.

Necessity of mineral salts.—Scurvy.—The other mineral salts, the phosphates, sulphates, and salts of potash are all supplied to us in our food. It is important to remember this, for if we do not have enough phosphates our bones and muscles are weak, and little children grow up with crooked spines and legs—whilst if we do not have enough salts of potash our blood is thin and poor, we get skin diseases and sometimes a dreadful disease called Scurvy. Now some foods are much richer in these salts than others.

Phosphates in cereals.—For instance all cereal plants, seeds, fruits and animal food contain a great deal of phosphorus in their mineral matter. Wheat and wheat flour are the richest in all kinds of phosphates, but barley, oats, rye, rice, maize, all contain phosphates too.

Potash in vegetables.—On the other hand, potatoes and all green vegetables, cabbages, turnips, carrots, pumpkins, onions, *brinjals*, contain a great deal of the salts of potash and lime, so that eating wheat, &c., will make the bones strong, and eating plenty of green vegetables will keep our blood pure.

Rice.—Poorness of rice.—Rice, strangely enough, which is the common food in India, was as we saw, very poor in mineral matters or salts—and it is also poor in nitrogenous matter. The average nitrogenous matter is 7 per cent. though this varies from 5 to nearly 12 per cent. according to the different soils on which it is grown.

These two facts show us clearly why it is that people who feed on rice alone, can never become strong like other people who eat foods which are richer in nitrogen and mineral salts. All who have to do hard work must eat plenty of nitrogenous food to repair their muscles, as well as plenty of carbonaceous food to produce the force or power to move those muscles.

Digestibility of rice.—Still rice is a very good food for more than one reason. It loosens the bowels less than any other of the cereals, and it is supposed to be the most digestible of all foods, that is, the starch in it is more easily digested than other kinds of starch. Boiled rice with its starch grains properly swelled out in cooking takes only an hour to digest, whilst beans, barley, or potatoes take over two hours, and meat over three hours—so that rice is sooner changed into blood and gives the stomach less work than any other kind of food.

A good mixed diet.—Rice, however, is too dry and starchy to be a strong or perfect food, and those people are healthiest and can do the most hard work who can afford to add *dhal* (peas or beans or lentils) or gram or *chapatis* made from the flour of wheat (*gahun*), barley (*jow*), maize or Indian corn (*mukkie*), spiked millet (*bajra, cumboo*), common millet (*ragi-murwa*).

Amount required daily.—The amount of food, in addition to water, that grown-up people require every day, is at least $1\frac{1}{2}$ *chittacks* nitrogenous, nine or ten *chittacks* of starchy food, $\frac{1}{2}$ or $\frac{3}{4}$ of a *chittack* of butter or sugar, and a $\frac{1}{4}$ of a *chittack* of common salt. Anyone eating that amount would be taking the right proportions of flesh-forming, heat-giving and mineral foods, and would neither have too much nor too little to keep himself in good health if he were doing an ordinary amount of work, and if the food was properly cooked.

Now all kinds of *dhal*, *gram* and flours are richer in nitrogen and mineral matter than rice, so that they supply what rice lacks, and are useful in giving variety to the daily food.

Atta, Soojee and Maida.—It must be remembered, however, that there are three kinds of wheat flour—*atta*, *soojee* and *maida*, and that *atta* should always be used for making *chapatis* as a supplement to rice food.

Atta is rich in flesh-forming and mineral substances, whilst *soojiee* is principally albumen and starch, and *maida* is nearly all starch and so only a carbonaceous food.

Milk and vegetables.—If people, in addition to rice and the foods named, can get plenty of milk and fresh vegetables besides, and do not take too much ghee or sweetmeats, they will have as good and as healthy food as it is possible to eat. Too much ghee, or too many sweetmeats are bad, because they are only heat-giving foods, and unless people are taking much exercise they will not make them healthy but only fat.

Milk.—Milk is a very good food especially for children because it contains everything our blood needs, and if it is added to rice with a little sugar, it makes a most nourishing food and digestible dish. It is a very good thing also to mix with cornflour, sago or arrowroot, which are nearly all starch, because in this way nitrogenous matter and mineral salts are added.

Vegetables.—Fresh vegetables are especially necessary to eat all the year round so that our blood may have the potash salts it requires. Salads and fresh uncooked vegetables or fruits have more of these salts than cooked vegetables, especially when they are steamed instead of boiled, because the salts are lost in the water they are boiled in; but in the hot weather it may not be always safe to take uncooked vegetables or fruit, particularly if cholera or dysentery is about.

Fruits, &c.—Mangoes, plantains, melons, pine-apples, peaches, dates and figs, oranges and lemons all contain either valuable mineral matter, or a special acid, which is very good for the blood.

And in the same way, potatoes, spinach, cabbages, carrots, turnips, onions, tomatoes, all kinds of *brinjals*, pumpkins, cucumbers, *kuddu* or vegetable marrows, *bhindi*, and *kerila* contain a great deal of the necessary salts of potash. Vegetables are sometimes difficult to get in the hot weather, but nearly all of these varieties may be had if a garden is properly looked after. Fresh *gram* leaves and turnip tops, which are generally thrown away, make a good dish for a change, very much like spinach if cooked in the same way.

Rice which some people eat as a vegetable, is no use instead of green fresh vegetables or potatoes. It has so little mineral matter that if eaten for long as a substitute for other vegetables, scurvy results.

Animal food.—People who eat much animal food of any kind, either mutton, goat, fowl or fish, should always take plenty of vegetables because all animal foods are very rich in nitrogenous matter, and require lighter foods, especially those which contain salts of potash, to mix with them. All meats, besides having a great deal of nitrogenous matter, are well supplied with phosphates; but we know that where too rich nitrogenous food is taken more blood than we require is formed, so that unless plenty of fresh vegetables are eaten the blood must soon become unhealthy.

Salt meats.—Salted meats, such as ham, tongue, or humps especially, require a great deal of fresh vegetables with them, or they cause scurvy. If fresh vegetables cannot be had lemon-juice is a good substitute.

Cheese.—Cheese is a food which is also very rich in nitrogenous material because it is mostly made from the curd, that is, the solid or nitrogenous part of milk. It should always be eaten with plenty of bread or *chapatis* and water, together with fresh salad or vegetable.

Eggs.—Eggs again are a very nourishing food as they contain about as much flesh-forming and heat-giving substances as an equal weight of meat. If they are eaten raw they only take 1½ hours to digest, but if hard boiled 3½ hours, because the white or albumen is hardened and takes two hours longer for the juices of the stomach to dissolve it.

Condiments.—Black and red pepper, mace, ginger, cloves, garlic and other condiments or spices, are all very good to mix with food in small quantities, as they make it both more tasty and more wholesome, but if they are taken too strong they have a bad effect on the digestion.

Drink.—As regards drinks—the best drink for grown-up people in good health is pure filtered water—for children, either filtered water or good milk.

Spirits.—Spirits or wine, though not really necessary to health, do no harm if taken in moderation—but if taken frequently, or in excess, they cause diseases of the liver and inflammation of the mucous membrane of the stomach.

Spirits are more hurtful in a hot climate than a cold one, and those who make long marches or hunting excursions in India, will find warm tea or coffee far better and healthier to drink than any kind of spirit or wine.

Cooking.—Besides knowing what different kinds of food consist of, so that we may judge which are the best and the most nourishing to eat together for our everyday food, we must know how to cook foods properly, so as to bring out the greatest amount of nourishment.

Cooking prepares food for our stomach by softening and heating it. If we were to eat raw or cold food always, our stomachs would not be able to go on working very long, but would become weak and diseased.

Cooking starchy food.—Some foods require more cooking than others. Generally speaking all foods, such as rice, which are hard and dry and contain much starch, require a great deal of heat and moisture to make them digestible.

Influence of cooking on starch cells.—With rice, as with all other grains, and all kinds of *dhal*, the most nourishing part is enclosed in very strong, tough coverings or envelopes, which it is impossible to digest—so that unless this tough part is first broken through by cooking no good is got out of the food. And not only should the tough covering be broken through, but these starch grains should all swell out and become soft in cooking—or when we eat them the salivary glands cannot change them into sugar in the short time they are in our mouths. Yet, until starch is changed into sugar, it cannot pass into our blood, so that we get no good from it unless it is so changed. Some kinds of starchy foods take much longer to convert into sugar when eaten raw than others, but when they are all properly cooked one dissolves as soon as the other. Thus, uncooked rice, or Indian-corn starch, requires three minutes in our mouths before the starch is changed into sugar, oat starch requires six minutes, wheat starch forty minutes, and potato starch three hours. The reason is that in some, the starch granules or envelopes are much harder than others, and so take a longer time to break through, but once they are broken through by proper heat and moisture in cooking, all the starch cells alike become a kind of paste or jelly which is easily acted upon by the saliva.

Even well-cooked starchy foods should, however, always be held in the mouth long enough for the saliva to mix with them, as no amount of cooking will change the starch into sugar, and as it is also impossible for the change to take place completely in the short time we have each mouthful of food in our mouths; but if saliva is well mixed with food the change goes on after we have swallowed it.

Steaming.—The best way to cook all starchy foods is to steam, and not boil them. If we put rice for instance into water and let it boil a long while and then throw away the water and eat only the rice, we shall have done a very stupid thing, for a lot of the nitrogenous matter and all the mineral salts which are so good for us, will have escaped into the water—we shall get none of them and our dinner will be only starch and water with whatever salt we may add.

Cooking rice.—The proper way to prepare rice is to wash it thoroughly in cold water first, then to steam it till tender. If this is done the starch grains will swell out to three times their size and all the goodness will be kept inside the rice.

Cooking potatoes.—In the same way, if we want to get the most goodness out of a potato we should either steam it till it is soft, over boiling water, or boil it without taking its skin off—If the skin is left on in boiling, or if it is baked in its skin, all the mineral salts and the best of the potato remain inside. A potato boiled without its skin takes $3\frac{1}{2}$ hours to digest, whilst one baked or boiled in its skin takes only two hours. This is because the one in its skin loses none of its juices or salts—and the salts and juices all help digestion.

Boiling.—More goodness is as a rule lost in boiling than in any other way, and not only in boiling rice and starchy foods, but in boiling meat. For even where boiling is properly managed a great deal of goodness and especially the salts of different kinds of food are lost. To boil meat or any vegetable nitrogenous food, such as *dhal*, properly, the water used should first of all be boiling, and kept boiling for five or six minutes, until the outer part of the meat or *dhal* is hardened so that none of the juices or salts run out. Then it should be cooled down by putting in one or two seers of cold water to about 180° Fahr. If it is cooked in boiling water that is 212° Fahr. the whole time, all the albumen becomes hard and is less easily digested, just as the white of an egg becomes hard if boiled too long.

Roasting.—It is the same with roasting meat. It should first of all be put very close to a hot clear fire for about five minutes until all the outer skin is hardened, and then should be drawn further away where the heat will gradually go right through it, melting up the fat from the fat cells, and preparing the albumen in such a way that it can be easily dissolved by the juices of the stomach. Meat either roasted or boiled in the proper way should keep all its goodness inside, so that when it is cut the juices gush out and flow on to the dish.

Soup.—On the other hand, if soup or beef tea is being made, the great thing is to get all the juices and salts *out* of the bones, meat or fowl, and to leave only the fibres or stringy parts. The meat or bones should therefore be put into cold water with a little salt and a few vegetables in a closed vessel and allowed to heat slowly and simmer as long as possible so that all the goodness comes out.

Chapatis.—Again *chapatis* which form a part of the daily food of so many people require careful baking or they produce indigestion, wind and uncomfortable sensations, sometimes even actual pain. When *chapatis* are light and well baked so that they are blown out with air in the centre, the starch grains are all swollen out and ready to be digested, but if they are heavy and under-cooked they give the stomach a lot of work with very little nourishment.

Bread.—Bread, as European people eat it, is much more digestible than *chapatis*—and the reason is that it is leavened, that is, mixed with yeast or some ferment, whilst the other is unleavened, or without anything to ferment it.

Leavened bread.—In flour that is leavened some of the starch in it becomes changed into *glucose*, which we know is a kind of sugar—this sugar then ferments and produces carbonic acid gas which swells the bread out and makes it light and digestible.

Choosing foods.—Not only must we know the general principles of the proper cooking of food, but we must know how to choose food that is wholesome, fresh and fit to eat.

Meat.—As regards meat: all lean meat when fresh has a deep purplish-red tint with a bloom over it on the outside of the muscle and a paler vermilion red with just a shade of purple on the cut surface. Mutton lean should be quite even in colour and have no flavour of tallow—whilst beef lean may be a little marbled with fat but it must have no flavour of suet. Mutton fat should always be very white—whilst beef fat should be slightly yellow. A single joint of meat should have very little smell, nor should it waste much in cooking. Generally for all meat, a good test is to push a clean knife up to the hilt into its substance. In good fresh meat the resistance is equal, but when some parts are softer than others it is a sign that the meat is changing. The smell of the knife is also a good aid. Good meat is neither too pale nor too dark—if very dark it is probably the flesh of an animal that has died and not been purposely killed.

Fowls.—In good tender fowls and birds the feet and leg joints are large, supple and a good light colour. If a bird has a thin neck and violet thighs it is decidedly old and tough. A good way to make a fowl look nice for the table is to lay it back downwards on a flat board and press the breast in with the flat of the hand until the ribs crack slightly—this forces more meat up on to the breast.

Fish.—As regards fish—only those fish should be eaten which come from the sea, or from clear running streams. They should be eaten whilst quite fresh and should be thoroughly cooked. When fish are really fresh, their eyeballs are full, their gills a bright pink colour and the flesh when cooked is firm. When stale, the eyeballs are sunk, the colour of the gills changed and the flesh will be flabby and stringy if cooked.

Stale or half-cooked fish are most dangerous, sometimes causing diarrhœa, sometimes tapeworm and other parasites.

Eggs.—Fresh eggs are not difficult to choose, if it is remembered that fresh ones are always heavier than stale ones, and that if held up to a candle or lamp the fresh are transparent in the centre and the stale at the end.

Eggs get lighter by being kept because some of the water passes off through the shell. Very stale eggs get so light that they will float even in plain water.

Test for eggs.—A good test in choosing eggs is to dissolve ½ a chittack of common salt in a ¼ of a seer of water, and to put each egg in by turns. If good they will sink, if bad they will float.

Milk tests.—To test milk two instruments have been invented, one called a lactometer—the other a creamometer—and if people do not keep their own cows, or have any suspicion that the milk supplied them is not as good as it should be, it is a good thing to know how to use both tests.

Lactometer.—The lactometer shows the density of the milk in which it is placed by means of figures graduating from 1035 down to 1,000. If milk shows less than 1,024—one may be nearly certain water has been added, though it will vary from perhaps 1,031 downwards according to the temperature.

Cold milk	at	30°	Fahr.	will	be at	1031
,,	,,	60°	,,	,,	,,	1030
,,	,,	70°	,,	,,	,,	1029
,,	,,	80°	,,	,,	,,	1027
,,	,,	90°	,,	,,	,,	1025
,,	,,	100°	,,	,,	,,	1024

If water has been added there is a loss of 3° for every 10 per cent. of water added—that is when the milk is about 60° Fahr. This method is an easy way of testing milk but it is not perfect—so it is a good thing to test with the creamometer as well.

Creamometer.—The creamometer is a tube marked off into 100 equal parts, and to test the richness of milk, it must be filled with milk and left to stand for at least 12 hours for the cream to rise. The amount of cream varies according to the time of year and the kind of cows and the food they are having—but it should never be under $\frac{8}{100}$ ths or $\frac{10}{100}$ ths.

Good English cows will have from $\frac{30}{100}$ths to $\frac{40}{100}$ths of their milk cream—so that $\frac{8}{100}$ths or $\frac{10}{100}$ths is very low. If any milk shows less than this, and at the same time the lactometer sinks low in it, it is almost certain proof that water has been added—if on the other hand there is too little cream and the lactometer stands at 1030 or higher, it shows the milk has not been watered but skimmed.

As regards other articles of food.—

Rice.—Rice. when it is good, is whole and not broken, free from dust and dirt, and with no trace of weevils or black specks in it. It is not a food which we require to get fresh or new, but rather old and good, as it should never be eaten until it is three years old. New rice is not at all easily digested, and if eaten before it has been kept at least six months, will almost certainly cause indigestion, diarrhœa and rheumatism.

Flour.—Flour from wheat should have no smell, and be quite white or only slightly yellow—if it is very yellow or gritty it shows the starch grains are changing and that bread or *chapatis* made from it will be acid. The custom of drying wheat in heaps after it has been washed to clean it, is often the cause of acid flour, because the sun cannot dry the flour right through a big heap and the flour ferments and becomes acid. If wheat must be washed it should be spread out in small quantities and dried quickly.

When flour is good, some of it will stick, if it is thrown against a wall or board—and dough made from good flour will stick well together and draw out easily into strings. If flour has a bad or dark colour, it shows either that it is old, or that it has had other grains, such as rye, mixed with it.

Fruit and vegetables.—In choosing fruit or vegetables the best test is the touch—if fresh, they are crisp and firm but not hard, and break off clean and straight—if stale they are tough and flabby and can be bent considerably without breaking. Very soft, over-ripe fruit is unsafe to eat at any time, but especially when cholera and dysentery are about. In the same way cucumbers, salads, or other vegetables that are taken uncooked, are dangerous to eat after they have been long gathered. Every moment any fruit or vegetable is kept after it has been cut or gathered makes it less digestible, especially in a hot climate where decay so soon sets in. If fruit or vegetables are to be used for preserving for the hot weather, it is doubly necessary to gather them quite fresh and to preserve or pickle them on the spot.

Cleanliness of foods.—Good food to eat depends upon other things besides merely choosing it well, for no food however good will be wholesome, or taste nice if it is kept in dirty places, or put into dirty vessels.

Uncooked fruits or vegetables should always be well washed in clean filtered water before eating, and no fruit that has been cut open and exposed to the dirt and dust of a bazaar should ever be eaten.

Meat should always be hung up in a wire-gauze or muslin safe, where the air can get to it, but where no flies or other insects can settle on it.

Fish should be laid on a clean dish either in a wire-safe or with a thin cloth over it, for the same reason.

Milk-cans.—Milk should always be put into tin vessels or *glazed chatties.* If a *chattie* is *not* glazed, no amount of scalding with hot water will remove the grease and sediment from the milk that soaks into its surface, because it is soaking into the substance of the *chattie* all the time the milk is in it, and not only if it is left dirty. All milk-cans or *chatties,* as well as cream pans, should be scalded out thoroughly with boiling water, every day directly they are emptied. Milk will not keep sweet, nor can good butter be made from cream set to rise in pans that are not perfectly clean. Great cleanliness is necessary with everything used in making butter, whether it is a bottle or proper churn and whether it is a wooden mould or a grooved butter-spat. All of these things must be well scalded immediately they are finished with. If they are put away dirty it will take twice the time to clean them later on.

It is also just as important to keep everything clean in preparing and storing *ghee.* If *ghee* is not made and kept in clean vessels it turns rancid, and becomes unwholesome and indigestible just the same as butter.

Cleanliness in children's food.—Again, everything connected with children's food should be kept very clean. Nothing upsets a child sooner than food which is slightly sour, either through being kept too long, or through being put in dirty vessels. A baby's feeding bottle should above all be kept very clean. Two bottles are best, so that one can be laid in clean cold water whilst the other is being used.

CHAPTER VI.

PERSONAL CARE OF HEALTH—CLEANLINESS AND CARE OF THE SKIN—THE EARS—THE EYES—THE HAIR—THE TEETH—THE BOWELS—EXERCISE AND GYMNASTICS—SLEEP—CLOTHING—CHOLERA—SMALL-POX AND VACCINATION—CARE OF CHILDREN—EARLY MARRIAGES.

Personal care.—The personal care of health, that is, each person's care of their own health, is closely connected in many ways with all that has already been learned. The choice of a house, the cleanliness of its surroundings and the ventilation of its rooms, as well as the question of good water and wholesome food are all subjects which have to do with the health of all, but there are many small ways besides, in which each individual can alone regulate or preserve his or her health. These are in bathing and washing the body, in taking the proper amount of exercise and sleep, in wearing sensible clothing, and in obeying the laws of health in every way. All of these are equally important, and no one who wishes to keep in good health can afford to neglect any one of them.

Bathing.—Bathing is necessary to keep the skin healthy. The skin, as we remember, is one of the excretory organs, and it is constantly getting rid of water and acids from the blood through the millions of little sweat glands on its surface.

Cleanliness of the skin.—Now if the skin is not washed thoroughly all over every day, the little pores become clogged up with their own dirt, mixed with the dust in the air around us and the fluff off our clothes; and when this happens the perspiration cannot run out as it ought to. Wherever this is the case and the skin cannot act, not only may the skin get diseased, but extra work has to be done by the lungs and kidneys, and they often break down and get diseased too. So that it is never a wise thing to have the body dirty. Even if the skin does not get clogged, and perspiration flows away freely, as it often will, simply because a hot climate keeps the pores open—it should not be left unwashed, because the perspiration and the scales which are constantly rubbing off our skins soon begin to decay, and cause that strong disagreeable smell which dirty people always have.

Soap and warm water.—The only way to keep the skin clean and sweet-smelling is to bathe every day in clean cold or tepid water, and at least once or twice a week to soap the body all over. The best is clear, yellow soap, not any cheap scented kind, and it should be put on with a flannel or something coarse, the body well rinsed after it and then rubbed hard with rough towels. There is always a certain amount of greasy or oily matter in the perspiration, and water alone can never take this away. Soap will mix with grease and remove it, but water will not, any more than it will mix with oil, if we pour both together into a glass.

Time to bathe.—The bath should be taken every morning on first getting out of bed to wash away all the perspiration of the day and night, and make people fresh for their day's work. This is the best time, but if it is not possible to have it then, any other time must do, except just after a meal. It is bad to bathe too soon after a meal, because whilst food is being digested, a great deal of blood is wanted in the stomach and bowels—whereas if a bath is taken, the water and the rubbing both cause a rush of blood to the surface of the skin. For this reason, a bath if taken after a full meal will cause indigestion and sometimes even a fit.

Pouring water over the head from *chatties* or pots is a good way of taking a bath in-doors or out, but especially in the open air, because if a cold wind happens to be blowing at the time, the exercise in lifting and emptying the *chatties* prevents people getting a chill.

Bathing in cold weather.—Perfect cleanliness of the skin is one of the best preventives against small-pox, cholera and all other dirt diseases, so that people should bathe and keep themselves clean in hot and cold weather alike. In the cold weather in Northern India some people think it is too cold to bathe, but if they remembered that their skin never ceases throwing off perspiration and waste matters, and that the clearer their skin, the clearer is their mind, and the better their health, they would no doubt wash their skin all the year round.

Washing the ears.—The cleanliness of one's whole body of course includes the cleanliness of the ears, the eyes, the hair and the teeth; but these are very seldom properly attended to. In cleaning the ears it must be remembered that we need only wash the outer ear, because the ear itself supplies a wax which keeps the little curved passage to the inner ear clean.

The wax.—If this wax is left alone it dries up into fine little scales, and these peel off one by one and fall out without being noticed, leaving a clean surface behind them—whilst if soap and water is put in and then the end of a towel screwed up and pushed in, this wax gets squeezed down into hard little lumps, and presses on the drum of the ear, causing inflammation and often deafness. No towel or cloth of any kind should ever be pushed into a baby's or child's ear. It is quite enough to wash anyone's ears as far as the finger can reach.

The eyes.—Babies' eyes.—The care of the eyes is another most important matter. More people suffer from eye diseases in this country than in any part of the world, and it is generally because people are so careless and dirty in their habits. A baby's eyes should be attended to directly it is born—they should be washed with the greatest possible care, with a fine linen rag dipped in clean warm water and *no soap*. The eyes must be washed carefully and gently until quite clean. If they are left unwashed they may not only become inflamed so badly as to destroy the sight—but if any fluid or matter from the child's eyes touches or gets into the eye of any one else, either a child or grown-up person, they may get the same disease. Everyone's eyes should always be washed when they get up in the morning, in clean cold water without soap. If they are kept clean they will not want smearing with grease or other things.

The head and hair.—The proper way to keep the head and hair clean is to brush and comb it well every day, and to wash it with warm water and soap or *rita* every week or ten days. If the hair is allowed to get so dirty that insects make their home in it, either skin diseases are produced, or swellings form over the eyes. Vinegar is a good thing to rub into the hair and head, to get rid of these pests.

The teeth.—Cause of decay,—The teeth ought also always to be perfectly clean, as it prevents them decaying, as well as keeps the mouth and breath sweet. When we remember how important our teeth are in helping digestion by masticating our food properly, we shall see that the longer we can keep them from decaying the better our health will be. All people perhaps have not the opportunity of cleaning their teeth with a brush and good tooth-powder after every meal, but it is quite possible for every one to rinse their mouth out with clean water, and so remove all the little pieces of food which are sticking to their teeth. It is a good thing to add a little permanganate of potash to the water if it can be had. If little bits of food are left sticking between the teeth, the heat and moisture of the mouth makes them soften and ferment—then the enamel becomes discoloured, gets soft and the tooth decays.

Betel chewing.—Of course teeth decay from other causes as well, but this is one of the chief, and perfect cleanliness is the only remedy for it. If people kept their mouths clean, no doubt they would leave off the dirty habit of betel-chewing which is very bad for the teeth, and sometimes causes cancer of the mouth.

The Bowels.—Attention to the proper action of the bowels is another matter of personal care. Mind and body are both more healthy and clearer when the bowels are kept regular, and it is easy to manage this if the habit is formed to make them act at a certain time every day by persistently trying to make them act at that time.

It is difficult to explain why this is, but it is certain that the body can be trained to repeat actions periodically and almost unconsciously; after a little exercise of the will the bowels will generally act regularly, if sufficient exercise and proper food are taken.

Walking, its influence on the bowels.—Exercise, especially walking, keeps the muscles of the abdomen in good order, and helps the contractions of the intestines whilst food is being pressed through them—and proper food causes the necessary secretions to be formed to digest the food. It is chiefly when lazy habits and indigestible foods are indulged in, that the bowels get out of order.

Constipation and diet.—Opening medicines harmful.—Generally an alteration in the food will set matters right—such as taking a tumbler of cold or tepid water first thing in the morning, or eating figs, oatmeal and coarse flour, with plenty of fruit and green vegetables. But if this does not mend matters, it is better to go to a proper doctor for advice and not to take quack medicines, or get into the habit of taking opening medicines.* Most opening medicines if taken often, weaken the digestion and do harm rather than good in the long run. If opening medicine is taken however, it is better to take two weak doses two nights running, than one strong dose on a single night—but an enema of soap and water is better than medicine.

Exercise.—Still if proper exercise is taken all the different functions of the body generally go on regularly and well. Daily exercise of the whole body is a necessity for every one, men, and women and children alike, if they wish to have good health. A healthy mind in a healthy body is what we should all try to have, and only those who exercise the mind by study, and the body by using their muscles, can have this. Exercise is especially necessary for young people because it hardens their muscles and makes them grow bigger, but it is also necessary all through life, to keep the skin and the bowels and all parts of the body acting properly.

Effect of exercise on the body.—The Liver.—When exercise is taken more waste matters are poured out from the body—the heart beats quicker, and the blood flows through the lungs quicker, getting rid of more carbonic acid—we breathe more quickly, and the muscles of our chest become stronger—more blood is sent to the skin, and more perspiration got rid of—more bile is squeezed out of the liver, and more waste matters are both poured into, and got rid of by the blood in every part of us. But when people lie or sit still the greater part of the day,

* See Appendix.

the circulation of the blood in the interior of the body, and especially in the liver, becomes sluggish and weak, the heart and lungs both work slowly, and waste matters accumulate everywhere, and make people feel lazy, and unable to move about, or do anything quickly. When people feel weak, dull, or melancholy, it is far oftener because they want more exercise than because they want more food. One can never get a fire to burn well without first clearing away the waste and the ashes from the fire that has just gone out, and in the same way food cannot nourish people if the body is all choked up with waste matters from the meal before.

Various exercises.—Running, walking, and playing are all good ways of taking exercise, especially for little children, and if children are well and strong they are generally fond of playing and moving about just the same as puppies and kittens and little kids are. All young things play if left to themselves, and it is this playing which strengthens their muscles, and makes them grow larger and stronger.

Running.—Running is a good thing for older boys and girls, if they run without tiring themselves too much, and without getting too much out of breath. If they go either too far, or too fast, they may injure both their lungs and their heart, unless they practise little by little and train themselves to go farther and faster gradually.

Walking.—Swimming.—Walking and running are both excellent ways of training the heart and lungs, and so also are cricket, tennis and all such games; but the best of all exercises is swimming, wherever there is a place to practise it, as it not only strengthens the heart and lungs but nearly every muscle in the body.

Gymnastics.—Apart from games and ordinary exercises however, gymnastics are excellent to develope the body and keep it in health.

Gymnastics, that is systematic exercises beginning with easy ones, and gradually getting more difficult, not only educate the body as lessons do the mind, but they can cure it of certain diseases if properly employed. For instance, a narrow chest and stooping back can be cured, and both the heart and lungs will be the stronger for it —in the same way indigestion and biliousness are sometimes cured either by gymnastics or horse exercise. No precautions in food and drink, and no medicine, it must be remembered, can keep the liver and bowels in order without exercise.

Light and heavy gymnastics.—Now gymnastics are of two kinds, called light and heavy. Light gymnastics mean exercises done with light dumb-bells, Indian clubs, rods, balls, &c., and are suitable for girls or little boys—and heavy gymnastics are exercises on parallel and horizontal bars, pulling or lifting heavy weights, and so forth, and they are only suitable for men or for boys who have gradually worked up to them.

Object of exercise.—All exercise is good so long as it *trains*, and does not *strain* the muscles or any part of the body, and so long as it is taken before, or between meals, and never immediately after—whilst regular and sufficient exercise, with the physical discipline of the body, is one of the best things to give a healthy tone to the mind, and to make children and grown-up people recognise the necessity of law and order in daily life.

Sleep and exercise.—Sleeplessness.—It is also one of the best means of securing healthy and sound sleep. Sleeplessness is more often caused by bad digestion, or the want of being tired than anything else, and when it is from this cause it is no use taking opium or similar things. The only permanent cure is either plenty of hard physical work, or proper exercise. Sometimes people cannot sleep because they go to bed just after a heavy meal, or because they lie on their left instead of their right side, and thus press the heart instead of the liver, which is much better—or again because there is no fresh air in the room, and they are breathing the same air over and over again and so get a bad headache. No one can fall asleep until nearly all the blood in the brain has left it, so it is not a good thing to work the brain much before going to bed. Whilst any one is thinking or studying hard, the brain is very full of blood, and generally if anyone is working for an examination their head is so full of their work that they think about what they have been reading or studying after they go to bed, and that of course prevents the brain becoming calm enough for sleep. Strong tea and coffee, like small doses of opium, belladonna, or Indian hemp (*hashing, bhang*), all increase the circulation of blood in the brain, and by making it more active, prevent sleep, so that they are all bad to take just before going to bed. Night is the natural time for sleep, and those who find they cannot sleep well at night should remember this, and two things besides: Never to go to sleep in the day, and to take plenty of exercise.

Amount of sleep.—The amount of sleep every one takes, is generally a matter of chance or habit, but although children require a great deal, grown-up people are healthier and stronger if they only sleep 7 or 8 hours out of the 24. No one, unless they are ill, should allow themselves more.

Clothing.—Head and abdomen.—As regards clothing, which is another matter of purely personal care, the chief thing is to clothe the head and the abdomen well. They are the two most sensitive parts of our body. The head is most affected by heat, and the abdomen by cold and chills, and to those who want to keep strong,—sensible clothes are as important as clean clothes. Men's and boy's heads are generally enough protected by their *puggarees*, but women are often badly off, and if they go out when the sun is very hot, they should have a good thick umbrella of white cloth, pith, or leaves.

Flannel kummerbunds.—Men, women and children alike, should always wear flannel wound round their stomachs. At night it is the best thing to prevent fever, and by day it prevents chills, especially in the cold weather in Northern India, or in the monsoon, or when the seasons are changing. Flannel clothing is better than cotton, because flannel or woollen stuffs absorb the perspiration, whereas cotton soon gets wet through, and becomes cold and damp next the skin.

Changing clothes.—Of course clean clothes should never be put on unless thoroughly dry, and if anyone gets wet through, all the clothes should be changed at once. Flannel worn round the abdomen keeps the liver and kidneys especially, in good order, besides helping the skin to act better all over the body. At the same time no flannel or belt should be bound so tightly round the body as to press the lower ribs, particularly if exercise is being taken—and after exercise it is always a good thing either to change all the clothes which have become wet with perspiration during the exercise, or to put on a thick coat or wrap.

Woollen clothing.—Directly exercise is finished, the skin begins to cool down, and then if perspiration is suddenly stopped by a cold wind blowing on anyone, rheumatism, or some kind of inflammation of the lungs, or other organs, may result. During exercise we need light clothing—after exercise dry, warm and especially woollen clothing. Woollen clothing is good, not only because it absorbs perspiration, but also because it is a bad conductor of heat.

Wearing flannel or wool next the skin is most necessary in malarial places, because by preventing chills it makes people less likely to be attacked by malarial poison.

Colour.—For keeping out heat the colour and not the material is the chief thing to think about. White is the best; next grey, yellow, pink, blue; and lastly black, so that in hot countries white or light-grey clothing is the best.

Other personal precautions.—There are still a few other ways by which people can not only preserve their own health but that of others, and this is by helping to prevent the spread of all the dirt diseases in the ways already spoken of, as well as by personal precautions in the case of the two worst—Cholera and Small-pox.

Cholera.—The way in which everybody may help to stop cholera spreading, is to avoid going to a place in which there is cholera, unless absolutely obliged,—again, to avoid going to all Fairs and other crowded places,—to avoid getting over-tired, or being exposed to wet, cold, or great heat,—to be careful only to eat nourishing simple food, and drink filtered water, and to keep away from all dirty places.

Small-pox.—Vaccination.—In the same way small-pox may be stopped by taking care not to go near places where there is small-pox, and by avoiding all things which make people weak or ill; but the chief safeguard against small-pox is vaccination—a very wonderful, easy, and safe way of protecting oneself and others against it. A hundred years ago in England nearly everybody caught small-pox: a great many died, and a great many more were blinded or made hideous for life.

Inoculation.—First of all, doctors tried to protect people by inoculation, that was, by taking some of the matter from a person who was ill with small-pox, and actually rubbing it into the blood of others who were well.

This sometimes made people have small-pox more mildly, but it also often killed them as it does still in India, wherever it is done.

Vaccination.—Buffalo calves.—At last a clever man discovered that if matter was taken from a cow that had cow-pox, that is, a kind of small-pox, and passed it through the blood of people, it protected them almost completely from small-pox; whilst if they took it, they only had a very mild attack. This kind of protection, which is the one sensible people all over the world use, is called vaccination, and it is a thing everyone should see is done to all around them. Vaccination through buffalo calves is one of the best methods of getting plenty of good lymph to vaccinate numbers of people with, both in cities and scattered villages.

To really protect people from small-pox it should be done to every small baby before it is six months old—to every child after it is seven or eight years old, and again every seven years, up to 30.

Proper vaccination.—The marks.—If people are properly vaccinated they *very* seldom get small-pox, but vaccination is only thorough when there are at least three or four perfect vesicles which leave what are called the vaccination marks. If there are no marks, or only very faint marks on a child or grown up person, vaccination should be done again. Small-pox is not caused by the anger of a goddess as many people believe; it is caused by dirt and carelessness, and as soon as everybody has himself and his children properly vaccinated, and keeps his house and surroundings clean, we shall, no doubt, see it disappear as many of the most fearful diseases once known in Europe have now disappeared.

Care of Children.—Food for a baby.—Bad food for a baby.—Of course it is only possible for grown-up people to take care of their own health. Children and babies cannot do so, and yet it is just as important for them to be healthy and strong. When we think that a baby may live for sixty or seventy years we must see how unkind it is to allow it to lose its health in any way; either by giving it improper food, or shutting it up in close, badly-smelling rooms, or clothing it wrongly. Everything that has been learnt about keeping a house and its surroundings clean, about washing and bathing the skin, and having plenty of fresh air and exercise, is very important to remember wherever there is a baby. The only food a baby should have until it begins to teeth, and the saliva begins to flow, is milk. Milk, as we know, is a perfect food and has everything our body wants to make it grow and get strong—and as a matter of fact it is cruel to give a baby anything but milk or patent milk-food for the first six months, because it cannot digest any other kind of food. If it has rice, or a piece of *chapati*, or a little meat given to it, it has no saliva in its mouth to turn the starch of the rice or *chapati* into sugar—neither has its little stomach the power to break up and digest the solid part of meat. So that even if such food does not give a strong or healthy child indigestion, it simply passes out of the body without giving any nourishment.

A baby should never be allowed to eat or drink too quickly, or to suck an empty bottle, as any of these things may give it wind.

Clothing for a baby.—The eyes.—Besides having good food, a baby ought to have clean, loose clothing, a flannel band round its body, and its head protected from the heat of the sun. It should have a bath every day, and never have its eyes smeared with *ghee* or other grease, because though *ghee* may do no harm in itself, yet it attracts flies and other insects to settle on the child's eyes—and the contagion from leprosy sores, or from other children's bad eyes, as well as the contagion of other complaints may be carried in this manner.

Age to marry.—Children, as they grow up, should all be taught to take care of their own health, and girls should never be allowed to marry until they are full-grown. If they become mothers before they have stopped growing, that is between 15 or 16, at the earliest, they cannot have healthy, strong children, and their own health will become weaker as well. It would be more sensible, however, not to marry until at least 18, as they do in Europe.

Way to become a strong race.—If the people of India wish to become strong, they must all obey the laws of health, and remember that—" Prevention is better than cure."

SECTION III.

NURSING.

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NURSING.

CHAPTER I.

REQUISITES OF GOOD NURSING—CHOICE OF ROOM—BED AND BEDDING—CLEANLINESS—FURNITURE IN SICK-ROOM—VENTILATION.

We have now learnt how to do the best in every way to prevent ourselves getting ill—but unfortunately until everybody knows how to preserve their own health, and tries their utmost to do so, we shall none of us be able to escape illness entirely.

Different illnesses.—Now there are very many kinds of illnesses or diseases. There are small-pox, cholera, scarlet fever and others—called infectious diseases, because people catch them from one another,—and there are illnesses which come from taking cold, or from accidents of different kinds.

Good nursing.—All of these require good doctoring; but if the patient is to recover they also require much more, that is, they require good nursing.

Good nursing means many things—it means :—

(1). Keeping the sick-room clean and fresh, and the right temperature.

(2). Making the bed comfortably.

(3). Making poultices, fomentations and various applications.

(4). Giving the medicine and food at the proper times.

(5). Washing and dressing the patient carefully.

(6). Noticing things to tell the doctor.

(7). Using disinfectants.

(8). Doing everything generally to save the patient being uncomfortable or worried.

Choice of room.—The first thing we have to do when anyone gets ill in a house, is to choose a room for the sick person to be in, and then to take everything out of it except what is really wanted. Most people when they get ill are generally put into their own bed-room, but this is not always the best room for getting well in, and a better one may perhaps be chosen.

A good room.—The room in infectious cases.—A good room is a large one, which is not near a noisy road or servants' houses—which is quite dry, with no smell of damp about it—which has a fire-place in it,—windows, or ventilators opening out above the verandah—where there is light and coolness but no heat or glare—and where the sun will not beat on it all day long. If the patient has an infectious illness, a room as far away as possible from the rooms where the rest of the family live, is necessary; but a sick person should never be put into a room that is seldom or never used, unless all the doors and windows are first thrown open to let in the fresh air—and unless, if it is in the rainy or cold season, a fire is also lighted in it for 24 hours or more.

Cleanliness of room.—Besides this, the room must be thoroughly swept and cleaned in every corner—and if there is only one large *durrie*, that should be taken away, and two smaller ones put, one on each side of the bed.

The small *durries* can be taken out of the room every day and well shaken, but a large one with the bed standing on it cannot be cleaned at all.

The bed.—The best kind of bed for a sick person is an iron one about $3\frac{1}{2}$ feet wide with a wire mattress; but if this cannot be had, and the patient is obliged to have a native bed, let it be new, or at least very clean, and not too wide for the nurse to be able to reach across it easily. The Indian custom of having the bed in the middle of the room is a very good one, because the nurse can attend to the patient from either side, so in illness there is no need to alter this position.

Cleanliness in everything.—Cleanliness is one of the chief things in a sick-room, and therefore we must not only begin by having everything clean, but go on keeping all clean.

Bed-clothes.—The bed itself must be perfectly clean, and the sheets and blankets equally so. An old *rezai* which has been used a long while to sleep on, is a very bad thing, because it is soaked with perspiration, and cannot smell sweet and clean. If *rezais* are used, there should be two, one for the night and one for the day, so that they can be put in the sun to air by turns. But cotton sheets and new blankets are the best because they are both warm and light. Sick people generally cannot bear anything heavy on them, but they may want to be kept warm.

Airing the bed.—It is always a good plan to have a number of clean things for the bed, and to hang everything out in the sun, or, in the rains, before a fire, as often as can be—for when anyone is ill the perspiration coming from their skin is very unwholesome.

Perspiration.—Water-proof sheets.—We know that perspiration is waste matter, and that it is always passing from our skins, so if the patient is not constantly provided with clean clothes and bedding, the perspiration never really leaves his body, but soaks into all he lies on, and makes him much longer in getting well. Perspiration in the bed-clothes will make a room smell badly even if everything else is kept clean. Another thing to be careful about, as regards keeping the bed and bedding clean, is to have a sheet of waterproof under the sheet, whenever there is any discharge of blood or matter coming away from the patient.

This, if smoothly laid in the proper place, will prevent anything soaking into the bed itself. If, however, either through carelessness or accident, a part of the mattress, or the *newar* become soiled, it must be removed at once, and either a fresh mattress, or new bed put in its place, the old one not being used by anyone until thoroughly cleaned.

Discharges in illness.—It must be remembered that all discharges coming from a sick person decompose, or go bad very quickly, and if left near the patient, will either make the disease worse, or add to it another more severe and dangerous.

Still another point to pay attention to is to make the bed well, and to put the pillows comfortably.

Making the bed.—If the sheet gets 'rucked,' it is not only very uncomfortable but it may cause a bed-sore, but if it is laid on perfectly evenly and smoothly, and tucked in securely or pinned fast with safety pins, the patient can sleep and rest in comfort. Every good nurse will also see that the night-dress is pulled down smoothly and that there are no crumbs or pieces of grit either in the bed or sticking to the back of the night-dress.

Furniture of sick-room.—Neatness and tidiness again are as necessary in a sick-room as cleanliness, and for this reason it is better to have only a few pieces of furniture in the room, just those which are really needed.

(1). Two strong tables, one for putting anything on, and another close up to the bed, where the patient may be able to reach things.

(2). Two or three chairs, so that neither the doctor nor the nurse need sit on the patient's bed.

(3). *A sofa or arm-chair for the convalescent stage.*

(4). A chest-of-drawers, or *almirah.*

(5). A washstand.

The commode or bed-pan is a piece of furniture which should only be brought in when wanted and taken out directly after to be emptied. It should be washed out both with water and disinfectants, so that it is kept scrupulously clean. One with varnished or polished woodwork is the best to have, because plain wood absorbs dirt and smell.

A room with only these things in it, will, of course, look very bare, but there is no harm in adding a little decoration where the patient is fond of pretty things.

Woollen curtains.—It is not a good thing to have woollen curtains or purdahs up because they collect dust, dirt and infection, and soon get to smell dirty in a sick-room, but muslin or cotton curtains or purdahs may be put up and will make the room look nice.

Pictures.—Pictures, too, may be hung up, but flowers, if they are brought into the room, should not be left more than a few hours, and only fresh ones in fresh water should be allowed.

Ventilation.—Besides keeping the sick-room neat and tidy and clean, there is one other thing that is more important than all; and that is to keep it well ventilated, constantly full of fresh air. The air in a sick-room should be kept as fresh as the air out of doors, and if when one goes into a sick-room, one notices that it smells, or is stuffy, it shows there is not enough ventilation.

We have learnt that if there is not good ventilation the air in a room gets slowly poisoned so, in a sick-room if the air is not kept moving, it slowly poisons the poor patient who has to breathe it.

Effects of bad air on babies and their mothers.—It is this poison that kills so many Indian women and their little babies, because it is the custom when a child is born to shut the poor mother up in a room where not even a door is open, and then for lots of neighbours and friends to crowd in. Some people say when babies or their mothers die, that "Fate has killed them," but doctors know better, they know it is poisoned-air. All of those who understand the laws of health must see how cruel this custom is, and that one might as well give a mother and her baby poison to drink, as give them only poisoned air to breathe into their lungs.

The only way to get enough fresh air is always to keep at least one window wide open, never to shut it night or day—for remember, people cannot easily catch cold in bed unless they are in a thorough draught. And if there is not a window in the room, but only a door, as is often the case where Indian women live, then be sure that it is always kept open, and that people do not stand or sit in it thus blocking up the only way air can come in.

Ventilation in cold weather.—In the cold weather, especially in Northern India, it is a good thing to keep a fire burning in a sick-room if there is a fire-place or chimney for the smoke to escape by; but if there is not, a fire must on no account be lighted. Neither must a charcoal *angéti* or *ghurra* ever be allowed in a sick-room, either for poultice-making, cooking, or warmth. The fumes from charcoal are most poisonous, and very dangerous in a closed or small room.

CHAPTER II.

POULTICE MAKING—LINSEED—BREAD JACKET—BRAN AND CHARCOAL POULTICES—THE WAY TO APPLY AND REMOVE POULTICES—DRY-HEAT APPLICATIONS.

Besides keeping a sick-room in good order as regards ventilation, cleanliness, and minor details, a good nurse, as we said, ought to be able to carry out the doctor's orders as regards poultices and other applications—and to be able to make a good poultice, as well as put on fomentations and blisters properly.

In doing any of these things there is, like in everything else, a right way and a wrong way.

Use of a poultice.—A poultice is used for its heat and moisture, to check inflammation, to soothe pain, or to help in drawing out matter—and if it is properly made, it will do what is wanted—if not it will do more harm than good.

Getting things ready.—When a poultice is to be made, first get *everything* that is wanted ready—boiling water, a metal or china bowl, a spoon or a broad-bladed knife, and a piece of rag, flannel or brown paper, with the linseed, or bread, or charcoal, of which the poultice is to consist. Then warm everything before beginning. The bowl in which it is to be mixed, the spoon or knife with which it is to be stirred, and the flannel or rag in which it is to be laid, should all be made hot—really hot not just warm.

Linseed-meal poultices.—Next, if it is a linseed-meal poultice, first scald the basin with a little boiling water, throw that away, and pour in as much water as is wanted according to the size of the poultice. The water must be actually bubbling on the boil, or it will not make either a hot, or a light poultice. Directly you have poured it in, take the knife in one hand and some linseed-meal in the other, sprinkle in the meal and stir it quickly with the knife all the time, and in one direction only. When it is smooth and stiff, take it out in the lump and spread it very quickly and evenly on the rag, flannel, or paper, leaving about an inch uncovered all round.

This is turned in to make the poultice neat, directly it is finished.

If the knife sticks in spreading the poultice, dip it into boiling water, but be very quick.

A thick poultice of course keeps in heat better than a thin one, but if the patient cannot bear a heavy one, spread a thin one, and cover it outside with a layer of cotton wool.

Poultices for the lungs.—In cases of inflammation of the lungs, or any internal inflammation, the linseed may be put into a bag of flannel or calico, or better still, one made of muslin inside, and flannel or mackintosh outside.

How to prevent sticking.—But if the poultice is for a wound or sore, and the linseed is required to touch the skin, a teaspoonful of glycerine in the water is a good thing to prevent it sticking. A flannel bandage is always the best to keep the poultice in place as it retains the heat.

Directly a poultice gets the least cold it must be changed, but the new one must be ready to put on before the old is taken off.

Practice necessary.—Practice in poultice-making as in all else, is certainly necessary, for though it sounds easy enough to make, it is not so easy to turn out a really hot, well-mixed, light poultice. Still as it is a thing everyone should learn, it is quite worth while to buy some linseed and make a few poultices before tormenting some poor sick person with any that are half cold or badly made.

Jacket poultices.—How to make the bags for them.—The most difficult poultice to turn out well is a jacket poultice to cover the chest all round. Generally it is made in one long piece and tied together, but unless anyone can not only make a good poultice, but is also clever in putting it on, or in changing it quickly, the safest plan is to make it in two pieces. And for this make two large bags, one of flannel for the back, the other of oiled silk and muslin for the front. They must be large enough to meet under the patient's arms, and should have three sets of strings at the ends,—the lower two to tie together under the arms, and the upper ones to tie together over each of the shoulders.

One side of each bag should be about an inch or two longer than the other, so that it forms a flap to be turned over and tacked down when the poultice is put in. When the bags are ready, that is, each sewn together on three sides, with the strings attached, fill the flannel one with a thick hot poultice, close the flap quickly, put a piece of mackintosh under it, and place it in the bed for the patient to lie on.

Putting on jacket poultices.—Then make another poultice to fill the muslin bag, but this should be thinner as it is to lie on the chest. When both poultices are put on, the two bags are tied securely together and a thick layer of medicated wool is spread over the upper poultice, covered with a sheet of oiled silk, and lightly tacked to the lower poultice. Medicated wool and oiled silk are the best, it should be remembered for keeping in the heat of a chest poultice on account of their lightness.

Saving fatigue to patient.—The great advantage of a jacket poultice made in this way is that it saves the patient a great deal of fatigue because the lower poultice never gets cold so soon as the upper, and therefore, need only be changed every other time a fresh upper one is put on.

Bread poultices.—Bread poultices, such as are sometimes ordered for small ailments of the face, eyes or hands, are made in one or two ways.

One way is to crumble up some stale bread, pour boiling water into a well-warmed basin, stir in the crumbs as you would linseed, cover it with a plate, let it stand by the fire for a few minutes and afterwards press it, if it is too moist, before putting it on the rag. A few drops of oil or glycerine on the surface are a good thing if it is necesary to prevent it sticking.

Another way is to put some water into a small *degchie*, and just before it boils to sprinkle in some bread crumbs, stirring all the while until it is thick and firm enough to spread on the rag. Bread poultices lose their heat sooner than any other, so it is always best to cover them with cotton wool, for a hard cold poultice is worse than useless.

Bran poultices.—Bran poultices are sometimes ordered because of their lightness. They are easily made by half filling a flannel bag with bran, closing it and pouring boiling water over it. The poultice will want wringing out in a cloth afterwards so that a cloth and a piece of stick to lift the poultice with, should both be placed ready before the water is poured on.

Charcoal poultices.—For badly smelling wounds, charcoal poultices are occasionally ordered. If the place is not very tender, the powdered charcoal is either mixed with linseed and sprinkled into boiling water, or it is simply spread over the surface of an ordinary linseed poultice. But if the wound is very tender a *chittack* of bread crumbs must be soaked a few minutes in boiling water and half an ounce ($\frac{1}{4}$ *chittack*) of charcoal mixed with $\frac{8}{4}$ of a *chittack* of linseed afterwards sprinkled in and stirred until it is quite soft. A little more charcoal is powdered finely over the surface of the poultice just before putting on.

Putting poultices on.—Poultices for wounds.—Poultices for internal inflammation.—In putting any poultice on, remember always to put one edge gently down first and lay the rest gradually on. There is no good to be derived from placing a steaming poultice suddenly on to a painful sore, because in nine cases out of ten, it is so unbearable that it has to be raised—whereas if it is held near the place, and gently, but slowly put on, it is soothing and not irritating. Generally speaking, for wounds, sores, boils or carbuncles, a poultice is required with the linseed or bread actually touching the part—but where a poultice is required to relieve deep seated inflammation, or congestion in any of our internal organs, the lungs, the bowels, &c., it ought not to be applied to the naked skin—but something, such as a thick piece of flannel, which conducts heat badly, must be laid between the skin and the poultice. If this is done, a boiling-hot poultice can be laid on the flannel and the heat will only reach the skin gradually without causing any pain.

Changing poultices.—Again, in changing a poultice the greatest care is necessary. Directly it ceases to be hot, moist and soft, it must be changed, and the proper way to take a poultice off is to begin at the top and turn it in as you draw it down, so that none of the bread or linseed falls about the bed. When it is removed the part is gently sponged and covered over lightly whilst the fresh poultice is being brought.

After treatment.—Again, when no further poultice are required, a strip of flannel, spongio-piline or cotton wool should be worn over the part for a time to prevent a chill from the sudden change.

Hot bottles, Sand bags, &c.—At times heat alone without moisture is needed, and in these cases either tins, jars or bottles filled with hot water and securely corked or closed to prevent accidents, are wrapped in flannel and applied to the feet, stomach, or wherever ordered—or simply a flat tile or slate is made hot, wrapped up in a flannel and applied,—or again sand or bran is sewn up in a flannel bag or old stocking and thoroughly heated in a *degchie* or oven and then applied. These hot, dry applications are very soothing especially in rheumatism as they mould well to the shape of a joint and keep their heat a long time.

CHAPTER III.

FOMENTATIONS—MUSTARD PLASTERS—BLISTERS—LEECHES—EVAPORATING LOTIONS—APPLYING ICE—INHALATIONS.

Besides poultices, other things such as fomentations, blisters, or leeches are sometimes ordered to relieve pain and inflammation, and these again are useful and soothing if properly applied, but the reverse if carelessly managed. Good nursing consists in taking trouble about every little thing in the sick room, and especially in such things as we are now considering.

Fomentations.—To manage a fomentation properly two large pieces of coarse flannel or *puttoo* are needed, plenty of boiling water, a large tin pail or bath and a wringer.

A wringer.—A wringer is simply a strong piece of *dussootie* with a wide hem at each end through which two sticks of bamboo are passed.

Flannel for fomentations.—In making a fomentation the wringer is spread out over the bath, the flannel is doubled into a straight piece, the size required, placed on the wringer, and boiling water is poured over it until it is saturated. Next the bamboos are twisted in opposite directions until the flannel is wrung as dry as can be, and then it is carried in the wringer to be put on to the patient. It should be covered up with cotton wool like a poultice, and the wringer, &c., put ready for another fomentation. If the fomentations are required to relieve difficult breathing, they can be placed either on the throat, as for croup, or on the chest.

Sponges.—Spongio-piline, which is porous one side and waterproof on the other, is an excellent thing for this purpose, or if this cannot be had two large sponges wrung in boiling water are a good substitute, and they have the advantage of being very light.

Turpentine.—Turpentine or opium fomentations are prepared in exactly the same way as plain hot fomentations, with the addition of the oil of turpentine or laudanum sprinkled over the flannel or spongio-piline when it is ready to put on. Particular care, however, is necessary with turpentine fomentations as it is a very strong remedy, and extremely painful blisters are raised if the fomentation is not properly prepared. The proper way is to sprinkle, not pour the turpentine on to flannel which has already been scalded and after that to rinse the flannel.

To relieve irritation.—If the irritation is very great from it, a piece of lint soaked in olive or salad oil, put over the part, will give immediate relief.

Neem leaves.—A fomentation of neem leaves is often useful in sprains, &c. The best way to prepare one is to boil the leaves and pour the neem water over the flannel.

After taking a fomentation off it is very necessary to wipe the skin thoroughly dry, and then to cover up the part with some flannel or cotton wool.

Mustard plasters.—Another method of relieving inflammation quickly is by applying mustard plasters, blisters or leeches. For plasters, mustard must always be mixed with cold water until it forms a paste, and spread thinly but evenly on a piece of brown paper or rag.

Applying mustard plasters.—If the patient has a very delicate skin, a piece of tissue paper, or very thin muslin may be laid over the plaster next the skin—and if it is to be put on the throat or chest, it should be well covered with flannel or wool, to prevent the fumes from the mustard rising to the mouth or nose, and causing irritation to the lungs. Great care must be taken not to leave the plaster on a moment longer than the doctor orders.

To relieve irritation.—If it has been left on too long or the irritation to the skin lasts very long, the part should be dusted with a little flour, Fuller's earth, or violet powder. A mustard leaf has the same effect as a mustard plaster and is cleaner, more comfortable and nicer in every way, as it only requires soaking in water for a few seconds before applying. But there may not be one always at hand, so it is as well to know how to prepare an ordinary plaster.

Blisters.—Way to apply.—Fluid from blisters.—Blisters which are more slow in their effect, require very carefully putting on *exactly* in the place the doctor orders, because if a blister is *too near* to the inflamed part it may do harm instead of good by increasing the congestion. If it is a blistering fluid it must be carefully painted on with a camel's hair brush, and if it is an ordinary blister it should be warmed by holding it to the fire or round a can of hot water, and when placed where required should be kept in position by a bandage, not fastened down with diachylon plaster as that will cause very unnecessary pain when the blister is rising. To take a blister off, draw it gently towards the middle from both edges, and if the doctor has ordered the bladder beneath to be pricked, be careful as the fluid, or serum oozes out that it does not run over the skin. Either have a sponge wrung out in hot water or a clean piece of soft old linen to soak it up. Sometimes the blistered part has to be kept open with poultices, or dressed with ointment, but in all cases the doctor's directions are to be carefully attended to.

Leeches.—How to apply.—Where leeches are ordered one must first be sure they have not already been applied to anyone suffering from an infectious disease—next in applying them, the same care as with blisters is required, to place them exactly where the doctor orders, because a doctor will never order them to be put on near a vein but always over a bone. The skin where they are applied must always be washed with hot water first, then either the leech is put to the part with a pill box held over it, or a piece of blotting paper with a hole or holes pierced in it at the points where the leech is ordered may be laid on the skin, and the leech kept over this by a wine glass or tumbler. Leeches, if ordered for the inside of the mouth, must always be put into a proper leech glass whilst biting so that there is no chance of an accident such as swallowing the leech. Should the leech, however, get either into the nose, mouth, or stomach, it can be removed by very strong salt and water.

How to make leeches bite.—If there is a difficulty in making a leech bite, the skin should be smeared with a little sugar and water or warm milk, or with a little blood taken from the nurse's finger—but generally pinching the tail is enough to make them bite, or trying very gently to take the creature off again.

To remove leeches.—When enough blood has been drawn, if the leech does not drop off of its own aocord, a little salt should be sprinkled on its head and it will come off at once. Leeches must never be dragged off as their teeth may remain in the patient's skin and cause great loss of blood. In most cases pressure with the finger or with a small pad of wet lint, will be enough to stop the bleeding, but this is not always successful, and if these fail, either a piece of absorbent cotton wool, or of lint rolled into a hard cone, and bound tightly over the bite may be tried, or the place may have to be touched with caustic, though this must only be done with the doctor's orders.

Evaporating lotions.—Another way of reducing the temperature of an inflamed place is by evaporating lotions.

The lotion is generally made by adding eight parts of cold water to one part of spirits of wine, a small piece of lint or linen is then dipped in and applied to the part. The lint must be kept constantly wet without taking it off, for if it dries it does more harm than good. It is only when the lotion is evaporating, or passing off as vapour, that the inflammation is reduced.

Applying ice.—Ice to the head.—Still another way of reducing temperature is by applying ice. If it is ordered for the head, the best way is to fill a bladder or small waterproof bag, half full of ice broken into small pieces, and to mould it to the shape of the head, and afterwards fasten to the pillow with safety pins. With a restless patient, however, it could not be kept in place in this way—another plan therefore is to take a strip of calico about a yard long and eight or nine inches wide—tear the ends in half, up to within fourteen inches of the middle,—place the broad part on the top of the head over the ice bag, draw the back ends forward and fasten under the chin,—and the front ends so as to cross at the back of the neck—bringing them forward again to the forehead where they are fastened with a safety pin. Of course as soon as the ice is melted it must be replaced by more.

Ice is always best kept in a blanket, and where the water can run away from it. If it is kept in a glass or basin the water which soon collects round it makes it melt much quicker.

Inhalations.—For reducing inflammation in the throat, or in bronchitis, inhalations are often ordered. Inhalation means breathing in or inhaling steam or vapour. Sometimes hot water inhalations alone are ordered, or hot water with a teaspoonful of vinegar or some tincture added. Those who can have proper inhalers have simply to have the boiling water poured in and to breathe the steam through the tube.

Simple method.—Others who are not so well off can make a very good inhaler by pouring boiling water into a jug with a towel folded into a circular shape placed round the edge. The patient then lays his face on the towel and inhales the steam.

CHAPTER IV.

THE GIVING OF (1) FOOD, (2) MEDICINES—TAKING THE TEMPERATURE—WASHING THE PATIENT—GIVING BATHS—CONVALESCENCE—THE NURSE.

Serving and managing food.—Amongst other things which a nurse is called upon to do in a sick room, is to give food and medicines. As regards food there are several things to remember in serving and managing it, which are quite as important as good cooking and nourishing dishes, as for instance :—

To follow out the doctor's orders exactly with regard to any special diet.

To cook whatever food has been ordered as perfectly as possible—and to take care where soups or beef tea are given that there is no grease on the surface, or round the sides of the plate.

To serve everything nicely and to bring it in to the patient on a clean tray covered with a fresh white dinner napkin with everything down to the smallest spoon *perfectly* clean.

Only to put small dainty helpings of anything before a patient at one time—and directly the food is done with to take it all away.

Neither to cook, warm, or keep any food in the room.

To have separate bowls, cups and spoons for each kind of food so as to have one bowl for soup, another for milk, another for puddings—and to wash each thoroughly before using for a fresh supply.

If the patient does not eat all brought in, to take it straight away and not to bring it in again.

Not to give warmed up or stale food to sick people as it does them no good. They must have everything as nourishing and as freshly cooked as possible.

To give all kinds of food either really hot, merely warm, or really cold, according as it is ordered.

Covering food.—No matter whether the food is hot or cold to take it in to the patient with a cover on and to uncover it in the room. The patient then knows neither flies nor dust have settled on it.

If a dish is too hot, to leave it to cool a little, not to blow on it, as the patient will not fancy it afterwards.

Raising a patient.—If a patient has to be raised up to drink, to pass the hand behind the pillow so as to support both the head and shoulders. Two fingers put behind the head are no use, and swallowing is difficult where the neck is too much bent.

To have a feeding cup if possible, when the patient cannot sit up to take food.

Never to wake a patient out of sound sleep to take food unless the doctor orders it.

Never to give a patient food immediately before washing or in any other way disturbing him, but to have it ready to give afterwards, especially in cases where a patient is very weak.

In fever and severe cases to give food through the night as often as through the day, if ordered.

Wash for the mouth.—If there is an unpleasant taste in the mouth, to let the patient rinse the mouth out before taking food with some wash made by mixing a little Condy's fluid, or permanganate of potash, in some lukewarm water.

Enough to colour the water pale pink, is the right quantity.

Never to let a sick child see any other food than what it is to have, and not to let a child who is well eat anything in the room that is forbidden the other, as the sick child will probably cry and excite itself.

Medicines.—Next, as regards medicines the following things must be remembered.

To carry out the doctor's orders *exactly* and to give everything he orders at the exact time. If the time goes by and the medicine is forgotten, not to give a double dose next time,—as instead of doing good it may do great harm, when very strong drugs are being used. The best plan is to tell the doctor when he comes that one dose was forgotten and to take care that it does not happen again.

Always to shake the bottle before pouring out, and to re-cork afterwards.

To measure the quantity carefully, either in a medicine glass or spoon. A proper measure is the best as the size of spoons varies so much.

To measure in a minim glass when drop doses are ordered.

If any liniment marked "Poison" is ordered, to keep it in a separate place from medicines to be taken internally.

To give all medicine in *perfectly* clean glasses or vessels.

To have separate glasses, and separate measuring glasses for castor oil, cod liver oil, or any medicine with a strong taste.

For taking the taste of nasty medicines out of the mouth, to give a piece of hard *chapati*, dry bread or ship's biscuit to be chewed and spat out. This is far more effectual than rinsing out the mouth with water—though it is only practicable with grown up people, as children might swallow the dry biscuit and upset their digestion.

Not to awaken a patient from sleep to have medicine any more than food unless the doctor orders it.

And lastly to recollect that medicines alone cannot cure people—that careful nursing—plenty of fresh air and cleanliness in everything are wanted as well, if the patient is to recover quickly.

Temperature taking.—Another duty of the nurse is to "take" the patient's temperature for the doctor in fever cases. There is a special thermometer called a *clinical* thermometer, small enough to be put in anyone's mouth, which must be used to take temperature. To do this the thermometer must be below 98° Fahr. because the natural heat of the body is always 98·4° in health—and taking the patient's temperature helps the doctor to see how much hotter he is at different times of the day or night than he should be—and, therefore, how high the fever is. To get the thermometer down to 98° if it is higher, it must be shaken down by swinging the arm, not by knocking one hand against the other.

Care in recording temperature—In grown up people the temperature is taken by putting the thermometer either under the tongue or in the armpit. It must be kept under the armpit about five minutes to see what the temperature really is, but three minutes is enough under the tongue. In children it is better to take it either in the armpit or groin, always allowing three or five minutes. When the mercury stays at one line and goes no higher the temperature is "taken" and it must be written down at once to show to the doctor. Remember every little line on the thermometer means a great deal. If the mercury goes beyond, say 100, every little line it creeps up to means danger, and therefore, not only must 100 be written down but if it goes to the next little line above, 100·2 must be put down as that means it is two-tenths above the hundred, and if it goes to the next line it will be four-tenths or nearly half way on to 101.

Each time the temperature is taken these little half lines must be noticed very carefully as the doctor cannot tell what effect his medicine is having unless he knows exactly how the temperature varies.

Washing the patient.—Another very important duty of the nurse is to keep the patient clean—people when ill want washing as much as when they are well, if not even more. In India unfortunately many people leave off washing themselves or their friends directly they are ill—but all those who understand the action of the skin will know how foolish and harmful the custom is. People must be washed every day whilst they are ill, unless they are very, very weak and even then perhaps they can bear sponging nearly all over.

Washing refreshes them, and helps them to get well, because it keeps the skin acting. Sick people should be washed with warm water, clean soft flannel or a fine linen rag and a little good soap, and the skin thoroughly dried afterwards. Sponges are never a good thing for a sick room as they absorb dirt so quickly and cannot be cleaned easily.

Baths.—In cases where baths are specially ordered the doctor will say whether a hot, warm, tepid, or cold bath is to be given, with the temperature he wishes it—and then the nurse must try the water with a thermometer before letting the patient get in.

A Hot Bath is from	98° to 105° Fahr.
A Warm Bath is from	92° to 98°. „
A Tepid Bath is from	85° to 92°. „
A Cold Bath is from	56° to 65°. „

A patient should stay in—

A Hot bath from	10 to 15 minutes.
A Warm bath from	14 to 20 „
A Tepid bath from	14 to 20 „
A Cold Bath from	5 to 6 „

Before the bath is commenced, plenty of warm clean towels should always be put ready to rub the patient dry with, and all the necessary clean linen should be well aired and ready to put on in the order they are wanted.

Convalescence, care in.—When patients are getting well, that is, are convalescent, a good nurse will still be careful about many small matters, as for instance, that the patient does not catch cold, that many visitors do not crowd in, or talk too much, and that the patient has enough variety without fatigue.

Clothing.—Dangers after special diseases.—A convalescent should always be clothed in thin or thick flannel or woollen stuffs according to the time of year. This prevents chills which are very dangerous to people recovering from any chest diseases, or from rheumatic fever, measles, diphtheria or scarlet fever—in fact, after scarlet fever, measles or small-pox, even a slight chill may cause other diseases which if they do not actually kill the patient, may leave him an invalid or delicate in many ways for life. Whilst as regards rheumatic fever, patients perspire so profusely, both during and after the illness that they should always not only wear flannel, but also sleep only in blankets. This would prevent heart disease in many cases, because flannel and blankets absorb perspiration. Still they must always be changed, or washed frequently, or they will soon smell.

When anyone is convalescent from any disease in which the stomach and bowels have been affected, great care must be taken with regard to the dieting so that only such foods as the doctor orders are given.

Hunger, in convalescence.—Hunger is the first and a very good sign of convalescence, but it is no use giving too much food at first because the organs of digestion are all very weak and cannot digest much.

Dangers after typhoid fever.—This is especially necessary to remember after typhoid fever, when meat given too early may kill the patient. In typhoid fever, ulcers are formed on one part of the small intestines called Peyer's Patches, and if meat, or too hard food is given before these ulcers are healed, the wall of the intestine may break at the place where the ulcer has eaten into it and so the food find its way into the Peritoneum and cause inflammation and death.

These ulcers may even break by a patient merely raising himself up in bed –so that perfect rest and soft digestible foods are very necessary for anyone recovering from typhoid fever. Amongst soft digestible foods, however, no fruits, especially those which have pips or stones, like grapes or plums, must be included, after typhoid fever.

All convalescents, as they have a great deal of strength to make up, should eat little and often, masticate their food well, and eat those foods which agree best with their stomachs.

Getting up after illness.—The getting up after any severe illness should be very gradual as a patient may have a bad fall by trusting to his own strength and getting out of bed alone too soon.

A good nurse.—And now a few words in conclusion as regards the nurse. A good nurse will always be careful to keep constant control over her face and tongue—never to let the patient see by her face that he is dangerously ill—not to speak loudly but at the same time not to whisper in a sick room—to speak in a cheerful tone—to move about quietly and not to upset things constantly—to be patient and not to hurry either in washing a sick person, or in taking away eatables when done with—to be sympathetic, but firm as regards carrying out the doctor's orders—to notice what effect medicines have or whether there are any new symptoms to tell the doctor—to look after her own health and to take at least seven hours for sleep, as well as not less than half an hour's brisk exercise twice a day—to wash herself thoroughly all over every day with soap and water—to put on clean clothes throughout frequently and, if possible, only to wear dresses that will wash.

Lastly, in all things to remember "to do as she would be done by."

CHAPTER V.

INFECTIOUS DISEASES—ORIGIN AND SPREAD OF INFECTIOUS DISEASES—PRECAUTIONS DURING ILLNESS—DISINFECTION AFTER ILLNESS—OF ROOM—BEDDING—CLOTHING—THE BEST DISINFECTANTS—TABLE OF TIMES OF INCUBATION AND INFECTION—CONSUMPTION AND FOUL AIR—CONSUMPTIVE ANIMALS UNFIT FOR FOOD—LEPROSY.

Character of infectious diseases.—Origin of these diseases.—Infectious diseases which are quite unlike all ordinary complaints because they spread from one person to another, require not only careful nursing as regards the patient, but special precautions to prevent them spreading. It is said that these diseases did not always exist in the world, and it is supposed they began about the 5th century, at a time when all the world left off using the great baths which the Greeks and Romans had always loved and which they introduced wherever they conquered. There were no such diseases as cholera, small-pox, typhoid fever, scarlet fever, typhus fever, diphtheria, measles, mumps, whooping cough, or even chicken-pox known, until people forgot the prophet Elijah's command, "Wash and be clean," and crowded together in cities. In dirt and darkness these horrible diseases began and grew, and it was not until people began to keep themselves and their houses and streets clean that some of the most fearful kinds of infectious diseases disappeared. There are some, such as the Black Death, and the Great Plague, that we seldom or never hear of now, but we have not yet got rid of all those that are mentioned, and we never shall until everyone learns how to keep themselves and everything around them clean.

That is the chief thing. The next, whilst we have these diseases amongst us, is to take precautions against their spreading. If every single person who was ill was properly taken care of and not allowed to go near other people until the doctor said they might, we should do a great deal to stamp out these diseases; but then *everyone* must help.

Mode of spreading.—First of all we must know that these diseases spread in different ways. Cholera and Typhoid fever travel from one person to another by means of the *excreta*, either through the air, through water, or through things which are infected. All the others are caught either by actually touching the sick person or going so close as to breathe their breath or by touching, or wearing things that have been in the room.

Next, we must remember that the same precautions (with but small exceptions in the case of typhoid fever), help to prevent the spread of all these diseases.

Precautions to prevent spreading.—These precautions which everyone should take directly an infectious complaint breaks out in a house, are:—

If the house is small or the people are not well off, enquire if a bed can be had in a public Hospital.

If the patient is to be nursed at home, make the top room in the house the sick room, and remove all durries, curtains, and everything that is not wanted in the way of furniture or clothes.

Do not allow anyone but the doctor and nurse to go near the sick person. If more help is necessary choose servants, who, if possible, have already had the disease.

Do not allow such servants to mix with the others, or to go to the bazaar, or in any way to mix with others until the illness is over and their clothes have been disinfected.

The nurse or anyone else attending the patient to wear cotton or washing dresses, and to put clean ones on very often.

If there are children, or many people in the same house, try to get some relatives or friends to have them till the illness is over.

If children have to live in the same house, keep them away from school and apart from all other children.

Allow no visitors at all in the sick room.

Keep the room well ventilated, let plenty of fresh air in, as that is the best and cheapest disinfectant. If there is a chimney in the room keep a fire always burning, as that draws a lot of the foul air away. And remember that ventilation is doubly necessary in a sick room because the patient is always in it, night and day. A good plan is to keep two upper windows opposite each other always open, and at least once or twice a day ; if it is cold weather, to cover the patient well up, and throw all doors and windows open so as thoroughly to change the air.

Cut the sick room off from all the other rooms by hanging up a thick cotton sheet, wetted with some good disinfectant. A disinfectant is something that kills fever germs.

Sprinkle a disinfectant that has no smell on the floors, and put some about in saucers, only do not use one that smells strongly, or you will not be able to tell whether the room is stuffy or not.

In diphtheria or whooping cough put a disinfectant into the basin the patient uses to spit into.

Always put disinfectants into the commode, or chamber, before it is used, as well as directly after it is used. Have it taken away to be emptied at once, and the commode, or chamber again washed out with disinfectant.

All excreta from infectious patients should be at once mixed with dry earth and buried in special trenches as far as possible from houses or water.

Give the patient small squares of soft muslin or old linen to use instead of handkerchiefs, and burn them directly they are used.

Give the patient old linen to wear, if possible, and burn it all when it is dirty.

Never send sheets or clothes to the *dhobie* unless they have been soaked in disinfectant.

Keep some cups and saucers, plates, dishes, knives, forks, spoons, glasses, &c., specially for the sick room, and always wash them in disinfectant each time after they are used.

Lastly, do not allow the patient to travel by rail, or dâk gâri until the doctor says the danger of infection is past. After the illness is over, the sick-room and everything in it must be thoroughly disinfected.

Disinfection after illness.—The room and clothes.—To do this hang up all clothes and the bedding in the room well spread out. Put some sulphur—1 ℔. or ½ a seer for every thousand cubic feet of space is the right quantity—into an iron pan or *gumla* resting over a bucket of water in the middle of the room, or if it is a large room, in pans in two or three places in the room ; next shut all doors and windows, and if there are gaps paste paper over them so that no air can get in or out. When all is ready put a few pieces of burning charcoal in between the sulphur on each pan, and directly it is lighted, shut the door you go out by and paste that over outside down the opening with paper—leave the sulphur to burn and keep the room shut up for 24 hours. The next day open all the doors and windows, and have them open as long as possible. Let the upper windows be open all night, and put all the clothing or bedding out in the sun all day.

Washing clothes.—Whatever clothes can be washed must then be sent to the *dhobie,* and when they are turned out, the floor, all the doors, and all the furniture must be scrubbed with chloralum, or some other disinfectant, putting 2 chittacks into every 4 seers of hot water.

Scraping walls.—If the floor and walls are mud they must be scraped and then washed with fresh clay water.

Burning things after Cholera and Small-pox.—After cholera or small-pox it is safer to burn everything, even the bed and bedding, as, if it is not thoroughly disinfected people may catch either disease from it years afterwards—but with the other diseases it is generally quite enough to disinfect clothes, bedding, and everything else from the room if it is thoroughly and carefully done.

Disinfectants.—Now what are the best disinfectants?

Sulphur.—Sulphur is, as we have said, the best for burning in a room after illness.

Condy's fluid.—Condy's fluid, which should be made sufficiently strong to form a pink colour, by mixing about a teaspoonful of permanganate of potash with eight seers of water, does not smell, and is excellent to sprinkle on the floor, or stand in basins in the room. It is also the best thing to put into water for washing the patient or in which the nurse washes her hands. It can be used quite safely, either for the skin of the face or the hair.

Chloralum.—Chloralum also has no smell, is very cheap, and may be used for washing plates, cups or saucers in, or for anything that Condy's fluid is used for. This or Condy's fluid is the best for soaking purdahs or sheets hung up at doors.

Carbolic acid.—Carbolic acid has a very strong smell, and is very irritating to some people, so it is best only to use it for clothing or things out of the room. Either this or the first two are excellent to put in the water in which clothes or sheets are being soaked before sending to the *dhobie.*

Green copperas.—Green Copperas, or Sulphate of Iron, is the best for disinfecting commodes and bed-pans both before and after use.

Terebene.—Terebene is a good disinfectant for those who can obtain it, and either Terebene or Carbolic Soap are good for the patient to wash with, both during and after the illness.

Table of illness.—Incubation and eruption.—The following table will be found useful for knowing how long each illness takes in coming out after the patient has "caught" it, and also how long the infection of each lasts:—

Disease.	From catching to beginning of Eruption generally	Beginning of Eruption to the end of the Infection.
Small-Pox	13 days	56 days.
Modified-Pox	13 ,,	35 ,,
Chicken-Pox	13 ,,	17 ,,
Measles	14 ,,	27 ,,
German measles	14 ,,	14 ,,
Scarlatina	4 ,,	49 ,,
Diphtheria	5 ,,	28 ,,
Typhus fever	19 ,,	21 ,,
Typhoid fever	21 ,,	28 ,,
Mumps	18 ,,	21 ,,

Before leaving the consideration of Infectious Diseases we must add a little about two other diseases commonly supposed to be catching, *viz.*, consumption and leprosy. They are both of them as much dirt diseases as any of the others, but they are unlike any of them, because they do not run a course of two or three weeks and then disappear, but unfortunately they generally last for life.

Consumption.—Consumption, which is a wasting of the Lungs comes from breathing impure air in dirty, close rooms; breathing it in so often that the little air cells become poisoned and diseased. Thirty years ago it killed nearly *eight* out of every thousand of our English soldiers every year.

Its decrease in England.—*Now* it kills barely *three* out of the same number. And the reason is that they have had bigger barracks with better ventilation, so that asleep or awake each man has the proper amount of fresh air his lungs require.

Now consumption may be caught by living or sleeping in the same room with a consumptive person, and thus breathing the same air, that is, air which is infected by the spittle and other organic matters coming from the consumptive person's lungs. It is most important always to take care that this spittle is got rid of properly so that it may not be dangerous.

Precautions in consumption.—The proper way is for a consumptive patient to have a special bowl or basin to spit into, and special handkerchiefs to use. The spittle should afterwards be emptied on to burning charcoal and the handkerchiefs burnt. If a consumptive person spits on the floor of the room, or on the ground anywhere near the house, he may not only give the disease to other people but fowls or other animals may get it, and if we eat those animals as food we may get it through them.

Consumption in animals.—Animals, it must be remembered, get consumption the same as we do from living in close stables or houses, so that we should give them plenty of fresh air if we wish to keep them well. Cows are specially subject to consumption, and if it is known they are suffering from it, it is most dangerous either to drink their milk, or eat their flesh.

With this disease, as with so many others, cleanliness is the best remedy, not only to help cure those who are ill, but to prevent those who are well from getting the disease.

Plenty of fresh air and dry houses to live in will do a great deal to stamp out consumption even in those who are born of consumptive parents.

Leprosy.—Leprosy, which is one of the most horrible diseases, and which is supposed by many people to be contagious, used to be a much more common disease all over the world than it is now. It was once a very common disease in England, but now there is scarcely a leper to be found because people have become cleaner, they have obeyed the laws of health and they have drained or cultivated the land. Leprosy is now found mostly amongst people who have dirty habits and are careless about keeping themselves clean, or disposing properly of their refuse, or who neglect to drain their land. Clean villages, clean habits, good water to drink, fresh air to breathe, good food with plenty of salt to eat, and good drainage all round, will help to stamp out Leprosy in India as it did before in England, if only everybody will help.

CHAPTER VI.

SICK ROOM RECIPES—DRINKS—NUTRITIOUS DISHES.

The following recipes may be found useful in the sick room.

(1) Drinks :—

Rice Water.—Wash one chittack of rice in cold water, boil for an hour, strain and sweeten. For an acidulated drink add the juice of one lemon. For a plain drink add cinnamon.

Barley Water, thin.—One chittack of well washed barley, a little lemon peel and sugar. Pour half a seer of boiling water on. Cool and strain.

Barley Water, thick.—To make it thick put the same quantities into an enamelled saucepan and boil for two hours. Strain into a jug containing lemon-peel and sugar. Add lemon juice to either drink especially in fever cases.

Oatmeal Water.—Boil two chittacks of oatmeal in two or three seers of water and add ½ chittack of sugar. If it is too thick add more water according to taste. Pour off the fluid and add lemon juice.

Lemonade.—Put the peel of a lemon cut very thin into a jug with ½ chittack of sugar. Squeeze the juice on to it and add half a pint of cold water, or if preferred a bottle of soda water.

Orangeade.—The juice of three or four oranges and one lemon with a little sugar added to a seer of cold water.

Toast Water.—A crust of bread toasted brown (not burnt) add two or three cloves. Pour cold water on it, stand for half an hour. This mixes well with.

Apple Water.—Put three roasted apples into a jug with lemon peel and sugar, add ½ a seer of boiling water.

Linseed Tea.—Pour a seer of boiling water on to 3 tablespoonfuls of linseed in a teapot or jug, cover it and let it stand for a ¼ of an hour to draw. Strain it and sweeten with honey or sugar.

Bran Tea is made in the same way.

Sage Tea.—Pour one seer of boiling water on ¼ of a chittack of green sage leaves (if *dried*, less is needed)—a little sugar and the rind of a lemon. Let it stand near the fire for half an hour, then strain.

Baël Drink.—One or two tablespoonfuls of the liquid extract of Baël fruit—or rather more of the fresh pulp, to half a seer of water, and sweetened to taste.

Cooling drink in fevers.—One teaspoon of cream of tartar, a lemon sliced, two tablespoons of sugar, and one seer of boiling water or barley water. Leave till cold—then use.

Milk and Soda Water.—One tea cupful of milk heated till it nearly boils. Put a teaspoonful of sugar with the milk into a large tumbler and add half or more of a bottle of soda water.

(2) Nutritious dishes :—

Beef Tea.—Take ½ seer of fine juicy steak—cut it up finely, removing all gristle and fat—put it in a stone or earthenware jar (not any metal *degchie*) with ½ seer of water ; place the lid on the jar and tie paper over it. Let it soak for an hour, then place it near the fire for three hours, and half an hour in an oven or standing in a *degchie* of boiling water. When cold, skim and heat up as required. Good beef tea should never be boiled, neither should it set into a jelly—therefore no bones or gristle should be put in as the *juice* of the meat and not gelatine is wanted.

Beef Tea when wanted quickly.—Half a seer of beef finely chopped—with all fat, &c., removed—half a seer of cold water. Bring it quickly to the boil and boil for five minutes.

Mutton Broth.—Half a *seer* of lean meat, without bone, to half a seer of water. Boil gently till very tender, putting a little salt and onion to flavour. Pour the broth into a clean basin, and when cold skim off the fat. Warm as wanted. If barley or rice are added, they may either be boiled separately till soft, and added when the broth is warmed for use, or cooked with it.

Chicken Soup.—Mince a small tender chicken, bones and all—put it in a jar just covered with cold water and stand for two hours. Then close the lid on with *atta* and bake or boil for an hour. This should give very strong good soup. Mutton or beef soup can be made in the same way.

Egg Soup.—The yolks of two eggs beaten up together over a slow fire, with half a *seer* of water added gradually, a small lump of butter and a little sugar. When it begins to boil, pour it from the *degchie* to a jug, and from the jug to the *degchie* till it becomes quite smooth and frothy.

Almond Soup.—(Very nourishing). Put two *chittacks* of washed rice into a *degchie* with $\frac{3}{4}$ of a *seer* of milk, a little salt and sugar—and simmer over a slow fire for an hour. Then add two *chittacks* of sweet almonds and four or five bitter almonds, peeled, and blanched, and pounded in a mortar with a $\frac{1}{4}$ of a *seer* of milk added during the pounding. Add half a *seer* more milk when they are pounded smooth, and strain. Heat this mixture, stirring it all the time, but do not let it come to the boil, and when hot, pour it over the rice to serve.

Rice Gruel.—(In diarrhœa).—Boil one *chittack* of ground rice in two *seers* of water with a little cinnamon for forty minutes. Some people like this with a tablespoonful of orange marmalade added.

Gruel.—Gruel may be made with milk and water mixed, or either alone. Put two tablespoonfuls of oatmeal in a *degchie* well mixed with a little water—then add half a *seer* of milk or water and let it boil gently for an hour, stirring it often. Flavour with sugar or salt. When nourishing gruel is required, milk and hot water should be used.

N. B.—It must be remembered, patients cannot live on beef tea, soups or drinks alone. The soup recipes here given are for the most part stimulating. To obtain nourishment as well as stimulant, starchy foods, such as rice, sago, tapioca, or barley should be simmered with the beef tea or soup for four or five hours and then strained. Beef tea alone is practically only a stimulant.

SECTION IV.

ACCIDENTS & EMERGENCIES.

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CHAPTER I.

FIRST AID—BLEEDING OF DIFFERENT KINDS—WAY TO STOP BLEEDING IN THE DIFFERENT PARTS OF THE BODY—TRIANGULAR BANDAGES—WAY TO FIX BANDAGES IN DIFFERENT PARTS—ROLLER BANDAGES.

First aid.—In daily life we are sometimes called upon to help people who have met with accidents or are taken suddenly ill. Everyone ought, therefore, to know what to do in such cases before the doctor arrives, as lives may often be saved by injured people being attended to directly they are hurt. They may have only a small cut or a slight sprain, but they may also have a bad wound which if not attended to on the spot may cause them to bleed to death; or a broken bone which perhaps if not protected from further injury at once may leave any one a cripple for life.

Now whether it is a small cut or large wound, the first thing to do is to stop the bleeding.

To stop bleeding.—To stop bleeding in all cases, except where it is very slight, four things must first be done:—

1. Place the person lying down and raise the part which is bleeding on a cushion or something rolled up to support it.

2. Press the wound with the thumb or fingers until you have found something to bind it with.

3. Wash the wound with cold water to remove any dirt.

4. See whether the bleeding is from an artery, vein or only the surface.

There are three kinds of bleeding, and it is not difficult to find out which kind it is if we remember that,—

1. *From arteries* the blood spurts out and is bright red.

2. *From veins*, the blood flows slowly and evenly and is of a purplish colour.

3. *From very small vessels and capillaries* the blood oozes out, that is, it flows slowly.

To stop bleeding from arteries, tie a hard pad tightly above the wound on the side nearest the heart so as to press the main artery against the bone, and then tie another over the wound.

FIG. 5.

To make a pad and bandage in one, take a three-cornered piece of cotton cloth, tie a knot in the centre (Fig. 5) with something hard, such as a stone, a rupee or pice, or anything handy, pushed into the knot, and place the knot exactly on the wound before tying the ends of the bandage. To tighten the bandage, make a "tourniquet," Fig. 5*a*,

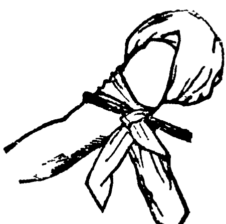

FIG. 5*a*.

by pushing a pencil or piece of wood under the bandage knot and turning it round as tightly as possible before fixing it.

Bleeding from veins is stopped in the same way, but the first pad must be tied *below* the wound or furthest from the heart. It is easy to remember these two ways of stopping bleeding when we think that as the blood in arteries is flowing from the heart it must be stopped coming from the side nearest the heart, and that as the blood in veins is going to the heart, it must be stopped coming from the side furthest from the heart.

Bleeding from very small vessels, is stopped by cold water bandages, or an ice bandage, or by bathing with very hot water. The two extremes, very hot and very cold water, have the same effect in stopping bleeding.

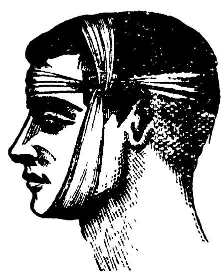

FIG. 6

The different parts of the body cannot of course all be bandaged alike and some are much easier to bind up than others.

To stop Bleeding from—

1. *The Head.*—Fig. 6, put a thick pad over the wound and place two bandages over it, one round the head, the other under the chin and over the head.

2. *The Neck*—Fig. 7, one cannot bandage at all, but only press with the fingers over the wound and the large vessels above and below it, pressing backwards against the spine.

FIG. 7.

3. *The Armpit.*—Press a firm large pad under the arm on the wound and bind the arm down to the side. If the bleeding does not stop, press with the thumb on the artery which can be felt at the root of the neck behind the inner bend of the collar bone.

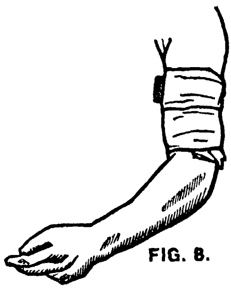

FIG. 8.

FIG. 9.

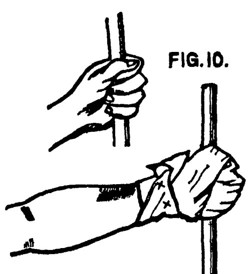

FIG. 10.

4. *The Arm above the Elbow*, Fig. 8.—Tie a pad on the wound and another above, on the inner side of the arm—that is on the line where the coat seam passes down.

5. **The arm below the elbow**, Fig. 9.—Put a pad in the hollow of the bend of the elbow, bend the lower against the upper part of the arm and bandage together.

6. *The Hand*, Fig. 10. Put a firm pad or piece of smooth wood on the wound, close the fingers on it, tie a bandage round the fist, and put the arm and hand in a broad sling. If the bleeding is very much, tie two pads firmly over the arteries or pulse at each side of the wrist.

7. *The Thigh*—Put one pad on the wound, and a second above on the inner side of the thigh—bandage both lightly using a tourniquet, and if necessary, press the artery with the finger knuckles in the middle of the fold of the groin.

8. *Back of the Knee Joint.*—Pad and bandage over the wound and again above, using a tourniquet.

9. *The Leg.*—Pad and bandage over the wound and above, and press on the artery at the back of the knee joint. If that is not sufficient to stop the bleeding put a pad in the hollow under the knee, double the leg back against the thigh and bandage tightly as in the arm.

10. *The Foot.*—Pad and bandage the wound and bind pads behind the inner and outer ankle bones. Put another pad and bandage on the middle of the front of the ankle if necessary, and if this fails put a pad under the knee, bend the leg back and tie it to the thigh.

11. *The Chest* or any part of the *Abdomen.*—Place the patient lying down on the wounded side, with the knees drawn up, apply cold water or ice to the chest, and give ice to swallow frequently, but no wine or stimulants.

12. *The Nose.*—Raise the arms, apply cold water or ice to the nose and forehead. If this fails put some cotton wool soaked in alum and water (five grains to an ounce of water) up the nostrils, or let a little alum powder be sniffed up.

Triangular bandages.—The best kind of bandage for any part of the body is the "triangular" bandage. A piece of calico, forty inches square, if cut cross-wise from one point to the other, will make two of these three-cornered or triangular bandages.

The longest side of the bandage is called the "lower border," and the point opposite it is called the "point."

When a broad bandage is needed the point is brought down to the lower border and the bandage then folded *in two.*

When a narrow one is wanted the point is brought

FIG. 11.

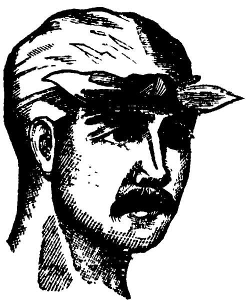

FIG. 12.

FIG. 13.

down to the lower border and the bandage then folded *in three.*

Bandages should always be fastened either by sewing, by a safety pin, or by a reef knot, Fig. 11, which cannot slip.

Triangular bandages, although all made alike, are folded and placed in several ways according to the shape of the part they are intended for.

For the head, Figs. 12, 13, —Fold a hem about 1½ inches wide along the lower border, put the bandage on with the hem on the forehead, close down to the eyebrows, the point hanging down at the back of the neck. Take the two ends round the head *above* the ears, cross them at the back, bring them forward and tie on the forehead. Then draw the point gently down, turn it up smoothly over the hem and pin it to the bandage.

For the Shoulder, Fig. 14 — Fold a hem as before, place the centre of the bandage on the shoulder with the point upwards, on the neck, and tie the ends round the middle of the arm. Take a second bandage, folded as a broad bandage and make a sling for

FIG, 14.

the arm, by putting one end over each shoulder and tying at the back of the neck. The point of the first bandage is under the sling and is drawn tightly down and pinned into place when the rest is finished.

FIG. 15.

For the Hip, Fig. 15.—Tie a narrow bandage round the body above the hip bones, take a second bandage with a hem folded, and place its centre over the wound, tie the hem round the thigh, pull the point through the narrow bandage, turn it back and pin it down.

For the chest or back, Figs. 16, 17.—Put the centre of the bandage over the wound, the point over the shoulder, the ends round the body. Tie the ends together first and then tie the point to one of them.

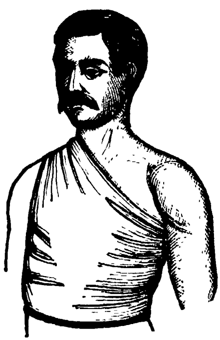

FIG. 16.

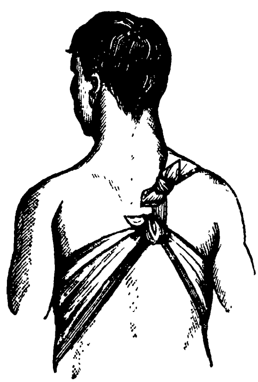

FIG. 17.

For the Arm, Fig. 18.—Use either a broad bandage passing over each shoulder and fastened at the back, or where more support is required, spread out a bandage, put the arm in the centre, with the point beyond and behind the elbow, tie the ends over the shoulder, bring the point forward and pin the bandage.

FIG. 18.

For the Hand.—Place the hand on the broad end of an unfolded bandage with the fingers towards the point, fold the point back over the wrist, pass the two ends round the wrist, cross and tie them.

For the Foot, Fig. 19.—Put the foot on the centre of an unfolded bandage, the toe towards the point, draw the point over the instep, bring the ends forward, cross and tie them either round the ankle or on the sole, if a splint is to be kept on.

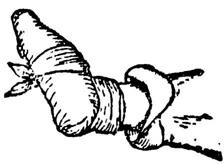

FIG. 19.

For any part of the body which is *round*, such as the forehead, arm, leg, &c., use a narrow bandage, place its centre on the wound, carry the ends round the limb, and tie over the wound itself.

N. B.—Those who wish to study the art of bandaging further, can obtain a triangular bandage with figures illustrating the different modes of applying it, from the St. John's Ambulance Association, London, at a small cost.

Although triangular bandages can be applied to any part of the body, still there are some cases, as for instance, in bandaging on splints, when it is better and more convenient to have a roller bandage.

Roller bandages.—Roller bandages are generally made of unbleached calico, flannel or linen, and they are required of different lengths and widths according to the part they are for.

Widths of bandages.—The most convenient are shown in the following table—

For	*Width*	*Length.*
Finger bandages	$\frac{3}{4}$ inch	1 yard.
Arm ,,	$2\frac{1}{2}$ inches	3 to 6 yards.
Leg ,,	3 ,,	6 to 8 ,,
Chest ,,	4 to 5 ,,	8 to 12 ,,
Head ,,	$2\frac{1}{2}$,,	4 to 6 ,,

Rolling a bandage.—When the bandage is torn the required width and length it has to be carefully rolled in order to apply properly. To do this, roll one end of the bandage two or three times as firmly as possible to make a beginning, then take this little roll in the fingers of both hands with both thumbs on the top of it; ask another person to hold the other part of the bandage fairly stretched and then commence rolling it up quite smoothly and tightly, so that there is not the smallest crease in the whole length. If it is not wanted at once put a stitch or a pin in to prevent it unrolling.

General rules.—There are some rules which must be remembered in putting on all roller bandages, as when first applying to leave the end a little long so that when the first turn is made this end is turned back and the bandage (Fig. 20) comes over it again, thus keeping it firm and preventing it from slipping.

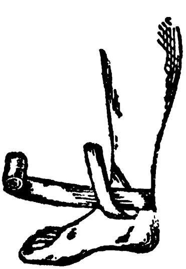

FIG. 20.

Again, always to bandage from within outwards; to commence bandaging from below and work upwards; to take care that the pressure is evenly and uniformly applied, but neither too much nor too little; to avoid all wrinkles in the bandage; in reversing or turning a bandage over, never to do so over the sharp edge of a bone, but always on the fleshy side; lastly, in fastening a bandage to stitch it or to pin it with a safety pin.

These rules hold good for all three ways of applying a roller bandage, either the simple spiral, the reverse spiral, or the figure of 8 bandage.

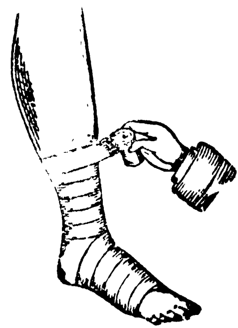

FIG. 21.

1. *The simple spiral*, Fig. 21, is applied by binding in spiral turns, each turn overlapping the under one about two-thirds of its width. This often slips out of place, so it is not as good as the reverse spiral.

2. *Reverse spiral*, Fig. 22, is put on like the first except that the bandage is turned back upon itself each time it is bound round the limb. This is done by placing the first finger of the empty hand upon the bandage at the part where the turn is to be begun, whilst the other hand turns the bandage back upon itself.

FIG. 22.

3. *The figure of 8 bandage* is the best one for joints, and is always used for the ankle joint or in bandaging

from the foot up the leg. The bandage is made to form a regular figure of 8 by carrying it over the upper part of the joint, then down, under, and across the lower part and then up over the upper part again.

Practise bandaging.—None of these bandages are very easy to put on the first time, so all who really wish to be able to give help and comfort to injured people, should practise bandaging on a friend until they can do it quickly and well.

CHAPTER II.

FRACTURED BONES—WAY TO TELL A FRACTURE—SPLINTS: TEMPORARY AND PROPER—WAY TO TREAT AND BANDAGE FRACTURES OF DIFFERENT BONES—DISLOCATIONS—SPRAINS—CARRYING INJURED PEOPLE.

When a bone is broken, or fractured, the person should never be moved until the part has been bound up with a splint so as to prevent the broken bone moving.

How to tell a fracture.—One can be nearly sure a bone is broken if any or all of these signs are noticed:—

1. If the limb or part is powerless.
2. If it is painful and swollen.
3. If when it is moved gently one hears or feels a grating noise, caused by the ends of the broken bone scraping against each other.
4. If the shape is altered, and the limb is in an unnatural position.
5. If it is shortened.

To be able to help anyone who has broken a bone, until a doctor can set it, one must know how to fix on splints and bandages on all parts of the body.

Splints.—A Splint is a piece of wood padded to make it soft on one side, and for the leg or lower arm is always longer than the *limb* itself. Splints can be made of anything handy at the time of the accident—a bamboo cane—a sunshade—a long thick roll of paper, a bough of a tree, or anything that is firm enough and long enough.

Temporary splints.—An excellent pair of temporary padded splints may be made by folding a shawl, or any kind of *chadar*, to a suitable size, wrapping a piece of wood in each end, and rolling the ends towards each other until they almost meet. The broken limb is then placed between the rolls resting on the centre of the shawl, and a couple of handkerchiefs or a bandage tied round to keep them in place.

There are four kinds of broken bones where no splints can be used, those of the head, the ribs, the jaw, and the collar bone.

The best thing to do for—

1. *A Broken Skull* is to put the patient lying down on a bed, in a dark room, with the head slightly raised, and a rag dipped in cold or iced water over the forehead and head.

FIG. 23.

2. *A Broken Jaw*, Fig. 23.—To put the jaw gently into its proper position and apply a narrow triangular bandage round the jaw and over the head.

FIG. 24.

3. *A Broken Collar Bone*, Fig. 24—To put a pad in the armpit, raise the lower arm gently and put it in a large sling, then take a broad bandage and tie the arm to the side with it as near the elbow as possible. The broad bandage must pass round the arm and chest outside the sling.

4. *Broken Ribs.*—Bind a roller bandage four or five inches wide, by six or seven yards long, round the chest to prevent the side moving, or tie two broad triangular band-

ıges firmly round the chest, making the lower part of one and the upper part of the other cover the broken bones.

All other kinds of broken bones may be put into splints and bandaged.

1. For a broken bone of the *upper arm*, Fig. 25, put two, three or four splints round it from the shoulder to the elbow, and bind with a triangular bandage; put the lower arm in a sling.

FIG. 25.

2. For a fracture in the *lower arm.*—Bend the lower arm up in a horizontal position with the thumb pointing upwards, and put on two splints, one on the inside from the elbow to the finger tips, the other on the outside from the elbow to the wrist. Tie the splints with a bandage both above and below the break, and then put the arm into a large sling.

3. For broken bones of the *wrist, hand, or fingers,* bandage the whole hand and wrist on to a broad splint with a triangular bandage and put the arm into a large sling.

4. *For a broken Thigh-bone,* Fig. 26.—Place a long splint from the armpit to below the heel, and another inside the leg

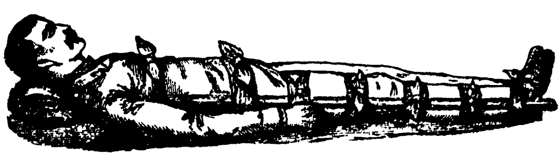

FIG. 26.

from the knee to the body. Tie firmly with six bandages in different places, and when finished tie both legs together.

5. *For a broken leg*, Fig. 27.—Put on two splints, one inside, one outside the leg from above the knee to below the heel, and tie firmly, tying the legs together afterwards as for a broken thigh.

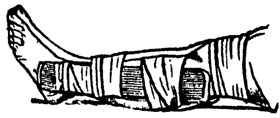

FIG. 27.

6. *For a broken Knee-cap*, Fig. 28.—Straighten the leg, raise the foot, put a long splint under the knee and bandage both above and below the knee. Tie the legs together.

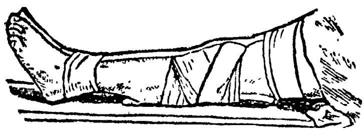

FIG. 28.

7. *For a broken Foot or Ankle*, Fig. 29.—Raise the foot and put two splints, one inside and one outside, fixing them with a figure of 8 bandage.

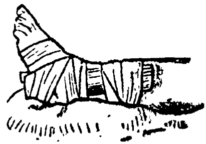

FIG. 29.

In cases where a broken bone is sticking out through the skin, the limb must be rested between a sling splint, like the pair of temporary splints described, and great care must be taken that it does not move or jar. Again, wherever there is bleeding as well as a broken bone, the bleeding, if from an artery, or a vein, must be stopped before the splints are put on.

Remember that these directions only help everyone to do what is best until a doctor is at hand. Putting splints and bandages round broken bones does not set them, they only prevent more damage being done. A proper doctor should in every case see the injury, and no one should allow a broken bone to be set by a potter, as he does not understand how bones or joints are placed in our bodies, and often binds up a limb without allowing for the swelling, so that it mortifies or dies, and has to be cut off.

Dislocations.—Sometimes bones instead of being broken are put out of joint, that is, are "dislocated."

In these cases the pain is very great, and the limb is quite helpless; but we can tell it is a bone out of joint and not broken, by remembering that—

1. The pain is always at a joint.
2. The part cannot be moved, instead of being easily moved as when a bone is broken.
3. The limb will not come into its natural position if it is pulled gently.
4. There will be no grating sound or sensation.

Treatment.—Great skill and often much force, are necessary to put a dislocation right, but a great deal of pain may be saved by placing the sufferer in the most comfortable position and applying rags or bandages dipped in cold water until a doctor can be had.

Children if they are dragged along by their arms, sometimes get the arm dislocated at the shoulder joint, but of course no one who understands about our bones and joints would do anything so cruel and dangerous.

Sprains.—Sprains, which are often so painful as to cause people to faint, are accidents where the tendons or muscles round a joint are violently wrenched, and cause great pain and swelling. Cold water bandages and perfect rest are the best. If there is much swelling at first, soak the part for an hour or so for the first few days in water as hot as can be borne, bandaging and resting afterwards.

Carrying people.—Stretchers.—Besides knowing how to help in accidents before a doctor arrives, everyone ought to know how to carry or move anyone who is too much hurt to move alone. If a *charpoy* is to be had, spread a piece of *durrie* or strong cloth on the ground close to the patient, lift him carefully on to it, and raise it by its four corners on to the bed. If a native bed is not at hand a stretcher can be made by turning the sleeves of a coat inside out, Fig. 30, buttoning it down the front, and passing two bamboo poles through the sleeves.

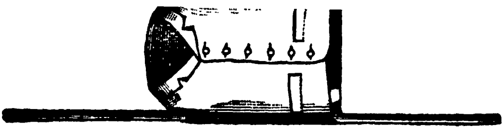

FIG.

Two waistcoats, Fig. 31, buttoned up, and the poles passed through the armholes will also serve. But if nothing in the shape of a stretcher can be had or made, the patient can be carried by two people forming a seat with their hands.

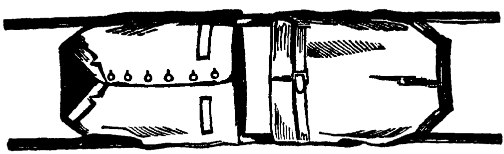

FIG 31.

If the patient cannot walk, but at the same time is not unconscious or helpless, *a four-handed seat* made by two people clasping each other's wrists, should be used. When ready, they stoop down behind the patient, and he sits on their hands, putting one arm round the neck of each bearer.

In cases where the arms are injured, or the patient is helpless, the *two handed seat* is used. For this two people clasp their hands with the fingers of each interlocked and the palms upwards to form the seat, and when this is ready they make a support for the patient's back by putting their hands on each other s shoulders.

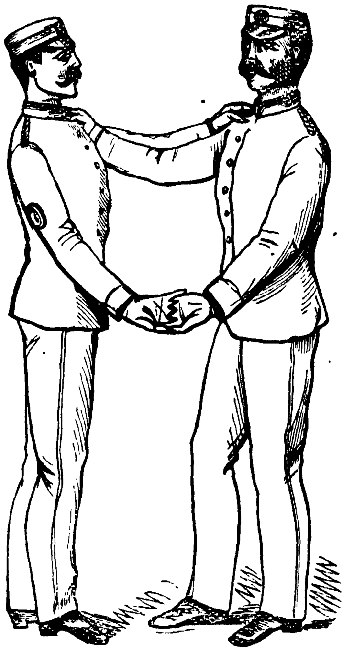

FIG. 32.

For short people or children the *three-handed seat* is the best. For this, one bearer grasps his own wrist with one hand and the second bearer's wrist with the other, whilst the second bearer grasps the left wrist of the first bearer with his left hand and places his right hand on the first bearer's shoulder, forming the back support.

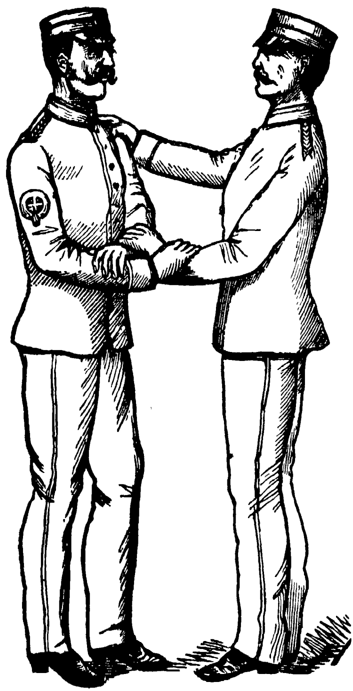

FIG. 33.

In case there is only one person to carry anyone who is quite helpless, either he must carry him simply pick-a-back, or he must stoop down in front of him, pass his right arm between the patient's legs, lift him across his back so that his arm comes in front of the bearer's left arm, and keep him from falling by holding his right leg and right arm.

CHAPTER III.

INSENSIBILITY—FAINTING—SUNSTROKE—APOPLECTIC, EPILEPTIC, AND HYSTERICAL FITS—CONCUSSION OF THE BRAIN—TREATMENT AFTER APPARENT DROWNING—SUFFOCATION FROM POISONOUS GASES.

Insensibility.—When people are either bleeding badly, or have broken a bone, they are often found unconscious or fainting, and when one can see that they have been injured or hurt in either of these ways, it is easy to understand why they are unconscious.

But people faint or lose consciousness from other causes as well, and it is always useful to know what to do in such cases.

Various causes.—They may be in a fainting fit from fright or fatigue, or unconscious from sunstroke, or from a fit of apoplexy, epilepsy or hysteria, or from a blow to the head, although no outward wound can be seen, or again, they may be unconscious through being suffocated from charcoal, fumes or poisonous gases, or from being long under water, as in drowning.

Fainting fits.—*Treatment.*—The first thing when anyone is found unconscious is to find out the cause, and the next to try and restore the person to their senses. A simple fainting fit is generally caused by such things as sitting in a close room, going too long without food—being overtired or exhausted—from hearing bad news, or from weakness after a long illness—and when people faint their face and lips grow white, a cold sweat comes out over the forehead and skin generally, and the pulse becomes very weak. This means that there is something wrong with the circulation of the blood in the head and the brain. The first thing therefore to do is to send the blood back to the head by placing the person lying down with the head very low, and to keep him in that position until he is better; next, to unfasten all the clothing about the neck and chest, if it is at all tight, but not to take the clothing off round the waist in case of a chill to the stomach. If the patient is in-doors he must be taken out into the open air, or at all events have plenty of fresh air, and if he does not recover soon, the next thing is to sprinkle cold water over the head and face, to put strong ammonia or smelling salts to the nose, and then to give a little brandy, or arrack and water, in a teaspoon, taking care that it does not cause choking.

In some parts of India people are brought round when fainting, by pressing the nose and holding the hand over the mouth so as to stop the breath. This may be good in some cases, although if anyone is suffering from the effects of bad air—that is too much carbonic acid gas—it will probably do more harm than good, because it would cause still more carbonic acid to accumulate in the blood.

To prevent fainting.—If anyone feels faint, but does not go off suddenly, they may often prevent a fit by drinking a glass of cold or iced water, by smelling ammonia or acetic acid, or by sitting with the head hanging down between the knees so that the blood is forced to the head.

Sunstroke.—*Sunstroke*, again, may cause unconsciousness in people, and when this is the case it may be known by the skin being hot and dry, the eyes reddened and the pupils small, the pulse quick and the breathing loud and hurried.

Treatment.—The proper treatment is to carry the patient at once to some shady or cool place, lay him down with the head slightly raised, take off all the clothing down to the waist, and pour a stream of cold water either from a *chattie* or *mussuk* over the head, neck and chest, especially over the back of the neck. When the patient shows he is coming round, no more water is needed. He should then be dried with a cloth and rubbed all over until quite conscious again. Neither spirits nor any kind of stimulants must ever be given. If anyone is insensible for long, try packing in ice or applying ice to the back of the neck, or if no ice is to be had, put a mustard poultice or turpentine fomentation to the nape of the neck and feet. As soon as he can swallow give plenty of cold water to drink, and a dose of quinine followed by some opening medicine.

Heat fainting is a very mild kind of sunstroke. The patient is not quite insensible but is giddy, sick and shivering, and should be laid on his back, the clothes loosened, the limbs rubbed and a glass of cold water given.

Apoplexy.—*A fit of Apoplexy* caused by the blood pressing on the brain is another thing which makes people insensible, and we may know that it is an apoplectic fit, and not sunstroke or mere fainting, by the following signs :—

Symptoms.—The breathing is very heavy, with a noise like snoring, and with one cheek puffed out; the face is flushed and the pupils of the eyes are *unequally* contracted or enlarged. Nothing will rouse the patient, and if the arms be raised, one will generally fall a dead weight and powerless, whilst the other may show signs of feeling.

Treatment.—The great thing is to move the patient as little as possible, but to place him lying down on the first sofa or bed that is at hand, with the head and shoulders well raised; loosen the clothing round the neck, put hot bottles, or flannels, or mustard plasters to the feet and legs, and sponges or rags dipped in cold water to the head—but to give no spirits, stimulants, emetics, or anything by the mouth. The chief object in the treatment is to draw down the blood from the head and prevent further bleeding from the broken blood vessel inside the brain—that is why cold must be applied to the head, heat to the legs, and the patient moved as little as possible.

Epilepsy.—*Symptoms.*—*In fits of Epilepsy* people become unconscious so suddenly that they fall down, sometimes with a piercing scream, on the spot, and so are often badly hurt by falling against something hard, or into a fire. Convulsions, foaming at the mouth, and biting of the tongue generally follow; whilst the hands are tightly clenched, the legs and arms jerked violently, and the breathing becomes so difficult that people turn black in the face. In some cases when the convulsions cease the patient gets up and walks away, at other times he falls asleep.

Treatment.—For treatment, raise the head with a pillow or roll of cloth—place something hard, such as a piece of wood or cork between the teeth, so that the tongue will not be bitten—prevent the patient hurting himself, but do not hold him down with any great force—undo anything tight and let him get to sleep as soon as possible.

Hysteria.—*Treatment.*—*In hysterical fits,* such as girls and women sometimes have, the patient generally falls down in some comfortable place, and not suddenly in a dangerous place as in epilepsy—she clenches her hands—grinds her teeth and laughs, cries and screams by turns. Cold water on the face is the best treatment, telling the patient at the same time that if the fit continues she must be drenched with cold water.

Hysteria generally comes from real or fancied weakness; and plenty of fresh air, exercise, and a good tonic will in most cases stop it.

Signs of concussion.—*Treatment.*—*In Concussion of the brain,* where people are stunned by blows on the head, or by falling from a great height, they may be either much hurt or only a little. If they are much hurt the signs are like those in apoplexy and the treatment should be the same—but if only slightly hurt the patient will be lying with the eyes shut, looking very pale and breathing slowly, if spoken to he will probably wake up as if from sleep and answer sensibly, dropping off again directly into half unconsciousness—perhaps after a few minutes he will be sick and then slowly recover. The best thing to do in such cases is to put the patient lying down with the head a little raised—give him plenty of fresh air—apply heat to the feet and hands, and cold to the head—and as soon as he can drink give a cup of warm tea or coffee.

Apparent drowning.—When anyone is taken out of a well, river, or any water, and seems dead because quite unconscious, it is often possible to prevent their death by restoring the breathing, and after that by restoring their warmth and circulation.

Even when people have been apparently dead for as long as three hours their lives may be saved if people will remember what to do until the doctor comes.

To restore breathing.—Dr. Sylvestre's plan.—First to restore the breathing, get the patient in a good position with the face downwards and the mouth open, so that any water in the mouth or windpipe may come out. Next turn the patient on his back, lying down, with a pillow, coat, or roll of something, placed underneath his shoulder-blades so that the head hangs back a little. See that all sand, mud or water is got out of the mouth, then draw the tongue forward, tie a piece of tape, cord or string round it, and fasten it under the chin—undo all the tight clothing from the neck and chest, or better still, strip to the waist.

Having done this begin to imitate the movements of breathing, Fig. 34. Stand at the patient's head, take

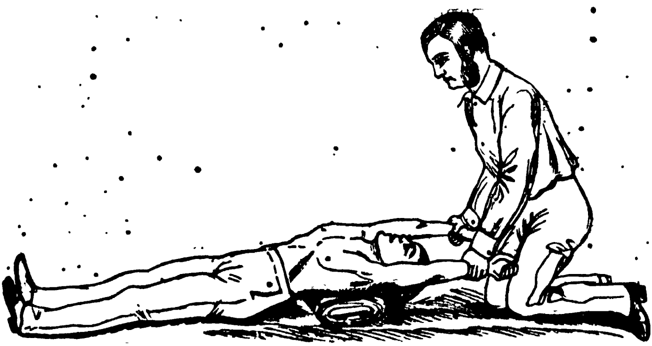

FIG. 34.

hold of the arms by the elbows, and draw them slowly and steadily upwards until they meet above the head. Keep them in this position for 2 seconds, so that air will be drawn into the lungs, because when the arms are up the ribs stretch out and the lungs can hold more air.

FIG. 35.

Then draw down the arms, Fig. 35, and press them firmly for 2 seconds against the sides of the chest so that air is pressed out of the lungs. Repeat these movements by turns, slowly and steadily about 15 times every minute, until either the patient breathes naturally, or a doctor arrives and declares him dead. If a second person is present he should put snuff or smelling salts to the nose, rub the chest and face briskly, dash cold and hot water by turns on the chest, or flap it with a wet towel and rub the body and legs with flannel or cloths.

This plan of restoring breathing is called after its inventor, Dr. Sylvestre's, and is the simplest and best to learn, because it does not require any great skill, and because *one* person can do it alone if no help is near.

Warmth and circulation.—After natural breathing has been restored, the warmth and circulation must be attended to.

The patient should be wrapped in warm dry blankets, and the legs and arms rubbed *upwards* with flannels, or rough dry bath towels, so that blood is helped along the veins to the heart. At the same time put hot bottles or bricks, or bags of warm sand, to the feet, to the pit of the stomach, and to the armpits. As soon as the patient is well enough to swallow, give small quantities of spirits and water, or wine or coffee, put him to bed, and get him to sleep if possible. If there is pain or difficulty in breathing afterwards, put a hot linseed-meal plaster on the chest and on the back below the shoulders.

Precautions.—In addition to this, it is necessary to remember not to let people crowd round the patient, especially if indoors—not to let him remain lying on his back unless the tongue is pulled out—never to hold the body up by the feet, and never to put the patient into a warm bath unless the doctor orders it.

Suffocation.—*Treatment.—In cases of Suffocation* by smoke, charcoal fumes, poisonous gases from a well, and such like, the first thing is to get the patient into the open air, to undo all tight clothing, and then to treat as before; first to restore breathing, secondly to help the circulation. The treatment should be kept up for one or two hours at least or until the doctor arrives.

In all these cases lives may be saved by remembering what to do, but if a doctor can be had he should be sent for at once and the treatment gone on with until his arrival.

CHAPTER IV.

ACCIDENTS—SNAKE BITES—BITES FROM ANIMALS—STINGS—BRUISES—*BURNS AND SCALDS*—*CATCHING FIRE*—SWALLOWING INJURIOUS THINGS—CHOKING—POISONS AND THEIR ANTIDOTES.

Besides such accidents as those by which blood is lost, bones are broken, or people become insensible, there are others which are continually happening around us, and which everyone should know how to treat. Amongst these are :—

Snake bites.—*Treatment.*—At the moment of the accident it is often not known whether the snake is poisonous or not. In every case therefore—

1. Tie a handkerchief, cord, or string tightly round the limb about two or three inches above the bite. Put a piece of stick under the cord and twist it until it is as tight as possible. Do not be afraid if the limb becomes swollen and discoloured below, but bind tightly so that no blood can pass to or from the part.

2. Tie two or three other cords above the first a little distance from each other, and tighten them also.

3. Make a cut about a quarter of an inch deep right across the bite and let it bleed well.

4. Put a hot iron or red hot piece of charcoal or wood right into the wound, or apply caustic or carbolic acid, or fire gunpowder into it, whichever can be done quickest.

5. Suck the wound hard, spitting out the poison each time until the hot iron or caustic is obtained.

6. If the bite be on a part that cannot be tied up with a cord, pinch up the skin over the bite, and cut out a round piece about the size of a finger nail and ½ an inch deep—then put the hot iron or caustic to the raw surface.

7. Give a wineglassful of brandy, or brandy and sal-volatile, every quarter of an hour. Three or four doses are generally enough as the patient must not be made drunk.

8. If no symptoms of snake poisoning appear in half an hour loosen the cords—but if poisoning symptoms do appear keep them on until the patient is recovering.

9. Do not let the patient move about, keep him quiet and cheer him. If he becomes very low, apply mustard poultices and hot bottles over the heart and to the stomach respectively—rub the limbs and try artificial respiration as after drowning.

It must always be remembered that the person bitten may get prostrate from fear even when the snake is quite harmless—therefore those who are treating him should never give up the hope of saving him, especially if after half an hour no marked symptoms of poisoning have shown themselves.

Bites from dogs, jackals or cats, should be well washed with hot water and bound up with a rag dipped in cold water. If the animal is mad, or supposed to be, tie a cord round the limb above the wound as for snake bites, wash the wound well and burn it thoroughly down to the depth the teeth went in. If nothing is at hand to burn it with cut it well across and let it bleed freely.

Stings of scorpions, venomous insects, &c., try to get the sting out by pressing a small hollow cane or watch-key over it—then put a paste of ipecacuanha powder and water on the place, or rub in ammonia, or ammonia and oil. When none of these can be had put rags on, dipped in vinegar and water, or strong salt and water. If the patient feels faint, give some brandy and water, sal-volatile, or wine.

Stings at the back of the throat or inside the nose, let the patient inhale steam as hot as can be borne.

Bruises.—If the skin is broken, bind up with a cold water or an ice bandage—if the skin is not broken, but is only "black and blue," put on a rag dipped in arnica lotion, or if there is no arnica, plain cold water or weak vinegar and water.

Burns and scalds.—First of all cover up the injured part so that no air can get to it. This is done either by dusting flour over it, or if the skin is broken, by covering it with a piece of rag dipped in oil. Carron oil, made by mixing equal parts of lime water and either sweet or linseed oil is the best to use, but ghee, which is fresh and clean and has no salt in it, will do instead. Flour or oil must be put on at once, and the part covered up with quantities of cotton wool or a piece of an old blanket. It must be left like this for seven days. A new skin will then have formed, the old dressing can be taken off and clean linen dipped in fresh oil again put on, until the place is quite well. Where the skin is neither broken nor blistered, cold water bandages may be put on, but in all cases the air must be kept out.

A burn should never be held in front of a fire, as it only makes it worse. In large burns the clothing should be cut off all round, and if any sticks, the part must be put into hot water until the clothing floats off.

For scalds in the inside of the mouth and throat, steam as hot as can be borne must be at once inhaled.

Clothes catching fire.—If anyone is alone and their clothes catch fire, they should lie down on the floor or ground, roll themselves up in a *durrie*, or rug, or any thick thing, and call for help. No one should rush out into the open air. If anyone else is at hand let them throw a rug or blanket over the person who is on fire, and roll them on the floor until the flames are out. The chief thing is to keep out the air as fire cannot exist without oxygen. If we remember this it will help us to keep our heads cool, because directly anyone is completely covered up and the rug pressed tightly round them we know the flames must go out.

Swallowing small articles, as buttons, or pice.— If the thing has only just been swallowed, give an emetic of salt and water, or mustard and water, to cause sickness ; or beat the whites of three eggs with a little water and let this be drunk at once, followed by a dose of ipecacuanha five minutes afterwards. White of egg hardens or coagulates in the stomach, and if it closes round the thing that was swallowed, may bring it away at once. If it is too late to be brought up by the mouth, let it alone and send for the doctor. If no doctor can be had do not give opening medicines. It is better for the patient to eat a lot of coarse thick food such as *dhal bhat.* The button or pice then becomes embedded in it and passes through the bowels without any trouble.

Even a pin may go safely through in this way, provided no castor oil or medicine is given until after plenty of food.

Choking may occur either from swallowing things like the above, or from a fish bone, or something else sticking in the throat. If it cannot be got up or pushed down with the finger, either eating a large mouthful of rice or bread, or drinking a good draught of cold water, will generally carry it away.

If a child chokes through a marble, nut, or anything getting into the *wind-pipe*, he must be held, face downwards, and the back gently tapped until whatever it is comes up again.

Lime and other things in the eye.—Wash the eye inside and out with vinegar and water until the lime is all out.

If simply grit gets into the eye it is easy to remove it from the under eyelid by merely pulling the lid down and taking the grit out with a small piece of clean cloth screwed up into a point, or with the tip of the finger, either wetted or smeared with a little oil or glycerine.

But if anything gets inside the upper lid, it is not so easy to get it out. The best plan is to press something hard, such as a pencil, or fine piece of wood across the outside of the lid at the top, and then by taking hold of the eyelashes, turn the lid inside out over the pencil or wood. If the substance is sticking to the lid it can then be removed, but if it cannot be found, a little pure glycerine dropped into the eye will make it water so much as to wash away the grit—or if the eyes are opened and shut several times under cold water, it will perhaps have the same effect.

Things in the ear and nose.—When anything gets into the ear or nose, it is generally best to leave it alone, and let it work its own way out, or if it causes pain in the ear first try floating it out by putting warm water in. If this has no effect try to get it out by syringing very carefully and gently with only a little water at a time. Great care is necessary in the case of the ear to prevent the thing being pushed further in, as it may press on the drum and cause serious inflammation with perhaps permanent deafness.

Poisons.—There are many different kinds of poisons, but it is quite enough for general use to remember there are two principal kinds—irritant and narcotic.

Irritant Poisons are generally easy to tell because the lips, mouth and tongue are burnt or stained and the patient is in intense pain.

Narcotic Poisons which act on the brain make people either stupefied, unconscious, or delirious.

Treatment in poisoning.—The three chief things to remember when anyone is found poisoned are;

(1) To get rid of the poison by making the person sick.

(2) To give an antidote to stop the poison doing further harm.

(3) To try to prevent death by different remedies.

The best way to make anyone sick is to give an emetic, or to tickle the back of the throat with a feather, fine brush, or the finger.

Emetics.—The chief emetics are:—

Good draughts of warm water. A large spoonful of salt or mustard in a tumbler of warm water. One or two tablespoonfuls of ipecacuanha wine or powder in warm water, or when stronger ones are required sulphate of copper or zinc.

Having made a patient sick, the next thing is to find out, if possible, what poison has been taken, and to give the proper antidote.

General Rules.—If the patient can speak, ask whether the taste in his mouth is *acid*, like vinegar or lemon juice; or *acrid*, that is bitter, sharp, or biting, like the taste of soda or lime.

Acid: any alkali will do as an antidote.

Acrid: any acid will serve the purpose.

Or in other words, if the taste is *acid*, give magnesia, or chalk and water, or wall plaster mixed with water, or soap suds or lime (*chuna*), or potash or carbonate of soda mixed with plenty of water; or milk, if none of these are at hand, whilst, if the taste is *acrid*, give vinegar, orange or lemon juice, tartaric acid in water, or olive oil in large quantities.

Rousing insensible patients.—If the patient is not able to speak, and is either drowsy or insensible, the first thing to do is to wake him up by dashing cold water on his head and face and then to keep him awake by giving him strong coffee to drink, and making him walk about. If this has no effect and his breathing grows fainter and fainter, the chest must be smartly rubbed with a cold wet towel and artificial respiration, as after apparent drowning, must be used. People can often be roused in this way even when they seem almost dead, the same as when they are unconscious for long after being nearly drowned.

Common poisons.—Apart from these general rules it is as well to know a little more in detail about a few of the more common poisons in India, especially arsenic, opium and datura.

Arsenic is generally used for murder. It is colourless and almost tasteless so can easily be mixed without being detected.

Opium is used for suicide or infanticide chiefly, and *datura* to conceal robbery or sometimes to kill people.

Arsenic poisoning—*Treatment—Antidotes*—

Arsenic (*Sammulfar—Sankhya—Hartal—Mansil*). The *symptoms*—which usually begin from ½ to 1 hour after taking the poison—are sickness, often of a blue or black colour; burning pain in the stomach; great thirst; diarrhœa. Sometimes cold skin, cramps and sleepiness. In treating a patient, if he is already sick from the poison itself, give him large draughts of warm water to make him more so. If he is not sick give him a mustard, or salt-and-water emetic every quarter of an hour till he is sick, or if this and tickling the throat both fail, give 20 grains of sulphate of zinc, or 5 grains of sulphate of copper—5 grains of ipecacuanha powder, or 4 grains of tartar emetic—every quarter of an hour until sickness is produced. After the sickness give as an antidote, either new milk, or milk and oil, the white of raw eggs, linseed tea, oil and lime water, followed later on by a dose of castor oil, or *kaladana.*

Copper degchies.—Poisoning from the green rust of copper *degchies* or vessels causes much the same kind of symptoms, and the same remedies are good.

Opium.—*Symptoms.—Treatment.—In opium* poisoning (*afium* and *afim*) there is generally no sickness as from arsenic, and nearly always deep sleep. The *symptoms* which begin from ½ to 1 hour after taking the poison are sleepiness or complete insensibility—small pupils of the eyes—great perspiration and clammy skin—very seldom any vomiting. The proper treatment is to give an emetic as quickly as possible, and to continue it every quarter of an hour until the stomach is well emptied, or until there is no smell of opium in what comes up. After the emetic strong coffee must be given every 20 minutes until the eyes begin to open, and the patient must be kept awake by dashing cold water over him or walking him about.

Datura.—*Symptoms.—Treatment.—In datura* poisoning the *symptoms*, which begin from 5 or 10 minutes to half an hour after taking it, are sleepiness—enlarged pupils —giddiness—delirium—unconsciousness but rarely sickness. The first thing is to make the patient sick; but if he cannot swallow, first drench his head and spine with cold water from a *bhistie's mussuk* for 3 or 4 minutes, and then if he becomes conscious give him an emetic. If the patient is much exhausted after this, give small quantities of rum-*sharab*, about one *chittack* every hour, or oftener, if there is any risk of his dying from exhaustion. If he lives for a day, half a *chittack* of castor oil, or 30 or 40 *kaladana* seeds should be given as a purge.

Datura seeds, it must be remembered, are rather like red pepper to look at, but give a bitter taste to any food they are mixed with.

In addition to these, Aconite and Nux Vomica are fairly common poisons.

Aconite.—*Symptoms.—Treatment.*—In *Aconite* (*bish*) poisoning, the *symptoms*, which come on in about 15 minutes, are numbness and tingling in the mouth and throat and afterwards in the limbs—frothing at the mouth—sleepiness and occasionally convulsions, or delirium, or paralysis.

The first thing, again, with this poison is to make the patient sick by an emetic; next, about an hour after the poison has been taken, give half a *chittack* of castor oil or two castor oil seeds in milk. If he is very weak give rum-*sharab*, every quarter of an hour, or strong hot tea, or if that is not to be had, catechu (*kuth*) in the dose of two ruttees dissolved in hot water—where the limbs are cold or cramped they must be rubbed with hot cloths.

Nux Vomica.—*Symptoms.—Treatment.—In Nux Vomica* (*kuchila*) poisoning, the *symptoms* come on in from a $\frac{1}{4}$ to one hour and are twitching in the limbs followed by violent spasms and often lock-jaw. The spasm usually affects the whole body, ceases for a time and then returns. The treatment is an emetic at once, then one ounce or more of animal charcoal mixed with water. Tea, linseed tea, or infusion of catechu are good if taken in great quantities and very strong—and small doses of opium, chloroform or tobacco juice are useful for relieving the spasms.

CHAPTER V.

SYMPTOMS AND FIRST TREATMENT OF ILLNESSES—BRONCHITIS—CHOLERA—COLIC—CONSTIPATION—CONVULSIONS—CROUP—DIARRHŒA—DYSENTERY—FEVER AND AGUE—SMALL-POX.

To know how to do the right thing when anyone is taken suddenly ill is as important as knowing what to do in any accident, or any of the other emergencies we have learnt about.

Symptoms of illnesses.—The first great point is to be able to tell one illness from another. This is done by noticing what are called the *symptoms* or signs. Each illness has more or less special signs, and these must be learnt and remembered quite as much as the remedies which are to be given.

First remedies.—The remedies here mentioned, it must be remembered, are only "first helps," that is for the beginning of each illness before the doctor can come. They may often save lives if properly applied, but they will not do to give day after day in long illness.

The illnesses mentioned are only a few which it does not do to neglect, and which must be treated at once if possible.

In Bronchitis, that is inflammation of the lining of the bronchi of the lungs, the *symptoms* are at first like those of a common cold, afterwards there is a moist, loose cough, fever, and restlessness and wheezing, or rattling sounds in the breathing. If it is treated in time probably only the large tubes will be inflamed, but if it is neglected and spreads to the smaller tubes it becomes very dangerous.

Treatment.—Put the patient to bed, clothed entirely in flannel and with the head well raised on a pillow—give an emetic of ipecacuanha, and put a large bran jacket-poultice both before and behind the chest. Keep the air in the room warm and moist by means of steam brought well into the room from a kettle with a long spout. If a long spouted kettle cannot be had, a tube to fix on to the spout of an ordinary kettle may be made of thick brown paper rolled and tied into shape.

In Cholera, the *symptoms* are:—

1. Bad diarrhœa, very copious like rice water.
2. Later on, severe sickness.
3. Intense thirst.
4. Cramps.

Treatment.—Put the patient in a warm bed, with hot bottles to the feet and arm-pits, and a mustard poultice over the whole abdomen.

Give ice and iced soda-water to relieve the sickness and 20 drops of Chlorodyne in a little spirit and water, or better still, Pills of 1 gr. Opium and 4 grs. Acetate of Lead, dissolved in water to be given after each loose motion up to the third but no more.

Give no food at first, afterwards milk and lime water or chicken soup. To relieve cramps rub the parts briskly with powdered dry ginger. If collapse sets in stop giving opium and give 15 drops of sulphuric acid in half a wine-glassful of water every hour, and put mustard poultices on the calves of the legs and over the heart.

In Colic, the *symptoms* are pain in the abdomen about the navel but no fever. The patient draws his legs up or bends forward, or presses something against the stomach to relieve the pain.

Treatment, a teaspoonful of castor oil with 15 drops of laudanum to a grown-up person, or for a child ten drops of the sweet spirits of nitre in a teaspoonful of caraway or aniseed water. Put the patient to bed, and apply hot fomentations to the stomach.

Constipation means the acting of the bowels at long intervals or unsatisfactorily. If allowed to continue for many days it may lead to inflammation resulting in death.

Treatment.—The safest plan is to give an enema of warm water, or soap and warm water—or for a baby an enema of one teaspoonful of glycerine.

In Convulsions in children. In some cases there are "warnings" of the approach of a fit, such as twitchings of the face, startings during sleep, or doubling of the fingers over the thumbs. In others a child goes straight off into a fit, it becomes deadly pale, stares and rolls its eyes about, the breathing is irregular and catching, the body becomes stiff and the hands are clenched.

Treatment.—If the child is *not* in high fever give it a hot bath immediately, then an emetic of one teaspoonful of ipecacuanha wine every $\frac{1}{4}$ of an hour till sickness is produced. Try to get the bowels to act either by an enema or a dose of epsom salts or senna. When the fit is over keep the child in a cool atmosphere and soothe it to sleep.

If in high fever put the child at once into a cold bath up to its neck, no matter whether dressed or undressed, and pour cold water on its head until consciousness returns.

In Croup, the *symptoms* are sometimes a slight cold or cough with a little fever, followed by the peculiar sound in the throat like the crowing of a cock, which is caused by the opening of the throat narrowing suddenly and violently each time the child breathes. At other times it comes on suddenly without any warning.

Treatment.—Give an emetic of ipecacuanha every quarter of an hour until sickness is produced, put the child in a warm bath for ten minutes, dry it well, wrap it up in flannel or something woollen, and put it to bed—keep the air of the room warm but damp by boiling a kettle, as in bronchitis, and letting the steam from it mix with the dry air. Steam should also be inhaled from a jug of hot water, if possible. Fomentations made by wringing out sponges in very hot water are also excellent to apply round the throat.

In Diarrhœa the *symptoms* are well known—the bowels act very often and only watery motions are passed.

Treatment.—Put the patient to bed with plenty of flannel wrapped round the abdomen. Give a dose of castor oil or Gregory's powder to children. To grown-up people give castor oil and ten drops of laudanum in a wineglassful of water every two hours, or until the doctor comes. Astringents, such as 3 grains of powdered kino and an equal quantity of powdered cinnamon, are dangerous to give without a doctor's advice, as they may either make the diarrhœa worse, or cause inflammation of the bowels.

Never neglect diarrhœa and always see a doctor about it.

In Dysentery, which is inflammation of the glands of the large or lower intestine, the *symptoms* are like those of griping diarrhœa, getting worse as the bowels act again and again, until at last almost nothing but bloody slime is passed, and that with great pain straining.

Treatment.—Put the patient to bed, wrapping plenty of flannel round the abdomen, give a dose of castor oil, and when it has acted, if the doctor has not arrived, give an enema of ipecacuanha, ten grains to ½ *chittack* of mucilage, for a child—keeping a napkin pressed over the bowel opening for about a quarter of an hour to prevent the enema coming away.

If fresh ipecacuanha cannot be had, give the native medicine, *mudar*, in exactly the same quantity and the same way, or failing that, give *auta-múl* or native ipecacuanha.

Baël drink is also a good thing to give.

Dysentery should always be treated *at once*, as delay often causes a long illness ending in death.

In Malarial fever and Ague, the symptoms are well known—there are pains in the head, legs and body—the patient is first hot and then cold—one moment shivering and the next at fever heat.

Treatment.—Put the patient to bed wrapped up warmly, give some opening medicine, castor oil or *kaladana* and cream of tartar mixture followed by five grs. of quinine when the bowels have acted.—Give hot lime-juice and water with a little ginger in it during the shivering fits—in the hot stage apply cold water to the head and give a cooling drink, and as soon as perspiration sets in give a hot cup of tea or coffee and five or ten grains of quinine.

To prevent fever and ague whilst living in unhealthy districts take two grs,, of quinine regularly once or twice daily, with tincture of steel, or better still dialysed iron.

At any time if the bowels are constipated or the liver is out of order take a 5-gr. Blue pill at night, followed by 3 drachms of sulphate of magnesia, or epsom salts the next morning.

Prevention of fever by hill women in the Punjaub.—A successful way of preventing fever in young children is practised by hill women in the Punjaub, who put their little ones to sleep during the heat of the day under small cascades of water falling through bamboo ducts about 1½ to 2 feet above them.

The head is placed on a pillow of dried grass and so arranged that the stream of water falls over the brain. The mothers watch their children all the time and have their reward in seeing them grow up healthy and strong and with less inclination to small-pox or bad eyes than most native children.

In Small-pox the *symptoms* are fever, shivering, sickness, headache and backache. On the third day small red pimples, or in other words the pocks begin to show, first on the forehead and face, next on the wrists, and then on the body and legs. The rash consists of very hard, red pimples until it is 48 hours old, and then a little liquid shows in the centre of each, 48 hours later again each pock has become a yellow colour and the fluid has changed into matter. The rash is at its height on the eighth day.

Treatment.—The first thing to do directly the disease is known is to keep the patient away from everyone but those who are to do the nursing. Choose a cool, well-ventilated room, or better still a tent in cold weather for fresh air is one of the best things to secure a good recovery and put the patient to bed with light but warm clothing on.

Begin by disinfecting everything from the first, and put plenty of disinfectants about the room and everywhere near it. Give water, lime-juice and water, or some cooling drink—with milk and arrowroot, milk and rice, bread and milk and beef tea as the principal foods—Sponge the body with water, or vinegar and water to soothe the irritation of the skin and powder it lightly with a little fuller's earth, or rice powder.

Bathe the eyes every day to keep them thoroughly clean, and if the lids stick together apply some simple ointment.

Conclusion.—At all times let everyone remember that "Health is Wealth," "Prevention is better than Cure," and that "God helps those who help themselves."

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